REPORT OF FOUNDATION INVESTIGATION
FOR THE
PROPOSED CROSSING OF HIGHWAY NO. 62
AT THE
SHERWOOD RIVER NEAR BONNECHERE, ONTARIO

for the

DEPARTMENT OF HIGHWAYS - ONTARIO

by the

Engineering Division
HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED
Toronto, Ontario

August, 1958.

ORDER OF CONTENTS

Section 1.1

PURPOSE OF REPORT

1.11 General

The purpose of this report is to present the results of a subsurface soil investigation on the proposed site of a new bridge to replace the existing single-lane steel Sherwood River bridge on Highway No. 62, and to offer recommendations regarding a safe foundation for the new structure.

Section 1.2

DISCUSSION OF PROCEDURES

1.21 Location of Boreholes

The field location of the boreholes for this investigation was established by Department of Highways' surveyors. At the completion of the work each borehole was marked with a large stake denoting the hole number for future reference. The locations and elevations of top of the boreholes are shown on the plan in Appendix 1.61.

1.22 Subsurface Drilling and Sampling

A primary program, specified by the client, of 4 soil borings was carried out in the vicinity of the proposed site of the new Sherwood River Bridge.

Two skid mounted, hydraulic head junior Longyear diamond drilling rigs were used on this project. All boring and sampling operations were completed by experienced soil sampling crews under the supervision of engineering personnel experienced in soil sampling procedures.

All soil borings were performed by the standard wash boring procedure. By this method, drill casing was driven into the soil by a 350 lb. hammer to a depth determined by the boring supervisor. All the soil contained inside the casing during this operation was thoroughly washed out to the bottom of the casing. Sampling tools were then lowered to the bottom of the hole. The sample was then taken and the sampling tools removed from the hole. Additional lengths of casing were added as required and the procedure repeated.

Attempts were made to obtain samples in the cohesionless soils by means of a 2-inch O. D. standard split spoon sampler. The standard penetrat-

ion test using a 140 lb. hammer falling 30 inches was recorded for each foot of sampler penetration. When necessary, recovery of samples for identification and correlation was obtained with a side slit sampler. All samples were visually examined and classified on the site, then placed in jars and forwarded to the engineering office. Where samples obtained were representative and relatively undisturbed, apparent density tests were made on site to obtain the approximate specific weight of the material.

1.23 Soil Testing

Selective samples from each strata were forwarded to the laboratory as a check on the visual field classification.

The results of all tests are given in the Appendices. The laboratory tests on the samples were performed by:

Donald Inspection Limited,
340 Richmond Street West,
Toronto 1, Ontario.

Section 1.3

DISCUSSION OF SITE

1.31 Geographic Location

The proposed bridge site is located on the King's Highway No. 62 at the proposed new crossing of the Sherwood River. The site is in the County of Renfrew, Township of Richards, Concessions III and VI, Lots 25 and 26.

1.32 Site Geology

The soils at the site vary in general from coarse to fine with depth, and thus are typical of an emergent landform which originated either in the post-glacial Champlain Sea or in one of the large inter-glacial lakes.

While bedrock was not encountered in the boreholes, geological maps of the area indicate that it should be granite.

The surface geological features of the site area are shown in the airphoto in Appendix 1.63.

1.33 Water Conditions

At the time of exploration, the water table in the boreholes on the north bank and the water level in the river were both found to be at EL. 561.5. On the south bank, borings were made in about 1.5 feet of water from an oil-drum barge.

There appears to be a difference of about 3.0 feet between high and low water levels in the river. Because of the sandy nature of the river bed, we have anticipated that scouring effects may go as deep as EL. 548.0 under the proposed locations of the abutments. In the centre of the river the effect may be greater.

1.34 Soil Conditions

The soils encountered on the site consisted generally of five structural types in the following order:

1. Topsoil - decomposed organic material intermixed with some sand.
2. Coarse sand and fine gravel.
3. Loose to dense grey silt and sand.
4. Fine to coarse brown sand with silt.
5. Fine grey silt, some sand.

The physical properties of the soil types are summarized below in order of their occurrence below the ground surface.

1. Decomposed organic material intermixed with some sand:

This layer of topsoil exists about 1 foot to 3 feet in depth at the site. This material is highly compressible and is considered to have no structural value, and should be removed before the construction of the abutment and the approaches to the bridge.

2. Coarse sand and fine gravel:

This layer of coarse material is about 3 feet deep on the north bank, but on the south bank it varies from about 4 feet to 9 feet deep. The soil is generally loose with standard penetration resistance ranging from 2 to 8 blows per foot, except in the vicinity of Borehole No. 2 where the standard penetration resistance went up to 32 blows per foot indicating denser material or the probable existence of coarser gravels.

3. Loose to dense grey silt and sand:

This stratum is the predominant soil at the site in considerations of the foundation of the bridge. It was found to occur at approximately EL. 555, for a depth of about 45 feet on the north bank and about 32 feet to 40 feet on the south bank.

The soil consists mainly of sand and silt in varying proportions. The content of silt or sand as the predominant material is somewhat irregular throughout this layer. Small traces of clay have been found but it is believed they will have very little or negligible effect on the structural characteristics of the entire stratum.

The apparent field density of this material is about 120 lbs/cu. foot. The standard penetration resistance is somewhat erratic throughout the layer, ranging from 6 to 55 blows per foot.

4. Fine to coarse brown sand with silt:

Sand appears to be the predominant material in this layer. It was difficult to sample through this layer as the soil is rather loose. Most of the samples in this layer were recovered either by washing out the material or by using the side slit spoon.

The standard penetration resistance averages about 10 blows per foot.

5. Fine grey silt, some sand:

This soil lies below EL. 490 more or less and is the final stratum encountered in boring.

The standard penetration resistance has a range from 4 to 26 blows per foot.

The maximum depth reached by boring in this stratum is EL. 467. From EL. 467 dynamic cone penetration tests were performed down to EL. 437 at which depth the cone penetration resistance is about 128 blows per foot.

Section 1.4

COMMENTS ON FOUNDATIONS OF STRUCTURE

1.41 General

Our understanding of the proposed bridge is that abutments are contemplated in the vicinity of chainage 436+85 and 437+85. We have assumed that the approaches to the bridge will be on fill contained and protected by wing walls. We have also assumed that the maximum height of the approach fills would be in the order of 15 feet.

1.42 Spread Footing Foundation At EL. 548.0

As it is difficult to evaluate the extent of scouring under the present river bed, we have assumed that spread footings would have to be placed at a maximum EL. 548. At this elevation, assuming the width of footing to be about 12 feet, the allowable soil pressure will be in the order of 1.8 tons per square foot. For a higher carry load, considerable widening of the footings is necessary, but by doing so the size of such footings would reach a point where it may become more economical to use other methods of foundation.

If spread footings are used it should be borne in mind that to put them at EL. 548 considerable excavation has to be done below water level. In order to prevent flooding of the excavation and liquefaction of the bottom of excavations, the free water surface in the soil surrounding the excavation must be kept below the bottom of excavations at all times. We expect that excavations could be made using water-tight sheet-piling and well-points (or deep well pumps).

Spread Footing Foundation At EL. 553.0

As an alternative for the north abutment, the footing may be placed at EL. 553 using a working load of about 2.0 tons per square foot, but

for the south abutment the working load should not exceed 1.0 tons per square foot. In both cases the abutments should be protected from scouring using permanent sheet piles or other appropriate means.

1.43 Pile Foundation

We have estimated that 10-inch wooden piles driven to approximately EL. 520 will develop a permissible bearing capacity of about 18 tons per pile, allowing a factor of safety of two. Such piles should be spaced not less than 30 inches centre to centre. Battered piles should be provided to take care of any horizontal load from the structure.

Because of the vibration during driving of the piles, it is anticipated that a certain degree of induced compaction of the underlying sandy soil will take place. This may give rise to difficulties in driving subsequent piles. Under such circumstances water jetting by the side of the pile simultaneous with the driving may be employed. This operation will assist in loosening up the soil through which the pile is to be penetrated, but it is important that all piles should be finally driven without the aid of jetting for at least 5 feet before the required elevation is attained. The length required of such piles should be checked with standard or established driving formulae.

With reference to the pile cap, if it is to be placed below the water level, care should be taken to see that the free water surface is kept below the bottom of the excavation at all times during construction otherwise liquefaction of the soil could occur with subsequent damage to the load carrying capacity of the piles. Well points and water-tight sheet-piling could probably be used successfully on this site to control the ground water.

If the pile cap is to be located above water level, we suggest it be

placed at approximately EL. 562.0. This has the distinct advantage of forming and working above the water level, but this advantage may be offset by a higher fill behind the abutments and on the approaches and cost in other items. An intermediate pier or piers in mid-stream may be necessary in view of the possibility of a longer bridge in this case.

Depending on design requirements, heavier types of piles such as monotube, tapered or caisson piles may be used to secure an allowable carrying load up to 80 tons or more per pile. These piles would have to be driven deeper than that required for wooden piles. The length of such piles and the load carrying capacity must, however, be determined from established driving formulae and load tests.

1.44 Recommendations

(1) In our opinion a satisfactory foundation for this bridge structure may be secured by one of two methods as follows:

Method I - Spread Footing Foundation:

Establish the footings of the abutments at EL. 548 using a maximum design soil bearing capacity of 1.8 tons per square foot.

Method II - Pile Foundation:

Drive 10-inch wooden piles to approximately EL. 520. They should not be spaced less than 30 inches centre to centre. Such piles are expected to provide a safe carrying load of about 18 tons per pile.

In both these methods, for excavation below the water table, well-points or other appropriate means will be required to control the ground water.

(2) We would also like to suggest the use of piles, cut off and forming the pile cap above high water level, that is, at EL. 562 approximately. This method has the distinct advantage of forming and pouring concrete above water line, provided it is not offset by high costs in other items. We have taken the liberty of including in this report a sketch, under Appendix 1.62, which shows one possible layout scheme of the abutments, and hope that it will be of some assistance to you.

(3) Other types of piles may be employed to give a higher carrying capacity per pile as required. This engineering office will be pleased to provide any additional information in this respect and to have the opportunity to supervise any pile driving or loading test which may be deemed necessary by your Bridge Design Office.

(4) We do not envisage any stability problems in connection with a 15-foot high approach fill provided the original topsoil, consisting of decomposed organic material, has been removed.

Section 1.5

PERSONNEL

The field work for this project was performed under the supervision of Mr. I. E. Thurber, B.Sc.

The airphoto interpretation of the site was provided by Mr. N. W. E. Lee, P. Eng.

Mr. W. W. F. Wong, P. Eng. was Project Engineer, and was responsible for the writing and completion of this report.

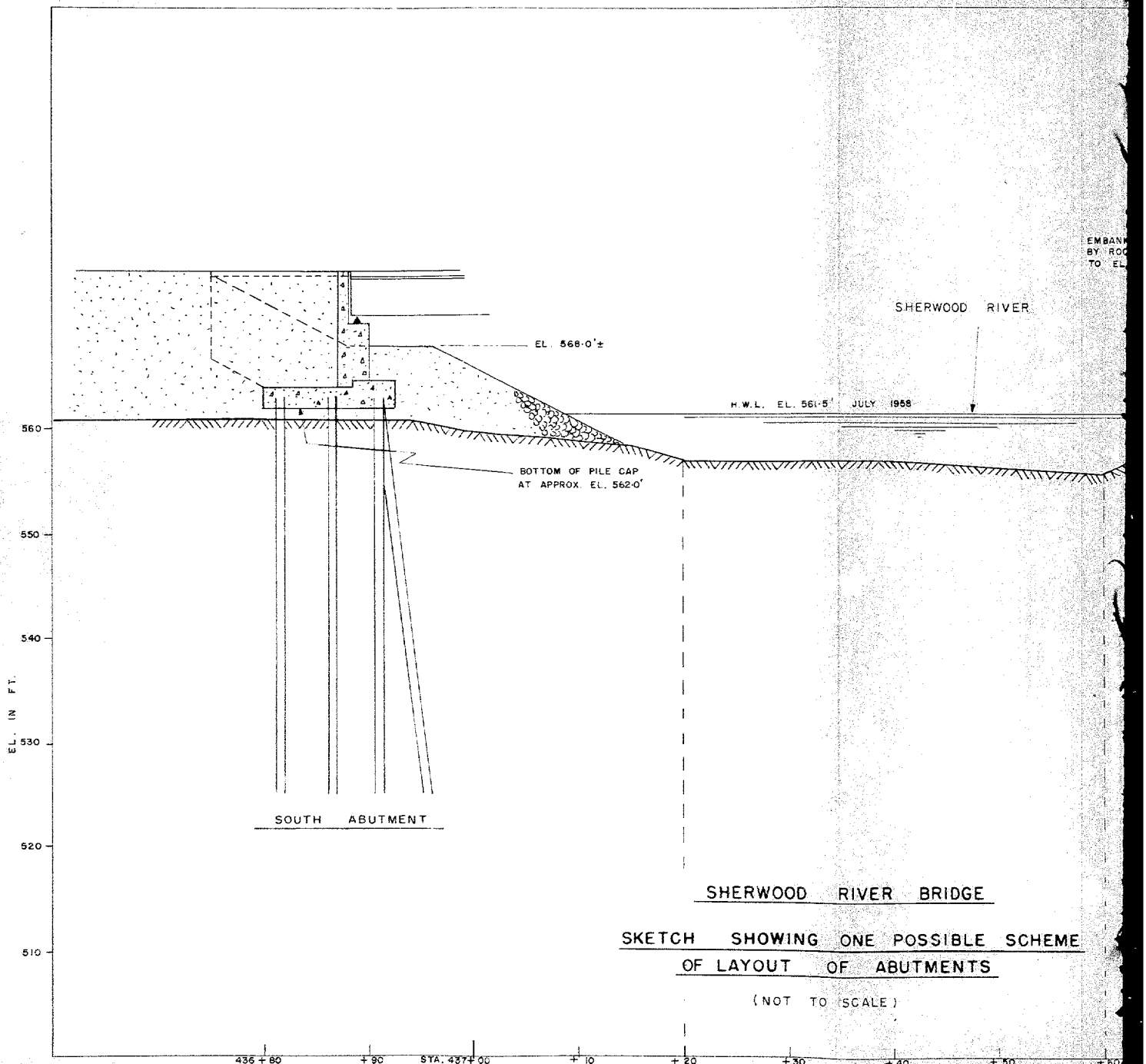
Mr. J. Kilgour, P. Eng. provided administrative supervision of the work and reviewed this report.

Section 1.6

APPENDICES

1.61 General Plan of Site and Subsurface Sections

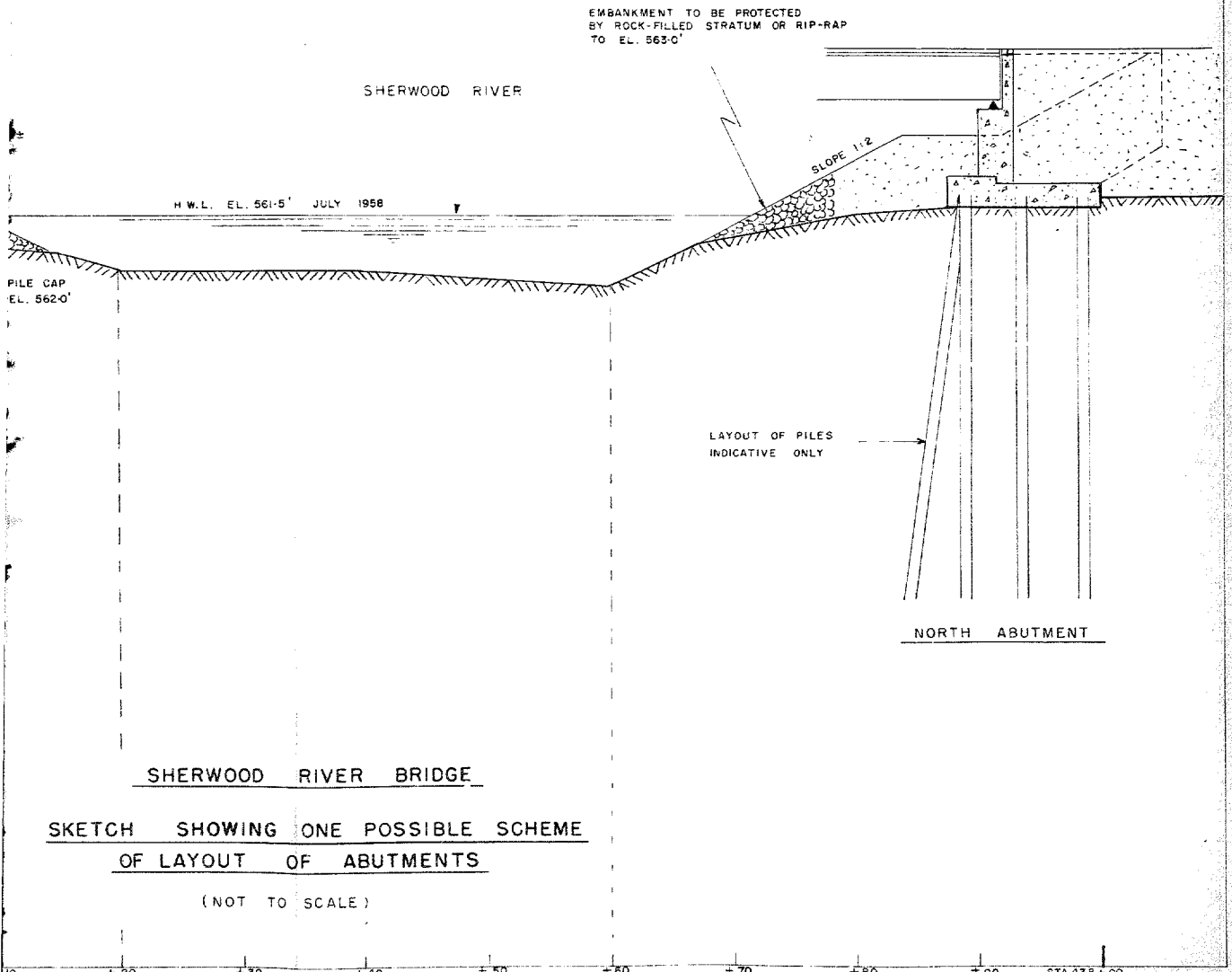
1.62 Sketch Showing a Possible Layout Scheme of Abutments



SHERWOOD RIVER BRIDGE

SKETCH SHOWING ONE POSSIBLE SCHEME OF LAYOUT OF ABUTMENTS

(NOT TO SCALE)



SHERWOOD RIVER BRIDGE

SKETCH SHOWING ONE POSSIBLE SCHEME OF LAYOUT OF ABUTMENTS

(NOT TO SCALE)

1.63 Office Logs of Boreholes

JOB No. H-529/58 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO

COORDINATES CH. 436 + 89·0 OFFSET 16·0' LEFT OF ℄

ELEV. (surface) 560·0 (collar) ____ Datum D.H.O.

BOREHOLE NUMBER 1

DATE (started) JULY 22, 1958 (finished) JULY 24, 1958

RIG No. ____ TYPE LONGYEAR JR. A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt, clay, sand, gravel, peat, fill

x — standard penetr. 2 s/s.
△ — vane shear
○ — pocket penetrometer

SAMPLE CONDITION: undisturbed; disturbed but represent.; fair; lost

W.S.
S.S.W.
S.S
S.T.
T.W.P
D.B.

BORING LOG

SCALE FT.	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
0	0	561·5			WATER LEVEL
	1·5	560·0			GROUND SURFACE
					DECOMPOSED ORGANIC MATERIAL AND SOME SAND
5	8·0	553·5			COARSE SAND & FINE GRAVEL
10					LOOSE TO DENSE
15					GREY
20					SILT & SAND
25					
30					
35					
40					
45	48·0	513·5			
50					FINE TO COARSE
55					BROWN SAND
60					WITH SILT
65	64·0	497·5			
70					FINE GREY SILT,
75					SOME SAND
80	80·0	481·5			

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 40 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		4·5	6·0	S.S.		2
2		9·5	11·0	S.S.	14/18	7
3		14·5	16·0	S.S.	14/18	6
4		19·5	21·0	S.S.	16/18	9
5		24·5	26·0	S.S.	13/18	10
6		29·5	31·0	S.S.	14/18	14
7		34·5	36·0	S.S.	13/18	22
8		39·5	41·0	S.S.	15/18	17
9		44·5	46·0	S.S.	9/18	17
10		49·5	51·0	S.S.W.		12
11		54·5	56·0	S.S.W.		7
12		59·5	61·0	S.S.W.		8
13		64·5	66·0	S.S.	14/16	26
14		69·5	71·0	S.S.	8/18	14
15		74·5	76·0	S.S.		10
16		79·5	81·0	S.S.W.		8

ATTERBERG LIMITS wp x — o wl

● — NATURAL WATER CONTENT

(CONTINUED ON NEXT PAGE)

TING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 1

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
△ — vane shear
○ — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

W.S. — washed sample
S.S.W. — side slit
S.S — split spoon
S.T. — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γf — field density
C — consolidation test
M — mechanical analysis
T — triaxial shear
K — permeability
U — unconfined compression

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 1 1/2

STANDARD PENETRATION TEST
X (BLOWS PER FOOT)
20 40 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		4·5	6·0	S.S.		2
2		9·5	11·0	S.S.	14/18	7
3		14·5	16·0	S.S.	14/18	6
4		19·5	21·0	S.S.	18/18	9
5		24·5	26·0	S.S.	13/18	10
6		29·5	31·0	S.S.	14/18	14
7		34·5	36·0	S.S.	13/18	22
8		39·5	41·0	S.S.	15/18	17
9		44·5	46·0	S.S.	9/18	17
10		49·5	51·0	S.S.W.		12
11		54·5	56·0	S.S.W.		7
12		59·5	61·0	S.S.W.		8
13		64·5	66·0	S.S.	14/18	26
14		69·5	71·0	S.S.	8/18	14
15		74·5	76·0	S.S.		10
16		79·5	81·0	S.S.W.		8

LABORATORY TESTS

ATTERBERG LIMITS W_P X — O W_L
● — NATURAL WATER CONTENT

REMARKS

JOB No. H-529/58 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS — ONTARIO

COORDINATES CH. 436 + 89·0 OFFSET 16·0' L. OF ℄

ELEV. (surface) 560·0 (collar) ..... Datum D.H.O.

BOREHOLE NUMBER 1

DATE (started) JULY 22, 1958 (finished) JULY 24, 1958

RIG No. ..... TYPE LONGYEAR JR. A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
△ — vane shear
○ — pocket penetrometer

SAMPLE CONDITION
undisturbed
disturbed but represent.
poor
lost

W.S.
S.S.W.
S.S.
S.T.
T.W.P.
D.B.

BORING LOG

FIELD TESTS

SCALE FT	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
80	80·0	481·5			
85					FINE GREY SILT, SOME SAND
90	89·5	472·0			END OF BORING & BX CASING
95					DYNAMIC CONE PENETRATION TEST FROM EL. 470·5 TO EL. 441·5
100					
105					
110					
115					
120	120·0	441·5			END OF HOLE

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 1 1 1/2

STANDARD PENETRATION TEST
X (BLOWS PER FOOT) 20 40 60

SAMPLES

No.	COND	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
16		79·5	81·0	S.S.W.		8
17		84·5	86·0	S.S.		12
18		89·5	91·0	S.S.		13

ATTERBERG LIMITS wp X — O wl
● — NATURAL WATER CONTENT

NOTE: CONE PENETRATION RESISTANCE AT END OF HOLE = 89 BLOWS PER FOOT

NTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 1

silt — clay — sand — gravel — peat — fill

x — standard penetr. & S.S.
∠ — vane shear
o — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

W.S. — washed sample
S.S.W. — side slit
S.S. — split spoon
ST. — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γ f — field density
C — consolidation test
M — mechanical analysis
T — triaxial shear
K — permeability
U — unconfined compression

FIELD TESTS

LABORATORY TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 1 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 40 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
16		79·5	81·0	S.S.W.		8
17		84·5	86·0	S.S.		12
18		89·5	91·0	S.S.		13

ATTERBERG LIMITS wp x — o wl
● — NATURAL WATER CONTENT

REMARKS

NOTE : CONE PENETRATION RESISTANCE AT END OF HOLE = 89 BLOWS PER FOOT

JOB No. H-529/58 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO

COORDINATES CH. 436 + 89·0 ; OFFSET 14·0' RT. OF ℄

ELEV. (surface) 560·0 (collar) ..... Datum G.H.D.

BOREHOLE NUMBER 2

DATE (started) JULY 26, 1958 (finished) JULY 28, 1958

RIG No. ..... TYPE LONGYEAR JR. A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
△ — vane shear
○ — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

BORING LOG

SCALE FT	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
0	0	561·5			WATER LEVEL
	1·5	560·0			GROUND SURFACE
					DECOMPOSED ORGANIC MATERIAL
5					COARSE SAND AND FINE GRAVEL
10	11·5	550·0			
15					LOOSE TO DENSE
20					
25					GREY
30					
					SILT & SAND
35					
40					
45					
50	50·0	511·5			END OF BORING
55					

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1/2

STANDARD PENETRATION TEST
X (BLOWS PER FOOT) 20 40 60

SAMPLES

No	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		3·5	5·0	S.S.	6/18	32
2		8·5	10·0	S.S.W.		36
3		13·5	15·0	S.S.	18/18	42
4		18·5	20·0	S.S.	13/18	15
5		23·5	25·0	S.S.	16/18	9
6		28·5	30·0	S.S.		13
7		33·5	35·0	S.S.	12/18	18
8		38·5	40·0	S.S.	15/18	28
9		43·5	45·0	S.S.	16/18	33
10		48·5	50·0	S.S.	0/18	41

ATTERBERG LIMITS wp x — o
● — NATURAL WATER CONTEN

INTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 2

silt — clay — sand — gravel — peat — fill

x — standard penetr. 2 S.S.
△ — vane shear
○ — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

W.S. — washed sample
S.S.W — side slit
S.S — split spoon
S.T — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γf — field density
C — consolidation test
M — mechanical analysis
T — triaxial shear
K — permeability
U — unconfined compression

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT)
1/2 1/2

STANDARD PENETRATION TEST
X (BLOWS PER FOOT)
20 40 60

SAMPLES

No	COND	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		3·5	5·0	S.S	6/18	32
2		8·5	10·0	S.S.W.		36
3		13·5	15·0	S.S.	18/18	42
4		18·5	20·0	S.S.	13/18	15
5		23·5	25·0	S.S.	16/18	9
6		28·5	30·0	S.S.		13
7		33·5	35·0	S.S.	12/18	18
8		38·5	40·0	S.S.	15/18	28
9		43·5	45·0	S.S.	16/18	33
10		48·5	50·0	S.S.	10/18	41

LABORATORY TESTS

ATTERBERG LIMITS WD X — O WI
● — NATURAL WATER CONTENT

REMARKS

JOB No. H-529/56 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS — ONTARIO

COORDINATES CH. 437+89·0 ; OFFSET 16·0 LEFT OF ℄

ELEV. (surface) 562·0 (collar) _____ Datum D.H.O.

BOREHOLE NUMBER 3

DATE (started) JULY 24, 1958 (finished) JULY 25, 1958

RIG No. _____ TYPE LONGYEAR JR A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
△ — vane shear
○ — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed but represent.
— fair
— lost

BORING LOG

SCALE FT.	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
0	0	562·0			GROUND SURFACE
	0·5	561·5			DECOMPOSED ORGANIC MATERIAL AND SOME SAND
	3·5	558·5			
5	7·0	555·0			COARSE SAND & FINE GRAVEL
10					LOOSE TO DENSE
15					
20					GREY
25					
30					SILT AND SAND
35					
40					
45					
50					
55	55·0	507·0			
60					FINE TO MEDIUM BROWN SAND WITH SILT
65					
70	70·0	492·0			
75					FINE GREY SILT, SOME SAND
80	80·0	482·0			END OF BORING & BX CASING

(CONTINUED ON NEXT SHEET)

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 | 40 | 60

SAMPLES No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		5·0	6·5	S.S.	12/18	5
2		10·0	11·5	S.S.	16/18	29
3		15·0	16·5	S.S.	16/18	55
4		20·0	21·5	S.S.W.		8
5		25·0	26·5	S.S.W.		8
6		30·0	31·5	W.S.		7
7		35·0	36·5	S.S.	16/18	10
8		40·0	41·5	S.S.W.		17
9		45·0	46·5	S.S.	14/18	23
10		50·0	51·5	S.S.	14/18	25
11		55·0	56·5	S.S.W.		7
12		60·0	61·5	S.S.W.		13
13		65·0	66·5	S.S.W.		10
14		70·0	71·5	W.S.		5
15		75·0	76·5	S.S.W.		9

ATTERBERG LIMITS W_P x — o W_L
● — NATURAL WATER CONTENT

NTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 3

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
a — vane shear
o — pocket penetrometer

SAMPLE CONDITION
--- undisturbed
--- disturbed but represent.
--- fair
--- lost

W.S. — washed sample
S.S.W — side slit
S.S. — split spoon
S.T. — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γ_f — field density
C — consolidation test
M — mechanical analysis
T — trioxial shear
K — permeability
U — unconfined compression

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 | 40 | 60

LABORATORY TESTS

ATTERBERG LIMITS wp x—o wl
● --- NATURAL WATER CONTENT

SAMPLES No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)	REMARKS
1		5·0	6·5	S.S.	12/18	5	
2		10·0	11·5	S.S.	16/18	29	
3		15·0	16·5	S.S.	16/18	55	
4		20·0	21·5	S.S.W.		8	
5		25·0	26·5	S.S.W.		8	
6		30·0	31·5	W.S.		7	
7		35·0	36·5	SS.	16/18	10	
8		40·0	41·5	S.S.W.		17	
9		45·0	46·5	S.S.	14/18	23	
10		50·0	51·5	S.S.	14/18	25	
11		55·0	56·5	S.S.W.		7	
12		60·0	61·5	S.S.W.		13	
13		65·0	66·5	S.S.W.		10	
14		70·0	71·5	W.S.		5	
15		75·0	76·5	S.S.W.		9	

JOB No. H-529/58 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO

COORDINATES CH. 437 + 89·0 ; OFFSET 16·0' LEFT OF ℄

ELEV (surface) 562·0 (collar) _____ Datum D.H.O.

BOREHOLE NUMBER 3

DATE (started) JULY 24, 1958 (finished) JULY 25, 1958

RIG No. _____ TYPE LONGYEAR JR. A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 s.s.
△ — vane shear
o — pocket penetrometer

SAMPLE CONDITION
undisturbed
disturbed but represent.
fair
lost

BORING LOG

FIELD TESTS

SCALE FT	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
80	80·0	482·0			END OF BORING & BX CASING
					DYNAMIC CONE PENETRATION TEST FROM EL. 480·0' TO EL. 450·0'
	112·0	450·0			END OF HOLE

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 40 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV	PENETRATION RESISTANCE (BLOWS PER FOOT)
16		80·0	81·5	S.S.		8

ATTERBERG LIMITS W_P x — O W_L
● — NATURAL WATER CONTENT

NOTE : CONE PENETRATION RESISTANCE AT END OF HOLE = 107 BLOWS PER FOOT

...TING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 3

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 s.s.
a — vane shear
o — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

W.S. — washed sample
S.S.W. — side slit
S.S. — split spoon
S.T. — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γ_f — field density
C — consolidation test
M — mechanical analysis
T — triaxial shear
K — permeability
U — unconfined compression

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT)
1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST
X (BLOWS PER FOOT)
20 | 40 | 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
16		80-0	81-5	S.S.		8

NOTE : CONE PENETRATION RESISTANCE AT END OF HOLE = 107 BLOWS PER FOOT

LABORATORY TESTS

ATTERBERG LIMITS wp X — o wl
● — NATURAL WATER CONTENT

REMARKS

JOB No. H-529/58 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS — ONTARIO

COORDINATES CH. 437+89 ; OFFSET 15'-0 RIGHT OF ℄

ELEV. (surface) 562·0 (collar) _____ Datum D.H.O.

BOREHOLE NUMBER 4

DATE (started) JULY 19, 1958 (finished) JULY 22, 1958

RIG No. _____ TYPE LONGYEAR JR. A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 s.s.
△ — vane shear
o — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed but representative
— fair
— lost

BORING LOG

SCALE FT.	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
0	0	562·0			GROUND SURFACE
	0·5	561·5			DECOMPOSED ORGANIC MATERIAL AND SOME SAND
	4·0	558·0			COARSE SAND & FINE GRAVEL
	6·5	555·5			MEDIUM TO DENSE GREY SILT & SAND
	50·0	512·0			FINE TO COARSE BROWN SAND, WITH SILT
	77·0	485·0			FINE GREY SILT, SOME SAND

(CONTINUED ON NEXT SHEET)

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST X (BLOWS PER FOOT) 20 | 40 | 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		5·0	6·5	S.S.	12/18	8
2		10·0	11·5	S.S.	14/18	24
3		15·0	16·5	S.S.	12/18	19
4		20·0	21·5	S.S.		10
5		25·0	26·5	S.S.	12/18	12
6		30·0	31·5	S.S.W.		11
7		35·0	36·5	S.S.	14/18	16
8		40·0	41·5	S.S.	12/18	15
9		45·0	46·5	S.S.	12/18	12
10		50·0	51·5	S.S.W.		9
11		55·0	56·5	S.S.		11
12		60·0	61·5	W.S.		
13		65·0	66·5	S.S.W.		13
14		70·0	71·5	S.S.W.		11
15		75·0	76·5	S.S.W.		12

ATTERBERG LIMITS W_P X — O
● — NATURAL WATER CONTENT

NTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 4

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 s.s.
△ — vane shear
o — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

W.S. — washed sample
S.S.W. — side slit
S.S. — split spoon
S.T. — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γ_f — field density
C — consolidation test
M — mechanical analysis
T — trioxial shear
K — permeability
U — unconfined compression

FIELD TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 | 40 | 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)
1		5·0	6·5	S.S.	12/18	8
2		10·0	11·5	S.S.	14/18	24
3		15·0	16·5	S.S.	12/18	19
4		20·0	21·5	S.S.		10
5		25·0	26·5	S.S.	12/18	12
6		30·0	31·5	S.S.W.		11
7		35·0	36·5	S.S.	14/18	16
8		40·0	41·5	S.S.	12/18	15
9		45·0	46·5	S.S.	12/18	12
10		50·0	51·5	S.S.W.		9
11		55·0	56·5	S.S.		11
12		60·0	61·5	W.S.		
13		65·0	66·5	S.S.W.		13
14		70·0	71·5	S.S.W.		11
15		75·0	76·5	S.S.W.		12

LABORATORY TESTS

ATTERBERG LIMITS wp x — o wl
● — NATURAL WATER CONTENT

γ_f (pcf)

REMARKS

JOB No. H-529/58 LOCATION SHERWOOD RIVER

CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO

COORDINATES CH 437 + 89 OFFSET 15·0' RT. OF ℄

ELEV. (surface) 562·0 (collar) _____ Datum D.H.O.

BOREHOLE NUMBER 4

DATE (started) JULY 19, 1958 (finished) JULY 22, 1958

RIG No. _____ TYPE LONGYEAR JR. A

HUNTING TECHNICAL AND EXPLORATION SERVICES

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
a — vane shear
o — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed but represent.
— fair
— lost

W.
S.S.
S.
S.
T.W.
D.

BORING LOG

FIELD TESTS

SCALE FT.	DEPTH FT.	ELEV. FT.	WATER OBSERVATION	LOG	DESCRIPTION
80	80·0	482·0			
85					FINE GREY SILT,
90					SOME SAND
95	95·0	467·0			END OF BORING & B X CASING
100					DYNAMIC CONE PENETRATION TEST FROM EL. 465·0' TO EL. 438·0'
105					
110					
115					
120					
125	124·0	438·0			END OF HOLE
130					

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

STANDARD PENETRATION TEST x (BLOWS PER FOOT) 20 | 40 | 60

SAMPLES

No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION & RESISTANCE (BLOWS PER FOOT)
16		80·0	81·5	S.S.W.		4
17		85·0	86·5	W.S.		5
18		95·0	96·5	S.S.		10

NOTE: CONE PENETRATION RESISTANCE AT END OF HOLE = 128 BLOWS PER FOOT

ATTERBERG LIMITS W_P x — o W_L

● — NATURAL WATER CONTENT

NTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 4

silt | clay | sand | gravel | peat | fill

x — standard penetr. 2 S.S.
Δ — vane shear
o — pocket penetrometer

SAMPLE CONDITION
— undisturbed
— disturbed, but represent.
— fair
— lost

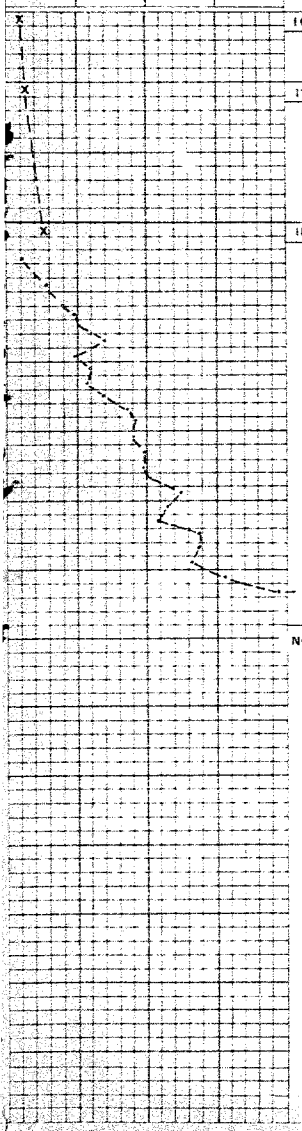
W.S. — washed sample
S.S.W. — side slit
S.S. — split spoon
S.T. — shelby tube
T.W.P. — thin walled piston
D.B. — diamond bit

γ_f — field density
C — consolidation test
M — mechanical analysis
T — triaxial shear
K — permeability
U — unconfined compression

FIELD TESTS | LABORATORY TESTS

SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 | 1 | 1 1/2

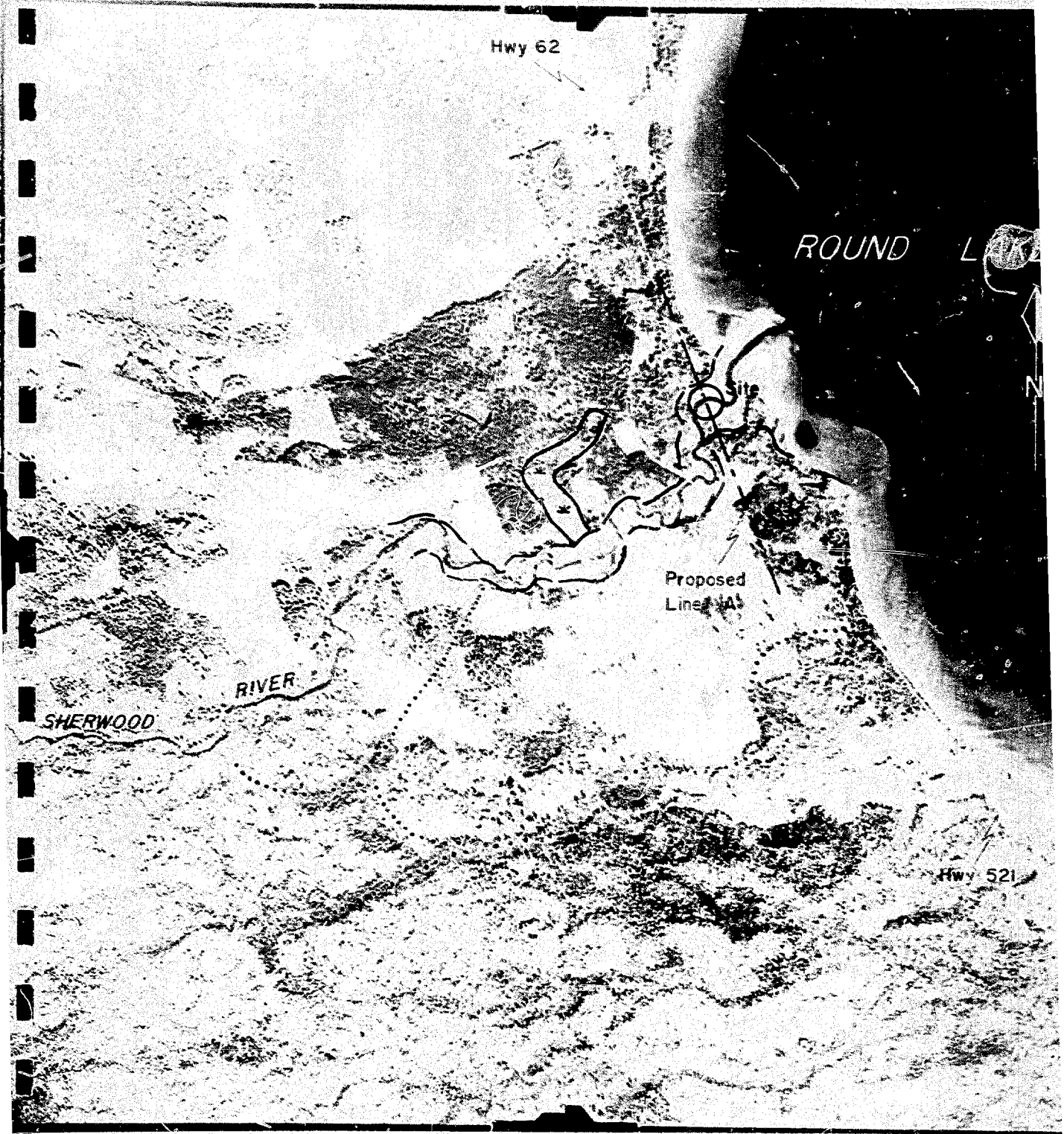
STANDARD PENETRATION TEST X (BLOWS PER FOOT) 20 | 40 | 60



SAMPLES No.	COND.	DEPTH FROM FT.	DEPTH TO FT.	TYPE	RECOVERY LENGTH REC. / DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)	ATTERBERG LIMITS wp x—o wl ● — NATURAL WATER CONTENT	REMARKS
16		80·0	81·5	S.S.W.		4		
17		85·0	86·5	W.[illegible]		5		
18		95·0	96·5	S.S.		10		

NOTE: CONE PENETRATION RESISTANCE AT END OF HOLE = 128 BLOWS PER FOOT

1.64 Air Photo of Site



SHERWOOD RIVER
ROUND LAKE ONTARIO

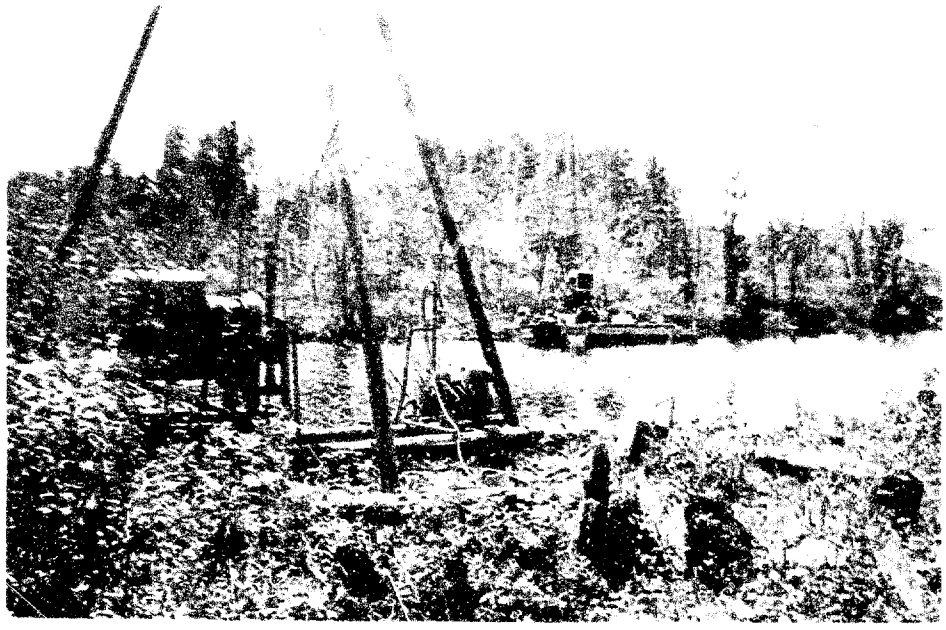
SCALE – 1" = 1320 ft.

Area enclosed by line indicates extent of present valley with alluvial deposits

..... Old channel scars

Old beach line — probably granular material

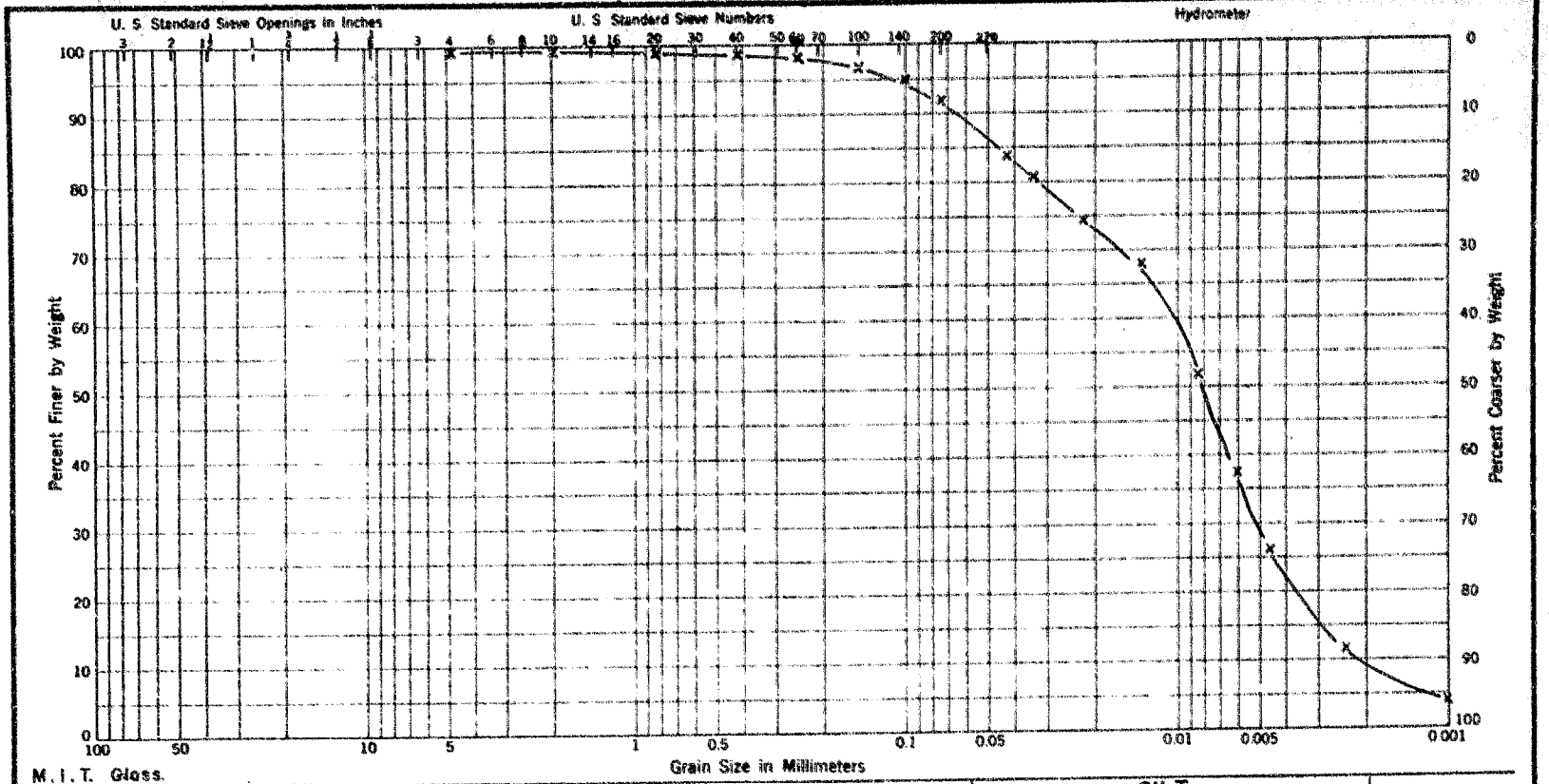
1.65 Photos of Site



General View of Site from Station 428+20 (approximately) Looking South

View of Site on South Bank Looking South

1.66 Soil Classification Charts



11%	sand
80%	silt
9%	clay

Classification

SILT, SOME SAND AND CLAY

(SILT)

HUNTING TECHNICAL and EXPLORATION SERVICES

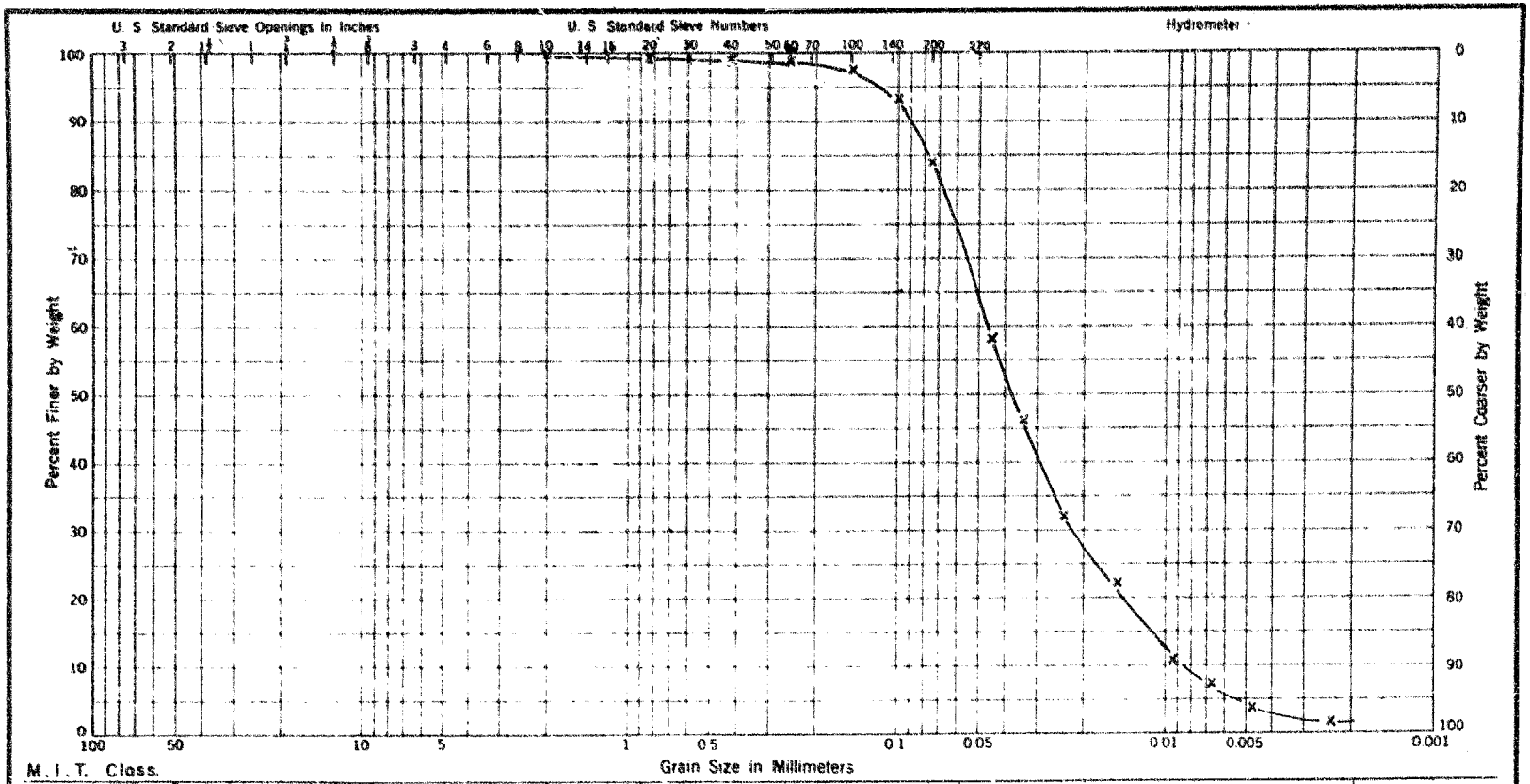
DEPARTMENT OF HIGHWAYS – ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER — KING'S HWY. NO. 62

SOIL MECHANICAL ANALYSIS

BOREHOLE 1 DEPTH – 19·5 TO 21·0'



25%	sand
73%	silt
2%	clay

Classification

Silt with sand

(sandy silt)

HUNTING TECHNICAL and EXPLORATION SERVICES

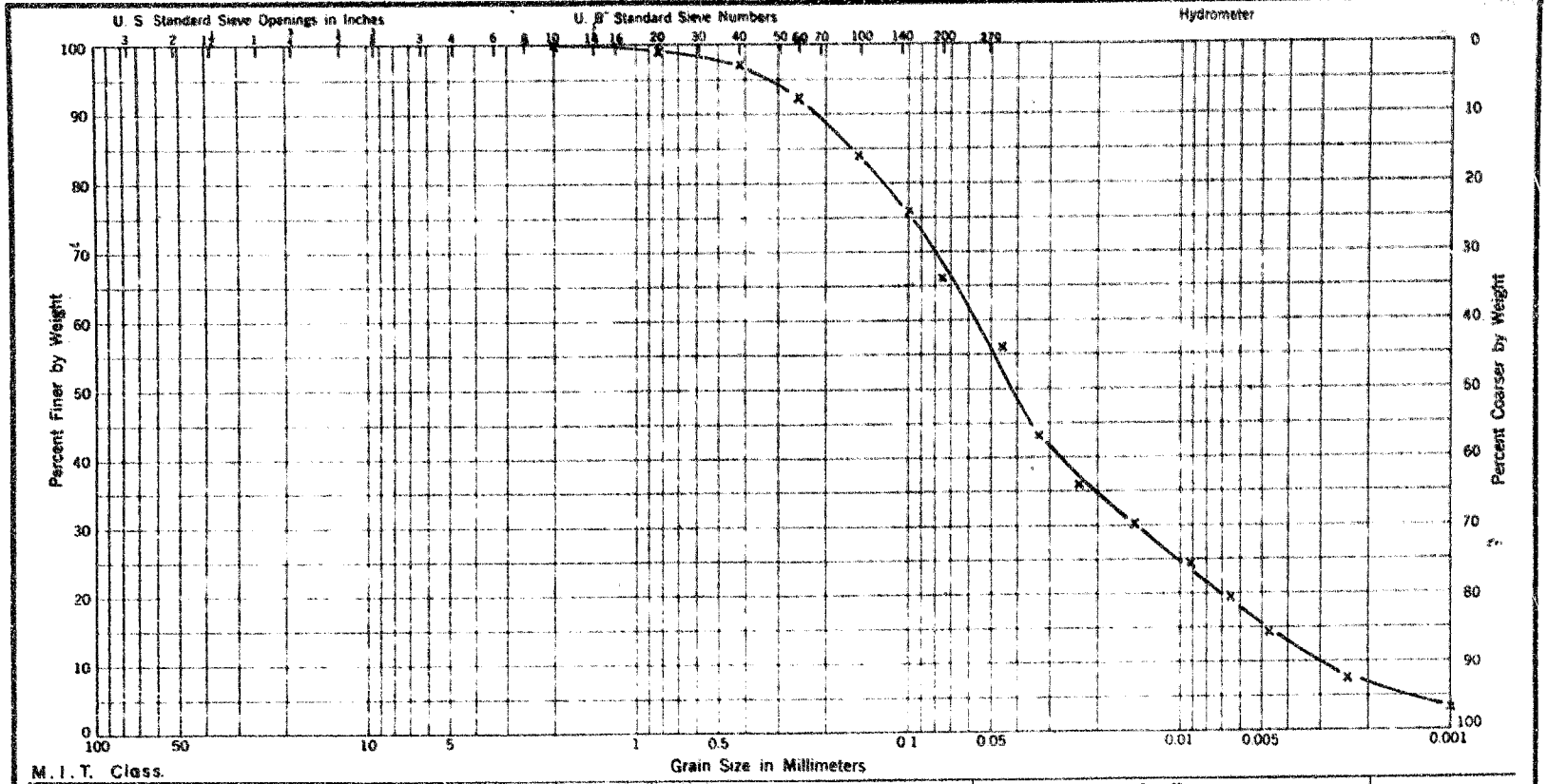
DEPARTMENT OF HIGHWAYS — ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER — KING'S HWY. NO. 62

SOIL MECHANICAL ANALYSIS

BOREHOLE 1 DEPTH - 64·5' TO 66·0'



40%	sand
54%	silt
6%	clay

Classification

Silt and sand, trace of clay (sandy silt)

HUNTING TECHNICAL and EXPLORATION SERVICES

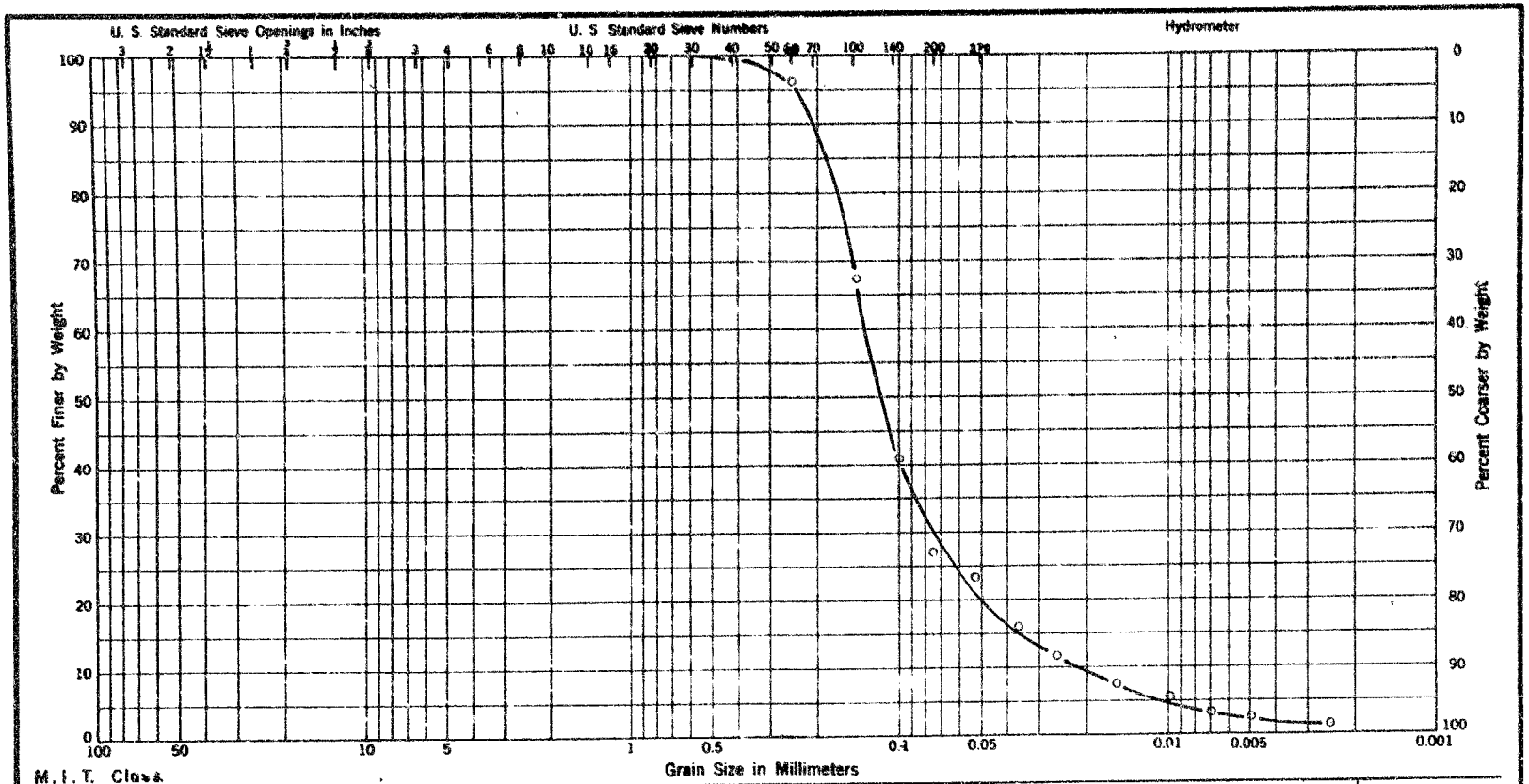
DEPARTMENT OF HIGHWAYS – ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER — KING'S HWY. NO. 62

SOIL MECHANICAL ANALYSIS

BOREHOLE 2 DEPTH – 43·5' TO 45·0'



M.I.T. Class.							
STONES	GRAVEL	SAND			SILT			CLAY
		Coarse	Medium	Fine	Coarse	Medium	Fine	

77%	sand
21%	silt
2%	clay

Classification

Fine sand, some silt
(silty sand)

HUNTING TECHNICAL and EXPLORATION SERVICES

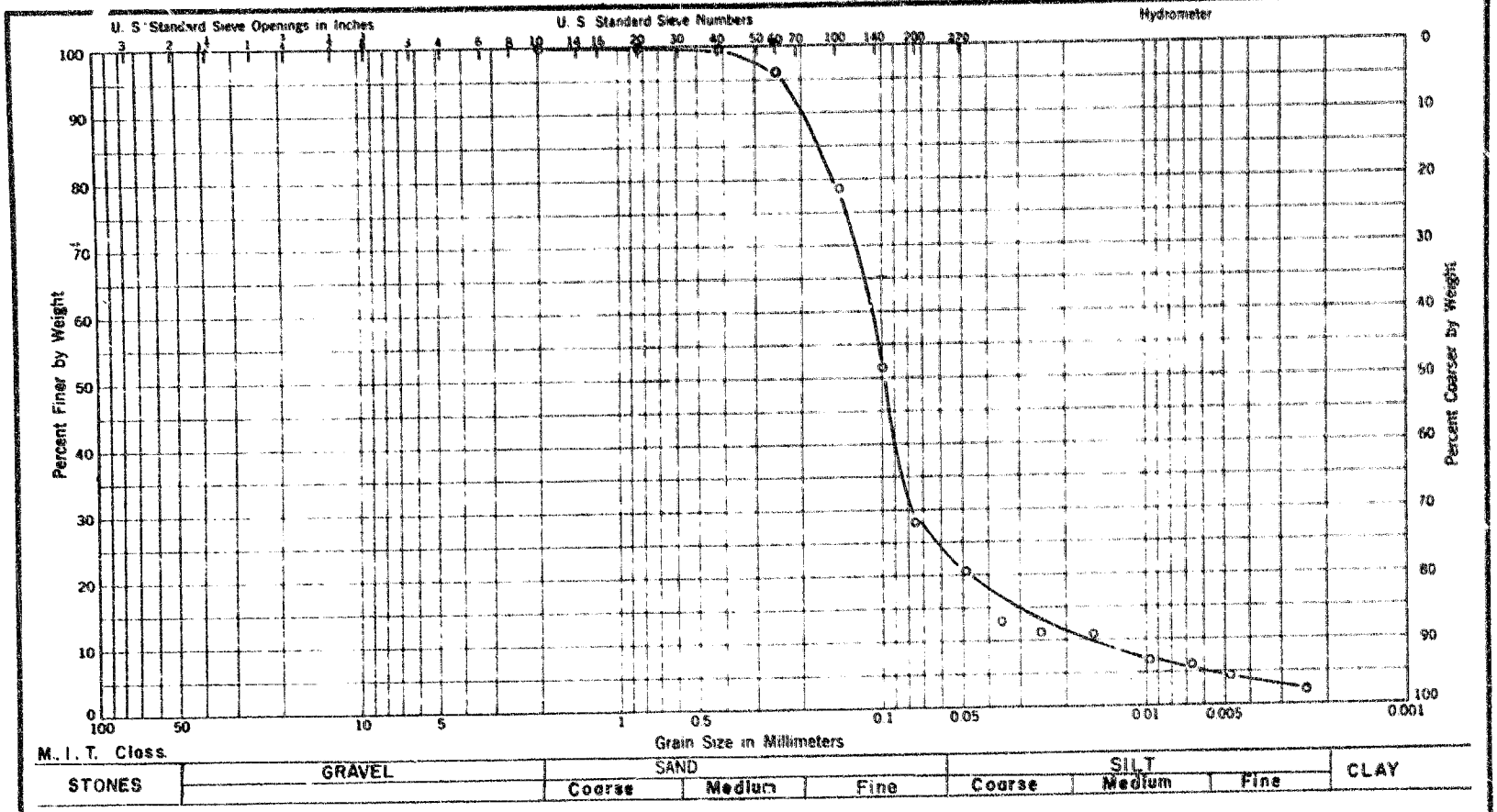
DEPARTMENT OF HIGHWAYS – ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER — KING'S HWY. NO. 62

SOIL MECHANICAL ANALYSIS

BOREHOLE 3 DEPTH – 10·0' TO 11·5'



76%	sand
22%	silt
2%	clay

Classification

Fine sand, some silt

(silty sand)

HUNTING TECHNICAL and EXPLORATION SERVICES

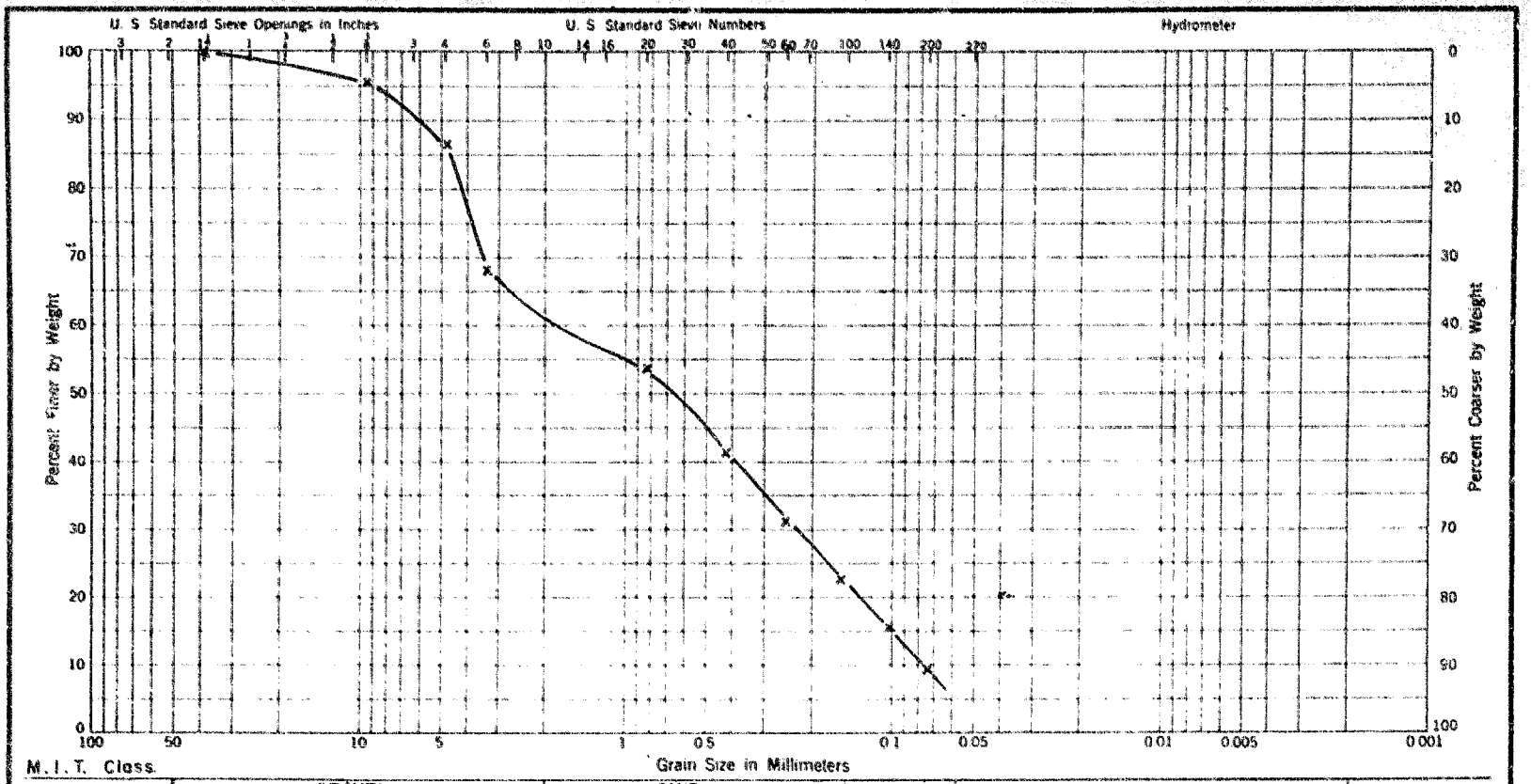
DEPARTMENT OF HIGHWAYS – ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER — KING'S HWY. NO. 62

SOIL MECHANICAL ANALYSIS

BOREHOLE 3 DEPTH – 35·0' TO 36·5'



40%	gravel
54%	sand
6%	silt

Classification

Sand and gravel

(gravelly sand)

HUNTING TECHNICAL and EXPLORATION SERVICES

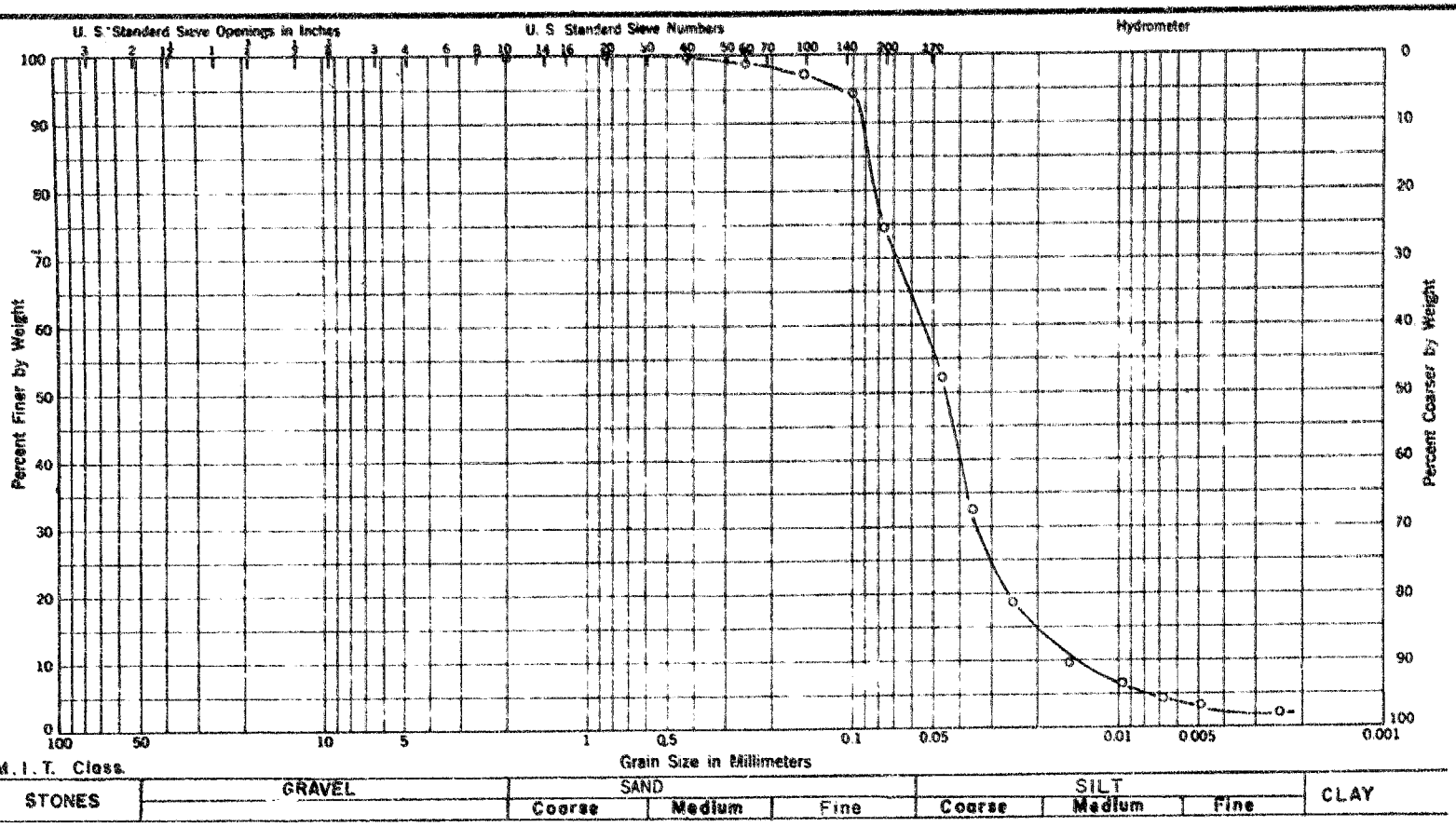
DEPARTMENT OF HIGHWAYS - ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER – KING'S HWY. No. 62

SOIL MECHANICAL ANALYSIS

BOREHOLE 4 DEPTH 5·0' TO 6·5'



40%	sand
58%	silt
2%	clay

Classification

Silt and sand
(sandy silt)

HUNTING TECHNICAL and EXPLORATION SERVICES

DEPARTMENT OF HIGHWAYS – ONTARIO

PROPOSED BRIDGE SITE

SHERWOOD RIVER — KING'S HWY. NO. 62

SOIL MECHANICAL ANALYSIS

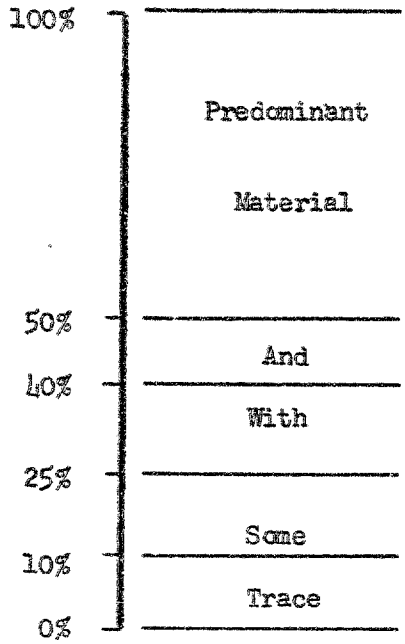
BOREHOLE 4 DEPTH – 15·0' TO 16·5'

HUNTING TECHNICAL & EXPLORATION SERVICES

1450 O'Connor Drive Toronto, Ontario

SOIL TYPES

The following system was used in classifying the various soils by name:



Example:

Medium dense	grey	silt	with	fine sand
(Penet. resist.) or relative density	(colour)	(pred. type)	(25%-40%)	(other type)

Unless believed to have a significant effect on the soil characteristics the minor soil types (i.e. traces) present are disregarded in the name used on the boring log and cross-sections. The complete classification is given with the gradation analysis.

In all cases the strength characteristics (e.g. penetration resistance) is quoted first, followed by the colour and finally the descriptive name based on the mechanical analysis.

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31F-88

W.P. No.

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 62

LOCATION SHERWOOD RIV., NEAR BONNECHERE,

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. ONE

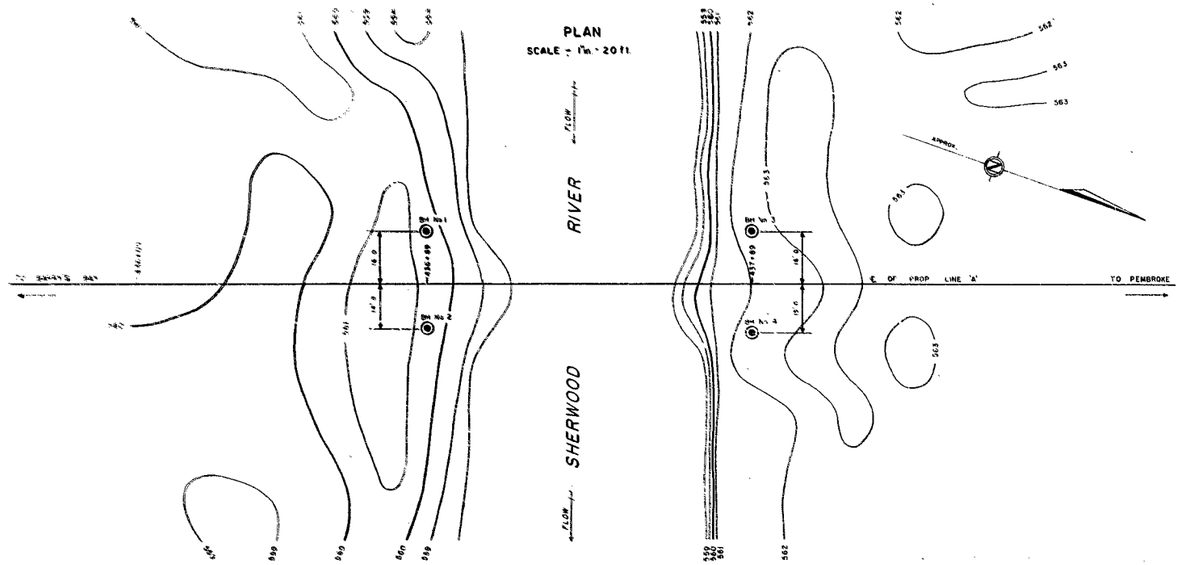
REMARKS:

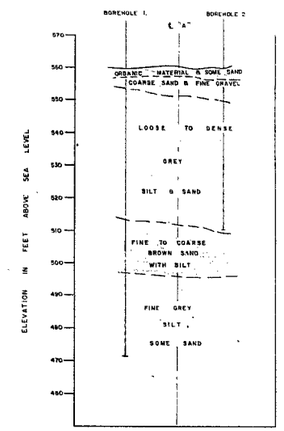
0.1-20 SEPT. 1/76

COUNTY OF RENFREW, TOWNSHIP OF RICHARDS
CON III LOT 26

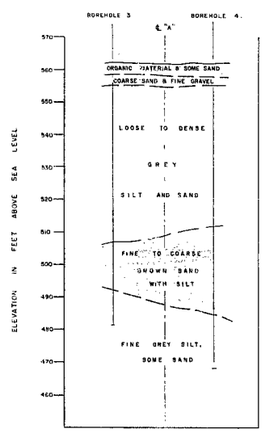
CON. IV LOT 26

PLAN
SCALE = 1in. = 20ft.



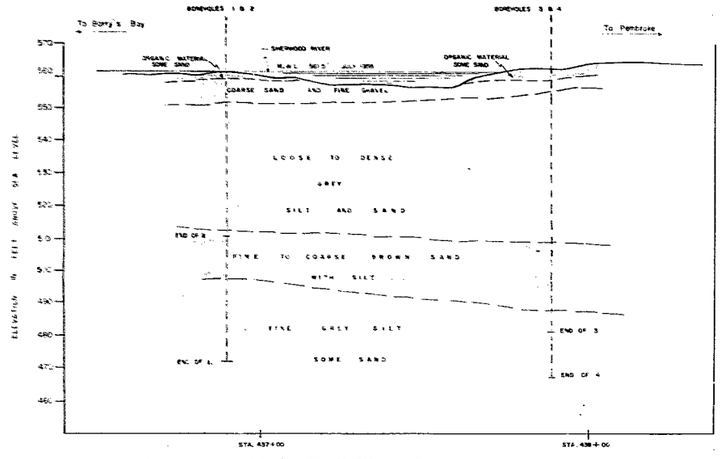


SOIL PROFILE
ALONG BOREHOLES 1 & 2



SOIL PROFILE
ALONG BOREHOLES 3 & 4

3:1 F-88
GEOCRES No.



PROBABLE SOIL PROFILE ALONG ℄ OF PROPOSED LINE 'A'

HUNTING TECHNICAL & EXPLORATION SERVICES LTD. TORONTO
DEPARTMENT OF HIGHWAYS – ONTARIO
LOCATION OF BOREHOLES AND SUBSURFACE SOIL PROFILES FOR PROPOSED CROSSING AT SHERWOOD RIVER AND THE KINGS HIGHWAY No. 62 PROPOSED LINE "A"
BRIDGE SITE
SCALE – 1 in. = 20 ft. | DRAWN BY – D.S. | DATE AUGUST 1958
Reference – PLAN-E-3397-1