

61-F-237C

NEAR MAXWELL

BEAVER RIVER

Mr. A. M. Toye,  
Bridge Engineer.

Materials & Research Section,  
(Foundations Office).

Attention: Mr. K. L. Kleinsteinber.

June 26, 1961.

FOUNDATION INVESTIGATION REPORT  
by H. Q. Golder & Associates,  
to County of Grey.

Re: Proposed Crossing - Beaver River,  
Township of Osprey near Maxwell, Ont.,  
County of Grey, Owen Sound.

Attached, we are forwarding for your use, the  
Report for the above site submitted by the Consultant,  
H. Q. Golder and Associates.

We have reviewed the report and agree with the  
discussion and recommendations contained in the report. Should  
there be any queries in connection with this project, that you  
would like to discuss, please feel free to call on our Office.

L. G. Goderman,  
PRINCIPAL FOUNDATION ENGR.  
Per:

*L. G. Goderman*

AGL/MdeF  
Attach.

cc: Messrs. K. Kleinsteinber (2)  
H. Greenland  
John Poy

(A. C. Sternac,  
SUPERVISING FOUNDATION ENGR.)

Foundations Office  
Gen. Files.

20-5

**H. Q. GOLDER & ASSOCIATES LTD.**

**CONSULTING CIVIL ENGINEERS**

H. Q. GOLDER  
V. MILLIGAN

**REPORT**

2446A BLOOR ST. W.  
TORONTO 9  
RO. 7-9201

TO

61-F-237C

COUNTY OF GREY, ONTARIO

ON

SITE INVESTIGATION

PROPOSED BEAVER RIVER CROSSING

TOWNSHIP OF OSPREY

NEAR MAXWELL, ONTARIO

Distribution:

- 4 copies - County of Grey,  
Owen Sound, Ontario.
- 4 copies - Department of Highways, Ontario,  
Toronto, Ontario.
- 2 copies - H. Q. Golder & Associates Ltd.,  
Toronto, Ontario.

June, 1961

6120

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## ABSTRACT

The results of an investigation carried out at the proposed Beaver River crossing on a county road in the Township of Osprey, opposite concession 8 between lots 10 and 11 about 1 mile north of Maxwell, Ontario, are reported. It was found that the site is underlain by up to 16 feet of compact to dense gravel and cobbles resting on dolomite bedrock. The bedrock which generally slopes down in a northerly direction is at about river bed level on the south side and about 15 feet below river bed level on the north side of the river. The gravel and cobbles stratum on the north side of the river contains a 2 foot thick layer of very loose organic sand at a depth of about 4 feet below river bed level.

Recommendations are made for founding the south abutment of the proposed rigid frame structure on bedrock and the north abutment on steel H piles driven if possible to bedrock or to practical refusal in the lower gravel and cobbles stratum.

## INTRODUCTION

H. Q. Golder & Associates Ltd. has been retained by the County of Grey, Ontario to carry out an investigation for a proposed replacement of the existing Beaver River bridge on a county road in the Township of Osprey, opposite concession 8 between lots 10 and 11 about 1 mile north of Maxwell, Ontario. The purpose of the investigation was to determine the soil conditions at the site and to provide information for the foundation design of the proposed bridge.

## PROCEDURE

The field work for the investigation was carried out from May 18th, 1961 to May 24th, 1961. Four boreholes were put down in 6X size to depths ranging from 10 to 24 feet using a standard trailer-mounted machine drillrig. The locations of the boreholes together with the inferred soil stratigraphy are shown on Figure 1. Detailed logs of each borehole are given on the Records of Boreholes.

The samples obtained during the investigation were dispatched to our laboratory for testing and representative samples of those remaining will be stored until December 1st, 1962 at which time you will be notified regarding their disposal.

The results of the laboratory testing are plotted on the Records of Boreholes and on the figures.

**GOLDER & ASSOCIATES**

All elevations in the report are referred to local datum and were obtained from a County of Grey bench mark consisting of a spike driven on top of a tree stump located on the west side of the road about 150 feet north of the existing bridge. The elevation for this bench mark was established as 93.5 by levelling from an old stake, about 225 feet to the north of the bridge, for which an elevation of 100.00 was supplied by County of Grey personnel.

#### SITE TOPOGRAPHY AND GEOLOGY

The site is located on the upper Beaver River which drains the top of the Niagara escarpment. The river here flows in a steep valley and continues to the east for a distance of about 6 miles on top of the escarpment where it becomes the lower Beaver River below the escarpment.

Above the bedrock which is Niagara dolomite, the upland plateau, in the area of the site, is partly covered with a drumlinized till plain and till moraines. At the proposed crossing the Beaver River has eroded its channel through the till and through some shale layers above the bedrock to form its present valley. Bedrock outcrops in several places at the site and is generally covered with recent shallow fluvial deposits which have filled in the previously deeper channel.

## SOIL CONDITIONS

The following soil strata were encountered by the borings put down at the site.

### Sand and Gravel Fill

At borehole 1 put down on the south side of the existing bridge a layer of granular fill about 4 feet in thickness was encountered at ground surface. The fill which comprises the roadway approach to the bridge is brown in colour and consists of subangular to sub-rounded sand and gravel in all grain sizes.

One standard penetration resistance or "N" value of 5 blows per foot was obtained near the base of the layer indicating that the relative density of the fill is loose.

### Topsoil

A layer of dark brown sandy topsoil about 9 inches in thickness covers the north bank of the river at the location of borehole 2.

### Sandy Gravel with Cobbles

Beneath the topsoil in borehole 2, the granular fill in borehole 1 and at river bed level in boreholes 3 and 4 a stratum of sandy gravel with cobbles was encountered. The stratum is generally grey brown in colour



and ranges from about 3 to 5 feet in thickness at boreholes 1 and 3 respectively. The stratum as indicated by the soil samples obtained, is essentially comprised of subangular to subrounded gravel with sand in all grain sizes and a trace of silt. Although not obtained in the sampler, due to its limited size, (about  $1\frac{1}{2}$  inches I.D.) the stratum contains cobbles and probably some small boulders. This is confirmed by the fact that the sampler could not be driven into the stratum at boreholes 3 and 4 due to the presence of particle sizes larger than the diameter of the standard sampler. In borehole 2 pieces of decayed wood and roots were encountered in the stratum.

A grain size distribution curve on a sample obtained from the stratum using a  $1\frac{1}{2}$  inch I.D. sampler is shown on Figure 2.

Standard penetration resistances or "N" values of 2, 8 and 70 blows per foot were obtained in the stratum at boreholes 1 and 2. Based on these results together with the observations made during drilling operations and taking into account the large particle sizes present in the stratum, the relative density is estimated to be loose to compact in boreholes 2 and 3 and compact to dense and generally compact in boreholes 1 and 4.

### Organic Sand

Underlying the sandy gravel with cobbles in boreholes 2 and 3 a stratum or layer of organic sand, about 2 feet in thickness, was encountered. The stratum which is grey brown in colour is comprised of subangular to subrounded sand in all grain sizes with a trace of silt and a few fine to medium subangular gravel sizes. The stratum contains organic matter throughout mainly in the form of minute pieces of decomposed wood giving it a spongy texture and a typical organic odour. Several layers of reddish brown organic matter up to about 1/8 inch in thickness, pockets of organic matter up to 1 inch in size and numerous small shells were encountered throughout the stratum.

An organic content determination on a sample from the stratum gave a value of about 25 percent.

Two grain size distribution curves on samples from the stratum are shown on Figure 3.

Two standard penetration resistances of 2 and 3 blows per foot were obtained indicating that the relative density of the organic sand is very loose.

### Gravel and Cobbles

A stratum of grey gravel and cobbles about 9 feet in thickness was encountered beneath the organic sand

in boreholes 2 and 3. Due to the presence of cobbles within the stratum, penetration could only be effected by drilling with a BX casing shoe. The composition of the stratum also made sampling with conventional samplers in most cases impossible. From the 2 samples obtained in borehole 2 the matrix of the stratum is generally comprised of subangular gravel in all grain sizes with pockets or lenses of sand. The maximum size of core obtained in drilling through the stratum was 7 inches although it is estimated that the maximum cobble size could be of the order of 12 inches.

Two grain size distribution curves on the samples obtained from the stratum in borehole 2 are shown on Figure 2. The grain size distribution curve for sample No. 4 indicates the presence of sand which was encountered as a lens or pocket within the gravel stratum.

Standard penetration resistances of 28 blows per foot and a value greater than 100 blows per foot were obtained in the upper portion of the stratum in borehole 2. These values together with the observation made during drilling operations indicate that the relative density of the stratum ranges from compact to very dense and is generally dense.

Bedrock

Beneath the sandy gravel with cobbles in boreholes 1 and 4 and the gravel and cobbles in boreholes 2 and 3 bedrock was encountered at elevations ranging between about 74 in borehole 1 and 57 in boreholes 2 and 3. The bedrock was proved in AXT size for a depth of about 5 feet in boreholes 3 and 4 and for a depth of about 8 feet in boreholes 1 and 2. It is a Niagara dolomite which was overlain by softer shales which have been eroded at the river but are exposed on the banks of the river valley. The dolomite is laminated or banded generally in 1 to 6 inch layers and the alternate layers are light grey to grey in colour.

The bedrock has a vesicular structure with many small holes up to about 1/8 inch in size and occasional cavities up to 1 inch size. These holes and cavities are generally non continuous. The bedrock contains occasional fossil shells.

Based on the rock core recovery and an examination of the core obtained, it is considered that the bedrock is weathered in about the upper 12 to 18 inches and generally sound below this depth.

## WATER CONDITIONS

The ground water level in the boreholes following completion was at about river water level, which during the period of the investigation was at about elevation 73.

Local information indicates that river high water level is at about elevation 76.

## DISCUSSION

### General

It is understood that the existing Beaver River crossing on a county road about 1 mile north of Maxwell, Ontario is to be replaced by a single span rigid frame structure. The proposed rigid frame is to be of reinforced concrete construction with a clear span of about 30 feet and a width of about 26 feet. The present profile grade at the crossing will be raised to accommodate the realignment of the existing road on the south side of the river. The amount of the grade increase is not known at the present time but it is known that some roadway fill will be placed on top of the proposed structure.

The borings put down at the site indicate that the bedrock surface generally slopes down to the north from about elevation 68 at the south abutment of the existing bridge to about elevation 57 at the north abutment. Bedrock is covered by about 5 feet of sandy gravel with

cobbles on the south side of the river and by about 16 feet of gravel, cobbles and sand on the north side. The river water level during the period of the investigation was about 1.5 feet above average river bed level.

#### Foundation Design

The south abutment of the proposed rigid frame structure can readily be founded on the bedrock, as planned. Depending on the location of the south abutment and as bedrock surface slopes down in generally a northerly direction, bedrock could be a few feet below or at about creek bed level. Due to the weathered nature of the upper 12 to 18 inches of the bedrock it is recommended that the footing be placed at a depth of 18 inches below bedrock surface. At this depth an allowable bearing pressure of approximately 15 tons per square foot may be used for foundation design.

At the location of the north abutment of the proposed rigid frame, the bedrock is covered by about 16 feet of highly permeable granular deposits consisting of sandy gravel and cobbles. To provide adequate scour protection the north abutment footing should be taken down at least 4 feet below river bed level. At this depth a 2 foot thick layer of highly compressible organic sand was encountered within the gravel. Therefore to eliminate possible detrimental settlement of the north

side of the rigid frame structure, the footing would have to be founded below the organic sand and in the lower gravel stratum at a depth of about 6 feet below river bed level. With the footing founded in the lower gravel under an allowable loading of up to 3,000 pounds per square foot together with the provision of compacted fill behind the abutment wall, the settlement of the rigid frame structure should be small and within tolerable limits.

However, the founding of the north abutment footing in the lower gravel or on bedrock would present a difficult construction problem in dewatering the footing excavation. Due to the presence of cobbles and probably boulder sizes in the upper and lower gravel strata it would be practically impossible to drive closed sheeting to an adequate penetration to permit dewatering inside the sheeting. Further, due to the highly permeable nature of the gravel deposits, dewatering of the foundation excavation could not readily be achieved by wellpoints or wells, which in themselves would be extremely difficult to install. Thus to found in the lower gravel or on bedrock, as would be necessary to minimize settlement of the proposed rigid frame structure, would entail a most difficult form of construction.

To eliminate expensive construction such as the use of tremie concrete, it is recommended that the north

abutment of the proposed rigid frame be founded on steel H piles. The piles should be driven if possible to bedrock or to practical refusal in the lower gravel stratum. To ensure the capability of the piles to be driven through or into the lower gravel and cobbles stratum without buckling, they should be of a relatively heavy section and no lighter than a 12BP x 53 lb. section. The piles supporting the abutment should be driven in a staggered and not a straight line pattern with the spacing between individual piles not to exceed 4 feet. For steel H piles driven to bedrock or to practical refusal in the lower gravel stratum, an allowable load of up to 30 tons per pile may be safely used in design. Settlement of the rigid frame structure founded on piles on the north side and bedrock on the south would be negligible.

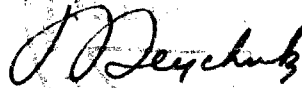
It is recommended that the base of the piled concrete footing be placed at about river water level to prevent excavation below the ground water level in the permeable sandy gravel with cobbles stratum. To safeguard against frost action on the concrete footings for both abutments at least 4 feet of earth cover measured from the base of the footings, and protected by filter gravel and rip-rap, should be provided.

It is further recommended that free draining granular backfill, well compacted in 9 inch lifts, be



placed behind the abutments of the structure. This granular backfill should extend horizontally from the back face of the abutment walls for a minimum distance of 4 feet. Prior to placement of the granular backfill behind the abutments and the fill for the roadway all topsoil covering the site should be removed.

In the design of the abutment walls it is recommended that an earth pressure coefficient,  $K$ , equal to 0.7 be used for the compacted granular backfill.

A circular professional engineer seal for J. L. Seychuk, P. Eng. The seal contains the text "PROFESSIONAL ENGINEER" and "J. L. SEYCHUK, P. ENG." around the perimeter. The signature "J. L. Seychuk" is written across the center of the seal.

J. L. Seychuk, P. Eng.

A handwritten signature in cursive script, reading "V. Milligan".

V. Milligan, P. Eng.

JLS/jb  
6120  
June, 1961

## LIST OF STANDARD ABBREVIATIONS

The standard abbreviations commonly employed on each "Record of Borehole", on the figures, and in the text of the report are as follows:

### SAMPLE TYPES

A.S. - Auger Sample	R.C. - Rock Core
C.S. - Chunk Sample	S.T. - Slotted Tube
D.O. - Drive Open	T.O. - Thin-walled, Open
D.S. - Denison Type Sample	T.P. - Thin-walled, Piston
F.S. - Foil Sample	W.S. - Wash Sample

### PENETRATION RESISTANCES

Dynamic Penetration Resistance - The energy required to drive a 2 inch diameter, 60 degree cone attached to the end of the drilling rods into the ground: expressed in blows per foot, where each blow represents 4,200 inch-pounds of energy.

Standard Penetration Resistance, N - The number of blows by a 140 pound hammer dropped 30 inches required to drive a 2 inch drive open sampler one foot into the ground.

Sampler advanced by static weight	- weight, hammer	- Wh
Sampler advanced by pressure	- pressure, hydraulic	- Ph
Sampler advanced by pressure	- pressure, manual	- Pm

### SOIL DESCRIPTION

The standard terminology for the descriptions of the relative density of cohesionless soils and the consistency of cohesive soils is as follows:

<u>Relative Density</u>	<u>N, Blows/ft.</u>	<u>Consistency</u>	<u>c, lb/sq. ft.</u>
Very Loose	0 to 4	Very Soft	Less than 250
Loose	4 to 10	Soft	250 to 500
Compact	10 to 30	Firm	500 to 1,000
Dense	30 to 50	Stiff	1,000 to 2,000
Very Dense	over 50	Very Stiff	2,000 to 4,000
		Hard	over 4,000

### SOIL TESTS

C - Consolidation Test	Q - Undrained Triaxial
H - Hydrometer Analysis	Qc - Consolidated Undrained Triaxial
M - Sieve Analysis	S - Drained Triaxial
MH - Combined Analysis, Sieve and Hydrometer	U - Unconfined Compression
	V - Field Vane Test




Note: Undrained triaxial tests in which pore pressures are measured are shown as Q' or Q'c.

### SOIL PROPERTIES


$\gamma$ - Total Unit Weight	K - Coefficient of Permeability
$\gamma_d$ - Dry Unit Weight	c - Undrained Shear Strength
$\gamma_b$ - Submerged Unit Weight	( $\frac{1}{2}$ Compressive Strength)
$L_L$ - Liquid Limit	St - Sensitivity
$P_L$ - Plastic Limit	$\phi'$ - Effective Angle of Shearing Resistance
W - Natural Water Content	$c'$ - Effective Cohesion Intercept
G - Specific Gravity	Cc - Compression Index
e - Void Ratio	Cv - Coefficient of Consolidation

RECORD OF BOREHOLE 1

LOCATION SEE FIG. 1 BORING DATE MAY 18-19, 1961 DATUM LOCAL  
BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER 8x CASING  
SAMPLER HAMMER WEIGHT 140 LB DROP 30 INCHES PEN TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT L <sub>L</sub> PLASTIC LIMIT P <sub>L</sub> P <sub>L</sub> — W — L <sub>L</sub> WATER CONTENT W				REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FT.		SHEAR STRENGTH C, LB. / SQ. FT.					WATER CONTENT, PER CENT				
						85										
80.8	GROUND LEVEL															
	LOOSE BROWN SAND AND GRAVEL FILL		1	2" D.O.	5	80										
76.8																
4.0	COMPACT TO DENSE GREY-BROWN SANDY GRAVEL WITH COBBLES		2	"	70	75										
73.8																
7.0	GREY-BROWN LAMINATED DOLOMITE BEDROCK		3	AXT K.C.		70										
			4	"												
64.8						65										
16.0	END OF HOLE					60										

W.L. IN CASING @  
EL 71.1 - MAY 19, 1961



W.L. IN CASING @ EL 71.1 - MAY 19, 1961

VERTICAL SCALE  
1 INCH TO 5 FEET

GOLDER & ASSOCIATES

DRAWN J.A.  
CHECKED J.A.

## RECORD OF BOREHOLE 2

LOCATION SEE FIG 1 BORING DATE MAY 19, 1961 DATUM LOCAL  
 BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER 8X CASING  
 SAMPLER HAMMER WEIGHT 140 LB DROP 30 INCHES PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT L <sub>L</sub> PLASTIC LIMIT P <sub>L</sub> WATER CONTENT W					REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FT	SHEAR STRENGTH C, LB / SQ. FT.					WATER CONTENT, PER CENT				
73.6	GROUND LEVEL					75										W.L. IN CASING @ EL 73.1 - MAY 19, 1961
72.8	TOPSOIL		1	2" DO.	2											
69.1	LOOSE GREY - BROWN SANDY GRAVEL WITH COBBLES		2	"	8	70										M
67.1	VERY LOOSE GREY - BROWN ORGANIC SAND		3	"	1											M ORGANIC CONTENT 25% BY WEIGHT
65			4	"	28	65										M
	COMPACT TO VERY DENSE GREY GRAVEL AND COBBLES WITH SAND LENSES		5	"	>100											M
57.6			6	AXT R.L.	—	55										
49.4	GREY - BROWN LAMINATED DOLOMITE BEDROCK		7	"	—	50										
24.2	END OF HOLE					45										

VERTICAL SCALE  
1 INCH TO 5 FEET

GOLDER &amp; ASSOCIATES

DRAWN J.A.  
CHECKED J.S.

## RECORD OF BOREHOLE 3

LOCATION SEE FIG. 1 BORING DATE MAY 19-23, 1961 DATUM LOCAL  
 BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER BX CASING  
 SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ $\frac{P_L}{W} \frac{W}{L_L}$ WATER CONTENT $W$					REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE BLOWS / FT.		SHEAR STRENGTH $C$ , LB /SQ.FT.					WATER CONTENT , PER CENT					
73.1	RIVER LEVEL				75											
72.5 0.6	RIVER BOTTOM															
	LOOSE TO COMPACT GREY-BROWN SANDY GRAVEL WITH COBBLES				70											
67.5																
5.6	VERY LOOSE GREY-BROWN ORGANIC SAND		1	DO. 3												
65.5					65											
7.6																
	DENSE TO VERY DENSE GRAY GRAVEL AND COBBLES WITH SOME SAND				60											
56.5																
16.6																
	GREY-BROWN LAMINATED DOLOMITE BEDROCK		2	ACT	55											
51.5																
21.6	END OF HOLE				50											

W.L. IN CASING @  
RIVER LEVEL - MAY  
23, 1961

M


VERTICAL SCALE  
1 INCH TO 5 FEET

GOLDER &amp; ASSOCIATES

DRAWN J.A.  
CHECKED *8/12*

RECORD OF BOREHOLE 4

LOCATION SEE FIG. 1 BORING DATE MAY 23-24, 1961 DATUM LOCAL  
BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER 3x CASING  
SAMPLER HAMMER WEIGHT 145 LB DROP 30 INCHES PEN TEST HAMMER WEIGHT -- LB DROP -- INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT L <sub>L</sub> PLASTIC LIMIT P <sub>L</sub>  WATER CONTENT W					REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH C, LB / SQ. FT.					WATER CONTENT, PER CENT					
73.1	RIVER LEVEL				75											
0.4	RIVER BOTTOM															
	COMPACT GREY - BROWN SANDY GRAVEL WITH COBBLES				70											
68.2																
4.9																
	GREY BROWN LAMINATED DOLOMITE BEDROCK			AST D-15	65											
62.2																
10.9	END OF HOLE				60											

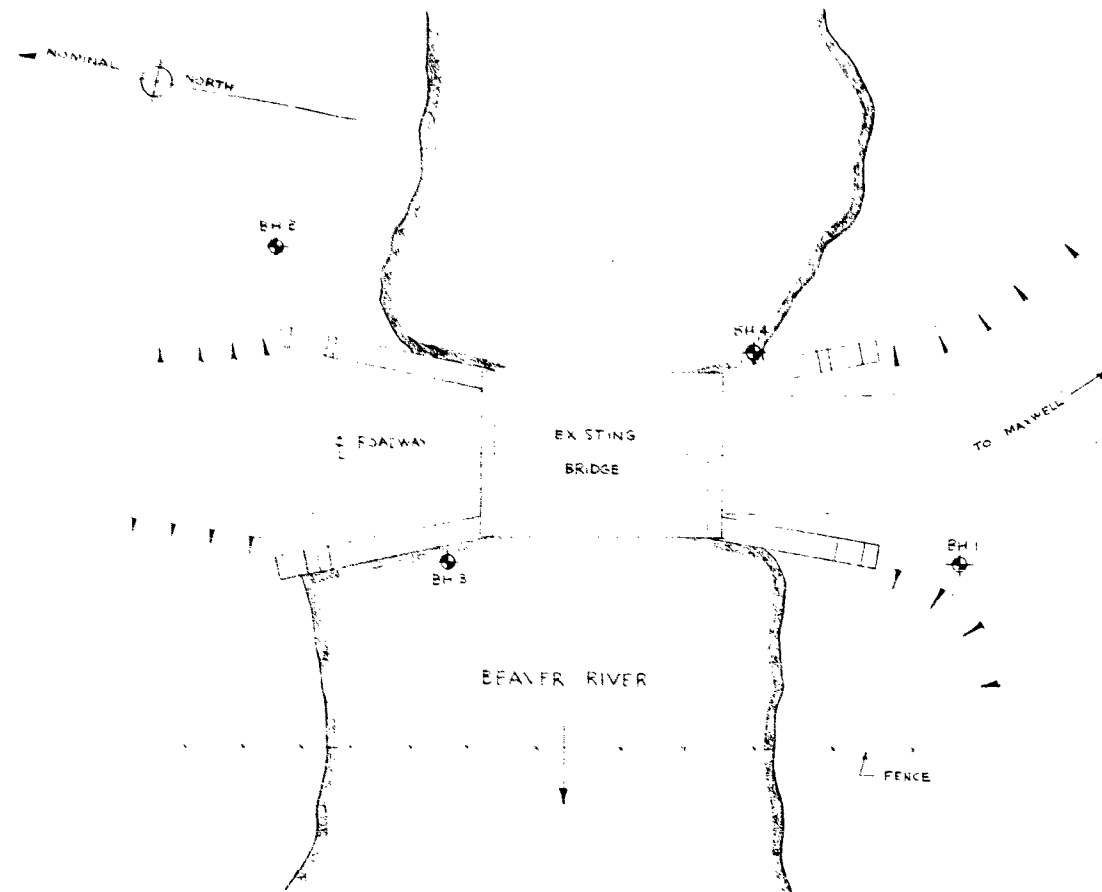
WL IN CASING  
3 RIVER LEVEL -  
MAY 24 1961

WL IN CASING  
3 RIVER LEVEL -  
MAY 24 1961

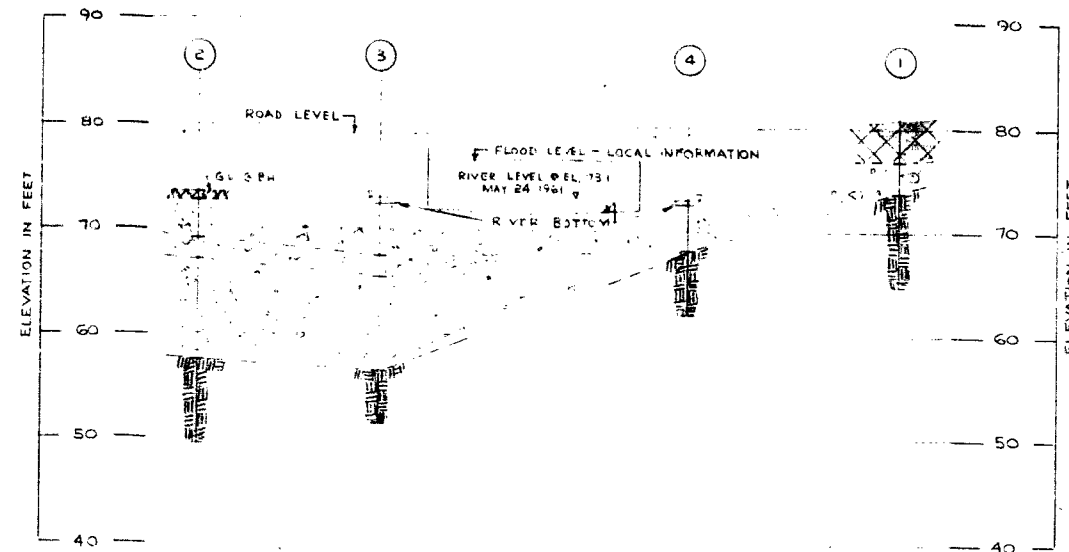
VERTICAL SCALE  
1 INCH TO 5 FEET

GOLDER & ASSOCIATES

DRAWN J.A.  
CHECKED J.S.









PLAN  
SCALE 1" TO 10' 0"

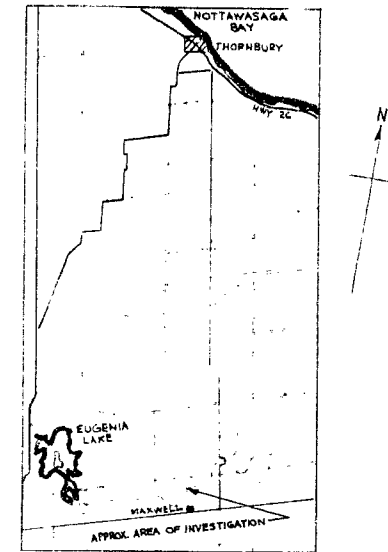


SCHEMATIC SECTION ALONG CL ROAD  
SCALE 1" TO 10' 0"

STRATIGRAPHY



-  DARK BROWN SANDY TOPSOIL
-  LOOSE BROWN SAND AND GRAVEL FILL
-  LOOSE TO DENSE GREY-BROWN SANDY GRAVEL WITH COBBLES
-  VERY LOOSE GREY-BROWN ORGANIC SAND
-  COMPACT TO VERY DENSE GREY GRAVEL AND COBBLES WITH SAND LENSES
-  GREY-BROWN LAMINATED DOLOMITE BEDROCK

SPECIAL NOTE: DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT BOREHOLE LOCATIONS ONLY. THE STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.



KEY PLAN  
SCALE 1" TO 4 MILES

LEGEND

-  BOREHOLE IN PLAN
-  BOREHOLE IN ELEVATION

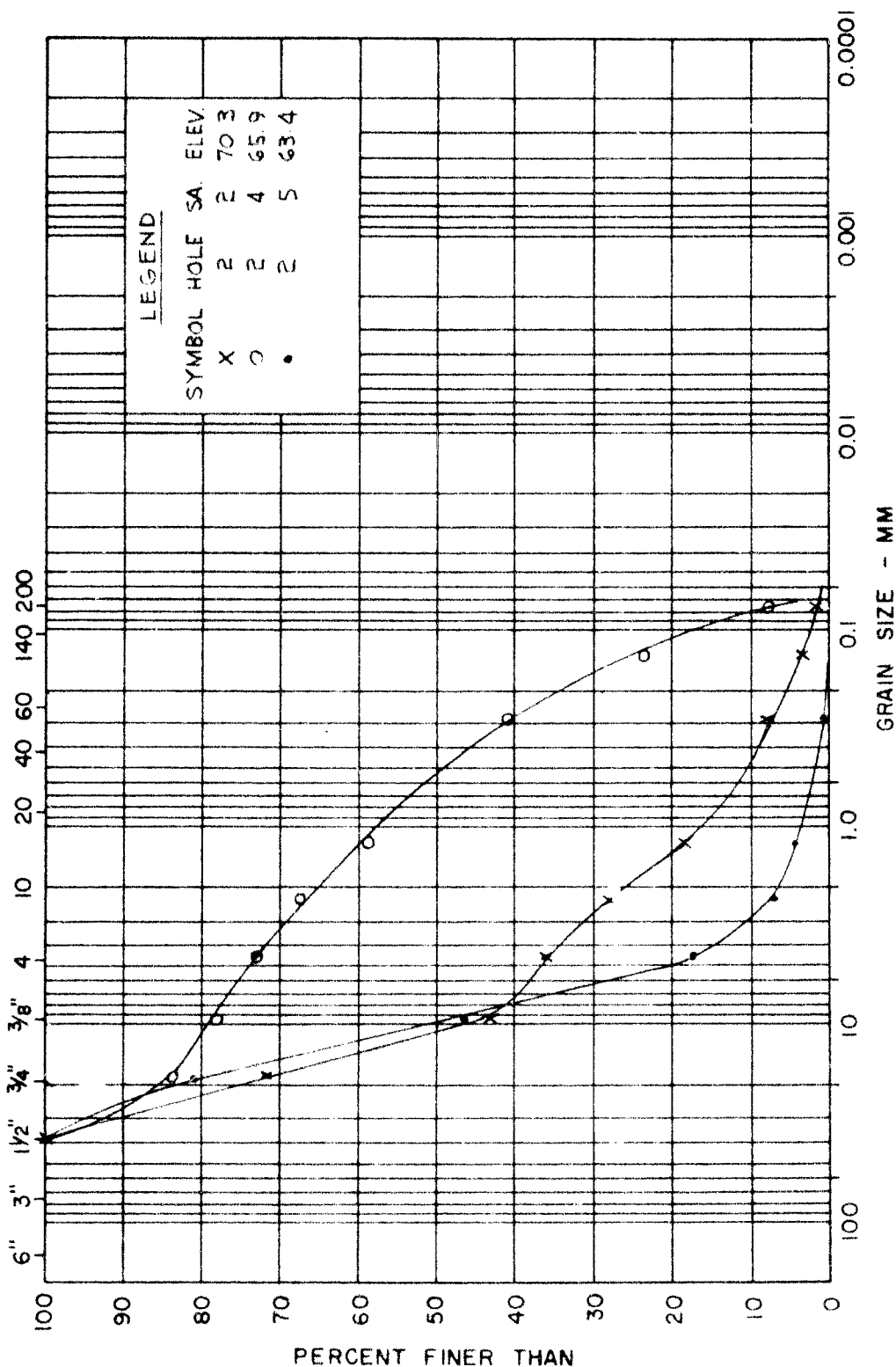
COUNTY OF GREY TOWNSHIP OF OSPREY PROPOSED CROSSING - BEAVER RIVER NEAR MAXWELL ONTARIO		GOLDER & ASSOCIATES CONSULTING CIVIL ENGINEERS	
		DATE: MAY 27, 1961 SCALE: 1" TO 10' 0"	
MADE J.A.	CHKD. J.S.	APPD. J.H.	FIGURE 1

# GRAIN SIZE DISTRIBUTION

FIGURE 2

M.I.T. GRAIN SIZE SCALE

SIZE OF OPENING - INS. U.S.S. SIEVE SIZE - MESHES/IN.



COBBLE SIZE	GRAVEL SIZE			SAND SIZE			SILT SIZE		CLAY SIZE	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE				

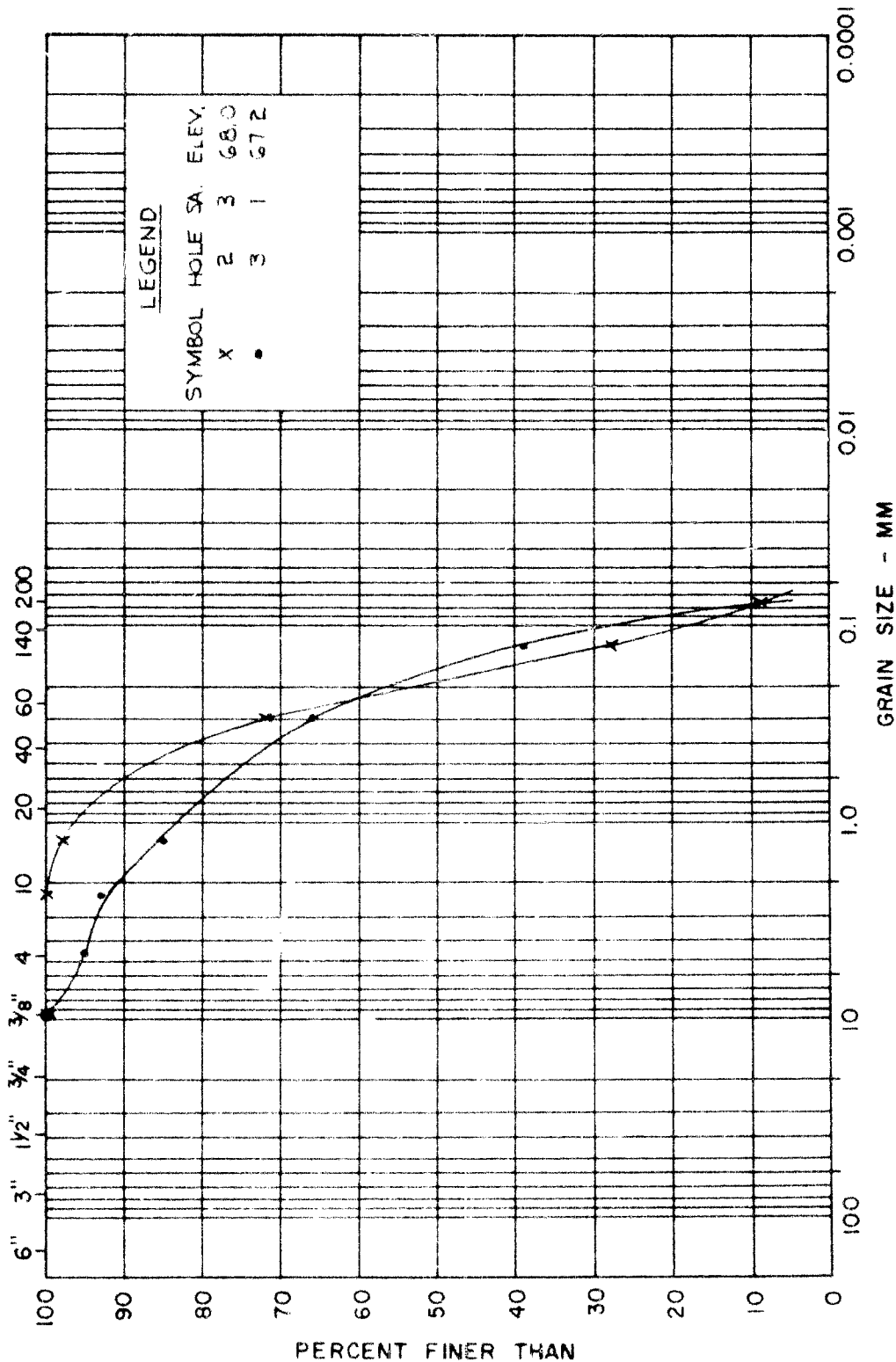


# GRAIN SIZE DISTRIBUTION

FIGURE 3

M.I.T. GRAIN SIZE SCALE

SIZE OF OPENING - INS. U.S.S. SIEVE SIZE - MESHES / IN.



PERCENT FINER THAN

GOLDER & ASSOCIATES