W.P. 26-63.

T7594

REPORT

TO

DEPARTMENT OF HIGHWAYS, ONTARIO

ON

SOIL CONDITIONS

PROPOSED SEWER

BANCROFT ONTARIO

Distribution:

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Rexdale, Ontario.
March 25th, 1964.

Department of Highways, Ontario,
P. O. Box 300,
Bancroft, Ontario.

Attention: Mr. J. E. Callaghan, P. Eng.,
District Engineer.

Re: Soil Conditions
Proposed Sewer
Bancroft, Ontario

Dear Sirs:

This letter reports the results of the above investigation carried out in accordance with your verbal instructions. The object of the investigation was to determine the soil and groundwater conditions at the borehole locations and to make recommendations concerning the design and installation of the sewer line from a soil mechanics viewpoint.

PROCEDURE

The field work for this investigation was carried out between February 27th and March 5th, 1964. Four boreholes were put down using a standard skid mounted diamond drill rig at locations and to depths specified by Proctor and Redfern, Consulting Engineers, Because of the boulder content generally encountered, all boreholes were advanced by diamond drilling methods. Bedrock was cored in borehole 2 in AXT size.

PROCEDURE (continued)

A complete log of each borehole is given on the Office Reports on Soil Exploration in Appendix I. The locations of the boreholes are shown on Drawing T7594-1 located in the pocket at the rear of this report.

The results of the laboratory testing are shown on the figures in Appendix II. All samples, remaining after testing will be stored until October 1st, 1964, at which time you will be contacted for instructions regarding their disposal.

All elevations and locations of boreholes were given to us by the Engineering Staff of the Department of Highways, Bancroft. It has been assumed that the elevations are referenced to Geodetic datum.

SITE AND GEOLOGY

The Town of Bancroft is situated on either side of the York River. The general topography of the area is typical of a river valley with relatively flat land in the valley and steep valley slopes. At the time of the investigation the river level at the Bridge Street bridge was at about elevation 1067. The elevation of borehole 1 was about 1124, or about 57 feet higher than river level.

SITE AND GEOLOGY (continued)

The overburden in the area consists generally of fluvioglacial drift directly overlying bedrock. Local information suggests that miscellaneous fill has been used in parts of the town. No reliable information is available on the location or type of fill that has been used; rock fill and sawdust fill have been suggested.

At least two types of bedrock are known to exist in Bancroft. This investigation encountered granite gneiss in borehole 2. Previous work at the Bridge Street bridge encountered a recrystallized limestone.

SUMMARIZED SOIL CONDITIONS

Fill underlies the ground surface at all the borehole locations. The fill consists of sand and gravel with some wood and cinder content at borehole 4 and some pieces of concrete at borehole 1. The thickness of the fill ranges from 1 to 4 feet. The natural overburden is granular in nature and complex in its variation. In borehole 2 in the low land, a stratum of boulders with sand and gravel of 9 foot thickness overlies bedrock directly. A stratum of dense to very dense sand and gravel underlies the fill in the other boreholes and the thickness ranges from 5 feet to over 15 feet. In borehole, 3, the materials become finer with depth changing to a compact medium to fine sand stratum which is about 11 feet thick and

SUMMARIZED SOIL CONDITIONS (continued)

then to a compact silty fine sand of over 8 foot thickness. In borehole 4, the silty sand underlies the sand and gravel directly and is underlain by another stratum of dense sand and gravel. The water level is at about river level in the boreholes near the river but was observed considerably higher at borehole 4.

The soil and groundwater conditions are discussed in detail in Appendix I, and recommended design values for each stratum are given.

DISCUSSION

It is understood that it is proposed to construct a sewer line in the town of Bancroft. The line along Highway #500 will be of 54 inch size while Station Street and Hastings Street will have 24 and 18 inch lines respectively. Because of the variable soil conditions and the large distance between boreholes making interpolation impractical, the discussion below is restricted to the conditions encountered at the borehole locations themselves.

Excavation and Dewatering

Because of the granular and relatively free draining nature of the overburden encountered in the river valley, the ground water table in

DISCUSSION (continued)

Excavation and Dewatering (continued)

the soil reflects the water level in York River. At the time of the investigation the elevation of York River was at about elevation 1069. The elevation of the observed water level in boreholes 2 and 3 were 1069.2 and 1069.8, respectively. Borehole 4 was caved and dry at elevation 1109. A water level was established at borehole 4, about 2100 feet from the river, at elevation 1108.7. In the construction of the sewer line below the river level, as at the location of borehole 2, the resulting water inflow would be large and some dewatering method would be required. At borehole 2 the invert of the sewer is planned at about elevation 1062, which is several feet below bedrock elevation. The use of driven sheeting to dewater this site is not considered feasible because of the difficulty presented by the boulders to driving. However, in view of the shallow depth and dense nature of the overburden, it would be feasible to excavate the bedrock under water in short lengths of trench and then install sheeting and bracing and backfill same. Impervious backfilling could be used below the water table to assist in reducing the amount of seepage into the trench during dewatering. Alternatively, the use of a wellpoint system installed with a hole puncher could be considered. This method of

DISCUSSION (continued)

Excavation and Dewatering (continued)

dewatering would require drilling into the bedrock in order to acquire maximum effectiveness of the wellpoints. In addition sheeting and bracing would probably still be required because of space restrictions in order to maintain road traffic. Because of the permeability of the overburden it is possible also that a conventional wellpoint system would have to be assisted by sump pumps.

The excavation at borehole 1 and 3, to depths of about 15 and 23 feet respectively below the ground level, would be carried out above the observed ground water level and as such could be carried out in temporary open cut with side slopes of 1-1/2 horizontal to 1 vertical. Any water inflow from surface run-off could be handled by pumping from sumps. However, the resulting width of the trench at ground surface would probably be too large to be practical for this location. Alternatively the sides of excavation could be supported by sheeting and bracing.

As before, the installation of driven sheeting would be complicited by the presences of boulders. Sheet piling, if used, would probably require jetting and may need to be driven in stages, concurrently with excavation

DISCUSSION (continued)

Excavation and Dewatering (continued)

to remove boulders which may be obstructing penetration. Timber sheeting, if driven, would also require such assistance to facilitate penetration without damage. Soldier beam and lagging could also be used though the economics of this method are doubtful.

In the design of the sheeting and bracing a trapezoidal earth pressure distribution should be used in which the ordinate of the trapezoid is equal to 0.8 of the maximum Coulomb calculated value at the base of the excavation, including surcharge loading. This ordinate would apply for the middle 3/5 of the sheeting depth. The sheeting or soldier beams should be carried to a sufficient penetration below the bottom of the trench to provide a factor of safety against bottom heave of at least 1.5. It is important that the excavations be well braced to avoid yielding which could cause subsidence of the street or immediately adjacent property.

At borehole 4, the invert at 9 feet below the ground level would be about 3 feet below the water table. If space permits, an open cut with temporary side slopes of 1 horizontal to 1 vertical could be used in conjunction with dewatering by wellpoints. Because of the silt content of the soil

DISCUSSION (continued)

Excavation and Dewatering (continued)

at depth, it is recommended that a "sanded-in" vacuum wellpoint system be employed. Alternatively sheeting could be driven to about 5 feet below the sewer invert and the inflow of water could then be handled by pumping from sumps.

Bedding of Pipe

Because of the dense nature of the soil below pipe invert, no significant settlement of the pipe should occur on backfilling.

Because of the cobble and boulder content of the overburden, it is recommended that the pipe be carefully bedded on a fine granular material in an earth foundation that is carefully shaped to fit the lower part of the pipe for the width of at least 60 percent of its breadth. The remainder of the pipe should be surrounded to a height at least 1 foot above its top by granular materials that are carefully placed to completely fill all spaces under and adjacent to the pipe. This fill should be placed in layers not exceeding 6 inches in thickness. Where the pipe is located in excavations in the bedrock, it should be provided with a cushion of compacted granular material between the invert of the pipe and the base of excavation. This cushion should be at least 12 inches for depths of earth cover up to

DISCUSSION (continued)

Bedding of Pipe (continued)

24 feet. The cushion should be proportionately thicker for greater depths.

Earth Loading on Pipe

The earth pressures on the pipe and their distribution are dependent on a wide variety of factors such as:

a) Depth of earth cover

b) Traffic or other surcharge loads

c) Type of backfill and the degree and pattern of compaction

d) Width of base of excavation and inclination of the sides

e) Type of bedding

f) Position of the ground water table

g) Shape and flexibility of the pipe

The design of the pipe to resist earth pressures should be carried out using established theories for computing loads on underground conduits which take the above factors into account. The computations of specific loads and earth pressure distribution on the sewer pipe are beyond the scope of this report. However, we would be pleased to assist you during design on the soil mechanics aspects should you so wish.

DISCUSSION (continued)

General

Although the overburden encountered in all boreholes was mainly natural sand and/or sand and gravel, the boreholes are at widespacing and therefore variations between boreholes are very likely. In particular local information suggests that areas are liable to be encountered in which fill predominates or bedrock occurs at a high elevation. Unless, therefore, additional route exploration is carried out, it is recommended that the specifications covering construction allow for changes in design, such as bedding treatment which may be required as a result of variations in the bedrock surface. In the event that compressible material such as sawdust should be encountered, the specification should allow for the removal of such material from below the pipe and replacement with suitable compacted bedding or other forms of support.

We believe that this letter report which was written by Mr. F. J. Heffernan and reviewed by Mr. M. A. J. Matich, P. Eng. contains the required factual soils information. Also that the interpretive comments from a soil mechanics standpoint are sufficient to allow design to proceed. However, should you require additional information, or if we can be of assistance otherwise, please give us a call.

Yours very truly,

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F. J. Heffernan, P. Eng.
District Soils Engineer.

FJH/reb

REGISTERED PROFESSIONAL ENGINEER
F. J. HEFFERNAN
PROVINCE OF ONTARIO

APPENDIX I

SOIL CONDITIONS

WATER CONDITIONS

OFFICE REPORTS ON SOIL EXPLORATION

SOIL CONDITIONS

The principal soil conditions encountered in the investigation are as follows:

Miscellaneous Granular Fill

All boreholes were located within highway limits and as such encountered a surface layer of granular fill which is probably typical of the roadway base at each respective location. At the locations of boreholes 2 and 3, thicknesses of 12 inches and 2 feet respectively of sand fill were encountered. At borehole 1 and 4, the granular fill was found to consist generally of sand and gravel having a variable content of boulders, concrete, wood and cinders, and was up to 4 feet in thickness.

For design purposes, the fill should be considered to be cohesionless with an angle of shearing resistance, ϕ, of 33 degrees. The wet unit weight should be taken as 135 pounds per cubic foot.

Boulders with Dense to Very Dense Sand and Gravel

Underlying the sand fill, at the location of borehole 2, is a stratum consisting generally of granite boulders, with sand and gravel. The shape of the grains is angular to subrounded. The boulders were up to 2 foot diameter size. The thickness as encountered in the borehole, was 9 feet.

Boulders with Dense to Very Dense Sand and Gravel (continued)

The coefficient o^ _ rmeability of this stratum is estimated to be about 1 x 10^{-2} centimeters per second.

Because of the boulder and gravel content the relative density is difficult to measure. A single standard penetration test encountered refusal after 3 inches of penetration. By interpolation the "N" value was 44 blows per foot. It is estimated that the relative density is dense.

For design purposes, this stratum should be considered cohesionless with an angle of shearing resistance, Ø, of 35 degrees. The wet and submerged unit weights may be taken as 120 and 58 pounds per cubic foot, respectively.

Compact to Dense Brown Sand with some Gravel, Cobbles and Boulders

Underlying the fill in boreholes 3 and 4 is a stratum composed mainly of sand with some gravel, cobbles and boulder sizes. Inspection of the samples recovered from borehole 3 indicates that the gravel content decreases with depth. The shape of the grains is angular to subrounded. The thickness of this stratum as encountered in the boreholes, was 11 and 5 feet, respectively.

Compact to Dense Brown Sand with some Gravel, Cobbles and Boulders (continued)

Mechanical analysis tests were performed on two samples from this stratum and the results are plotted on Fig. 1 in Appendix II. The results indicate that the stratum contains sand and gravel with less than 5 percent silt sizes. The proportion of gravel varies with a probable maximum of 25 percent gravel sizes.

The coefficient of permeability of this stratum is estimated to be about 1 x 10^{-2} centimeters per second. In borehole 3 a water loss was observed between depths of 6 and 13 feet suggesting that higher permeabilities than given above exist locally within this stratum.

Standard penetration tests gave "N" values ranging from 14 to 39 blows per foot. The presence of gravel sizes results generally in high "N" values and do not necessarily indicate the relative density of the stratum as a whole. It is believed that this stratum is generally compact with an average "N" value of about 15 blows per foot.

For design purposes, this materialshould be considered cohesionless with an angle of shearing resistance, ϕ, of 35 degrees. The wet and submerged unit weights may be taken as 130 and 68 pounds per cubic foot, respectively.

Compact Brown Medium to Fine Sand

Underlying the sand, with some gravel, at the location of borehole 3 is a stratum of medium to fine sand. Inspection of the samples recovered indicates that the stratum grades from a medium sand to a fine sand with depth. The thickness of this stratum in the borehole was 9 feet.

A mechanical analysis test was carried out on a sample from the bottom of this stratum and the results plotted on Fig. 2 in Appendix II. The results show the sample to consist of fine sand with about 10 percent silt sizes. The coefficient of permeability of this stratum is estimated as being about 1×10^{-3} centimeters per second.

Standard penetration tests carried out in this stratum gave "N" values of 12 and 15, indicating that the relative density is compact.

For design purposes, the material should be considered cohesionless with an angle of shearing resistance, ∅, of 32 degrees. The wet and submerged unit weights should be taken as 115 and 53 pounds per cubic foot, respectively.

Compact Brown to Grey Silty Fine Sand

Underlying the medium to fine sand in borehole 3, and sand with some gravel and cobbles in borehole 4 is a stratum of brown to grey silty fine sand. Inspection of the samples recovered indicates that the silt content increases with depth. In borehole 1 the stratum described as fine sandy silt is believed to be of the same geological origin and as such will be included in this description. At the location of borehole 4 this stratum ranged from 2 feet in borehole 1 to 8 feet in borehole 3. Borehole 3 however, was terminated within this stratum.

Mechanical analyses were carried out on two samples from this stratum and the results plotted on Fig. 3 in Appendix II. The sample taken from borehole 4 contained some gravel and this is reflected in the distribution shown on the figure. The sample from borehole 3, which is representative contains about 70 percent fine sand sizes and 30 percent silt sizes.

The permeability of the silty fine sand is estimated to be 1×10^{-4} centimeters per second. Where the silt content is higher than indicated on Fig. 3, the coefficient of permeability will be slightly lower.

Compact Brown to Grey Silty Fine Sand (continued)

Standard penetration tests carried out in this stratum gave "N" values of 15, 19 and 44 blows per foot. The high value has been influenced by the gravel content at that location. The relative density is believed to be compact.

For design purposes, the stratum should be considered to be cohesionless with an angle of shearing resistance of 30 degrees. The wet and submerged unit weights should be taken as 115 and 53 pounds per cubic foot, respectively.

Dense to Very Dense Brown Sand and Gravel with some Cobbles and Boulders.

Underlying the fine sandy silt in borehole 1 and the silty fine sand in borehole 4 is a stratumof brown sand and gravel with some cobbles and boulders. The shape of gravel grains is angular to subrounded. Both boreholes were terminated within this stratum. The thicknesses penetrated were 14 and 5 feet, respectively.

Mechanical analysis tests were carried out on three samples from this stratum and the results plotted on Fig. 4 in Appendix II. These samples were found to contain about 38 percent gravel sizes, 54 percent sand sizes and 8 percent silt sizes.

Dense to Very Dense Brown Sand and Gravel with some Cobbles and Boulders (continued)

The coefficient of permeability of this stratum is estimated to be 1 x 10^{-2} centimeters per second. In borehole 1 a water loss was observed during drilling from a depth of 13 feet to the bottom of the hole. It is believed that higher permeabilities than given above may exist locally within this stratum.

Standard penetration tests carried out in this stratum gave "N" values ranging from 34 to greater than 100 blows per foot. The average "N" value, taking into consideration the effect of the gravel content, is probably about 40 blows per foot. The relative density of this stratum ranges from dense to very dense.

For design purposes the stratum should be considered to be cohesionless with an angle of shearing resistance of 35 degrees. The wet and submerged unit weights may be taken as 130 and 68 pounds per cubic foot, respectively.

Bedrock

Bedrock was encountered in borehole 2 at a depth of 10 feet below ground level. It was cored in AXT size for a depth of 12 feet. The bedrock is sound red and grey biotite granite gneiss.

Bedrock (continued)

At the location of borehole 1, bedrock outcrops on the south side of Highway #28 and is steeply sloping towards the borehole location. At the location of borehole 2 a bedrock outcrop was observed on the east side of Hastings Street and to the north of the borehole location.

WATER CONDITIONS

The ground water table was observed in borehole 2 and 3 between elevations 1069 and 1070 or at depths below ground level of 5. 3 feet and 29. 6 feet, respectively. Borehole 1 was observed to be dry and caved at a depth of 15 feet. The ground water table was located about 6 feet below ground level or at about elevation 1109 in borehole 4.

At the time of the investigation the elevation of river level at the Bridge Street bridge was about 1067.

EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

The object of this form is to enable a comprehensive study of the soil to be made by combining on one sheet all of the information obtained from the boring. An explanation of the various columns of the report follows.

ELEVATION AND DEPTH

This column gives the elevation and depth of boundaries between the various soil strata. The elevation is referred to the datum shown in the general heading.

WATER CONDITIONS

In this column the water level in the casing at the time of boring or the water table in the ground, determined by a series of observations in a piezometer or standpipe, is indicated to scale by a horizontal line with the symbol W.L. or W.T. above the line. A notation of any complicated groundwater conditions will be made in this column.

DESCRIPTION

A description of the soil, using standard terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms:

Consistency	U-Strength Tons/sq. ft.	Relative Density	Standard Penetration Resistance. Blows/ft.
Very soft	0.03 to 0.25	Very loose	0 to 4
Soft	0.25 to 0.5	Loose	4 to 10
Firm	0.5 to 1.0	Compact	10 to 30
Stiff	1.0 to 2.0	Dense	30 to 50
Very stiff	2.0 to 4.0	Very dense	over 50
Hard	over 4.0		

STRATIGRAPHIC PLOT

The stratigraphic plot follows the standard symbols of the National Research Council, Canada.

ELEVATION SCALE

The information in all columns is plotted to a true elevation scale which is shown in this column.

GRAPHS

The main body of the report forms a graph which is used to plot to correct elevation the important soil properties which are obtained through field and laboratory tests. The scales and symbols for the plotting are shown at the head of the column.

OTHER TESTS

In this column are shown, by symbol, the other field or laboratory tests which have been performed on the soil and for which the results have not been plotted on the above graph.

SAMPLES

The first three columns describe the condition, type and number of each sample obtained from the boring. The location and extent of each sample is plotted to scale.

In the last column is shown the penetration resistance in blows of 4200 inch-pounds required to drive one foot of the sampler into the ground. When a 2 inch Drive Sampler is used the result obtained is termed the "Standard Penetration Resistance".

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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T-7594 BORING # 1 DATUM GEODETIC CASING BX

BORING DATE FEB. 27, 1964 REPORT DATE MARCH [illegible] 1964 COMPILED BY TV[illegible] CHECKED BY DBO

SAMPLER HAMMER WT. 140 LBS. DROP [illegible] INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE-OPEN
- D.F. - DRIVE-FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
- R.C. - ROCK CORE

ABBREVIATIONS

- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- Qc - TRIAXIAL CONSOLIDATED QUICK
- Q - TRIAXIAL QUICK
- S - TRIAXIAL SLOW
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

SOIL PROFILE

ELEV. / DEPTH	WATER CONDITIONS	DESCRIPTION
1124.0 / 0.0	HOLE DRY AND CAVED @ EL. 1109 FEBRUARY 28, 1964	GROUND LEVEL; BROWN SAND FILL WITH GRAVEL, BOULDERS AND CONCRETE
1120.0 / 4.0		COMPACT BROWN FINE SANDY SILT
1118.0 / 6.0		DENSE TO VERY DENSE BROWN SAND AND GRAVEL WITH SOME COBBLES AND BOULDERS
1104.0 / 20.0		END OF HOLE

ELEVATION SCALE: 1125, 1120, 1115, 1110, 1105, 1100

WATER CONTENT W% — O NAT. □ Lw △ Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

SAMPLES

OTHER TESTS AND ROCK CORE RECOVERY	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
			1	
	FAIR		2	
	DISTURBED	2"DO	3	54
M	DISTURBED	2"DO	4	96
50%	DISTURBED	AXT RC	5	
M	DISTURBED	2"DO	6	35
21%	DISTURBED	AXT RC	7	
		2"DO	8	[illegible]

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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T-7594 BORING # 2 DATUM GEODETIC CASING BX

BORING DATE MARCH 2, 1964 REPORT DATE MARCH [illegible], 1964 COMPILED BY JVG CHECKED BY DBJ

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- A.S. - AUGER SAMPLE
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- WT - WATER TABLE IN SOIL

SOIL PROFILE

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
1074.5		GROUND LEVEL		1075
0.0 / 1073.5 / 1.0		SAND FILL		
	water table symbol (about el. 1069)	BOULDERS WITH DENSE TO VERY DENSE SAND AND GRAVEL		1070
1064.5 / 10.0				1065
	W.L. @ EL. 1069.2 MARCH 2 1964	RED AND GREY BIOTITE GRANITE GNEISS BEDROCK		1060
				1055
1052.5 / 22.0		END OF HOLE		
				1050

WATER CONTENT W% ○ NAT. □ Lw △ Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS AND ROCK CORE RECOVERY	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	DISTURBED	2"DO	1	44
100%	GOOD	AXT RC	2	—
100%	GOOD	AXT RC	3	—
100%	GOOD	AXT RC	4	—

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T-7594 BORING # 3 DATUM GEODETIC CASING BX
BORING DATE MARCH 3, 1964 REPORT DATE MARCH 11, 1964 COMPILED BY TVG CHECKED BY DBO
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
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F.S. - FOIL SAMPLE
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K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASIN
WT - WATER TABLE IN SOIL

WATER CONTENT W% ○ NAT. □ Lw △ Pw
DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	ELEVATION SCALE	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
1099.4		GROUND LEVEL	1100					
0.0 – 1097.4		SAND FILL			Disturbed	2" DO	1	81
2.0 – 1086.4		COMPACT BROWN SAND WITH SOME GRAVEL AND BOULDERS	1095		Fair	AXT RC	2	
					Disturbed	2" DO	3	14
			1090	M	Disturbed	2" DO	4	16
13.0 – 1075.4	WL. @ EL. 1069.8 MARCH 3, 1964	COMPACT BROWN MEDIUM TO FINE SAND	1085		Disturbed	2" DO	5	12
			1080	M	Disturbed	2" DO	6	15
24.0 – 1067.4		COMPACT BROWN TO GREY SILTY FINE SAND	1075		Disturbed	2" DO	7	19
			1070	M	Disturbed	2" DO	8	15
32.0		END OF HOLE	1065					

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T-7594 BORING # 4 DATUM GEODETIC CASING BX

BORING DATE MARCH 4, 1964 REPORT DATE MARCH 11, 1964 COMPILED BY TVS CHECKED BY DBO

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

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- GOOD
- LOST

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- Q - TRIAXIAL QUICK
- S - TRIAXIAL SLOW
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASIN[G]
- WT - WATER TABLE IN SOIL

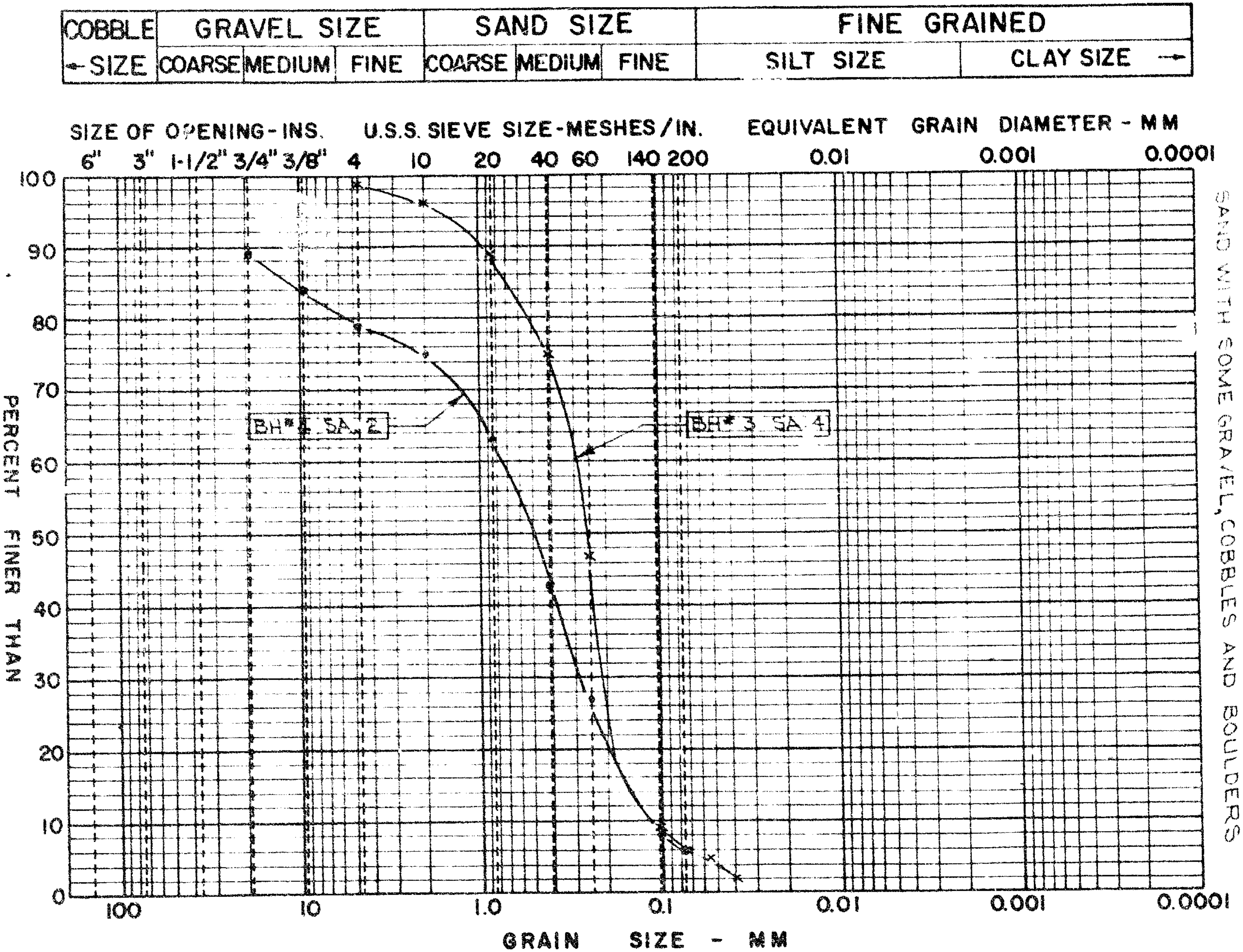
ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	ELEVATION SCALE	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
1114.6		GROUND LEVEL	1115					
0.0		BROWN SAND AND GRAVEL FILL WITH WOOD AND CINDERS			Disturbed	2"DO	1	70
1110.6 / 4.0		DENSE BROWN SAND WITH SOME GRAVEL AND COBBLES	1110	M	Disturbed	2"DO	2	39
1105.6 / 9.0	W.L. & EL. 1097.7 MARCH 4, 1964	DENSE BROWN SILTY FINE SAND WITH OCCASIONAL GRAVEL SIZES	1105	M	Disturbed	2"DO	3	49
1102.6 / 12.0		DENSE BROWN SAND AND GRAVEL WITH SOME COBBLES	1100	M	Disturbed	2"DO	4	54
1097.6 / 17.0		END OF HOLE	1095					

WATER CONTENT W% ○ NAT. □ Lw △ Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

APPENDIX II

Figures - Laboratory Testing

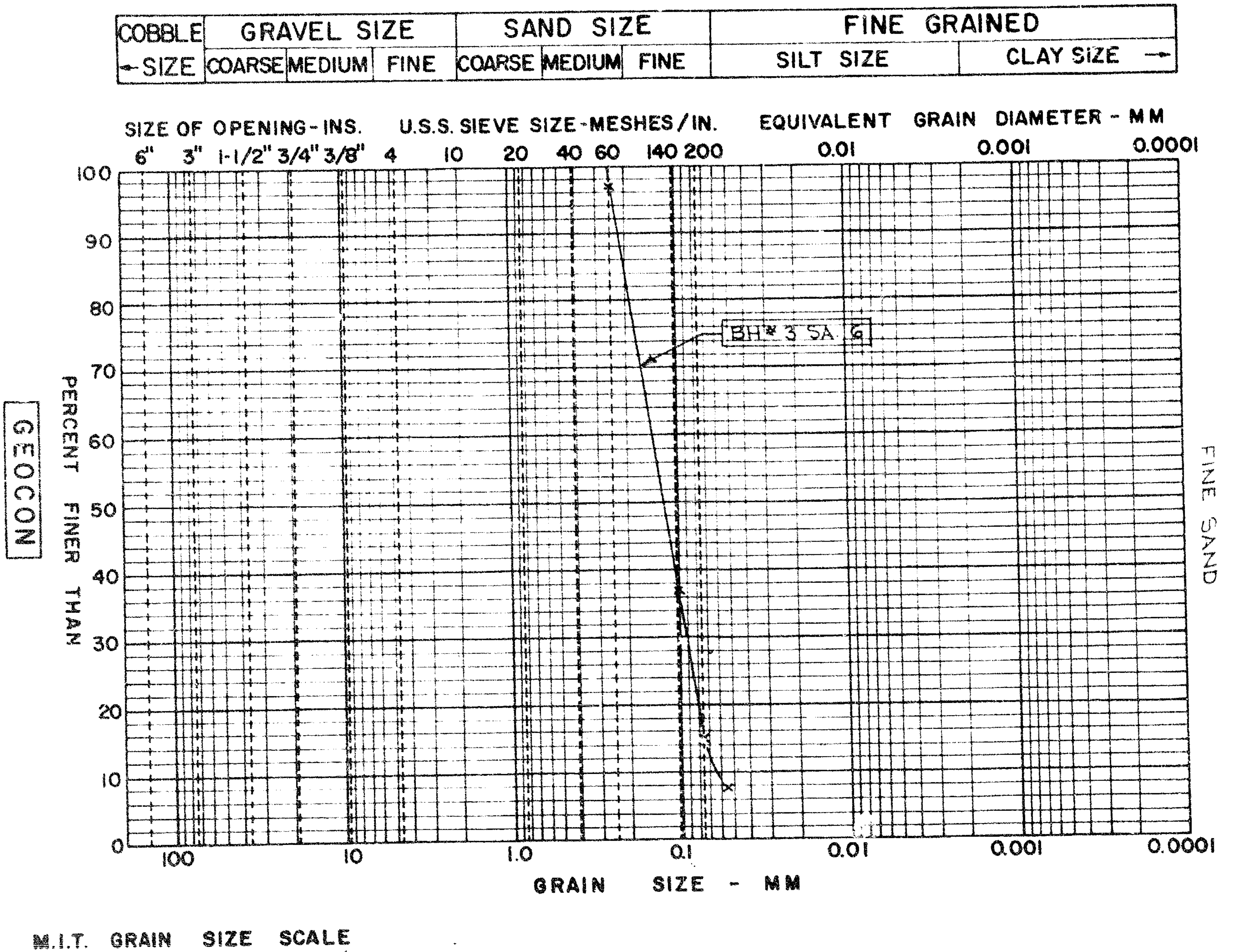


GEOCON

M.I.T. GRAIN SIZE SCALE

GRAIN SIZE DISTRIBUTION

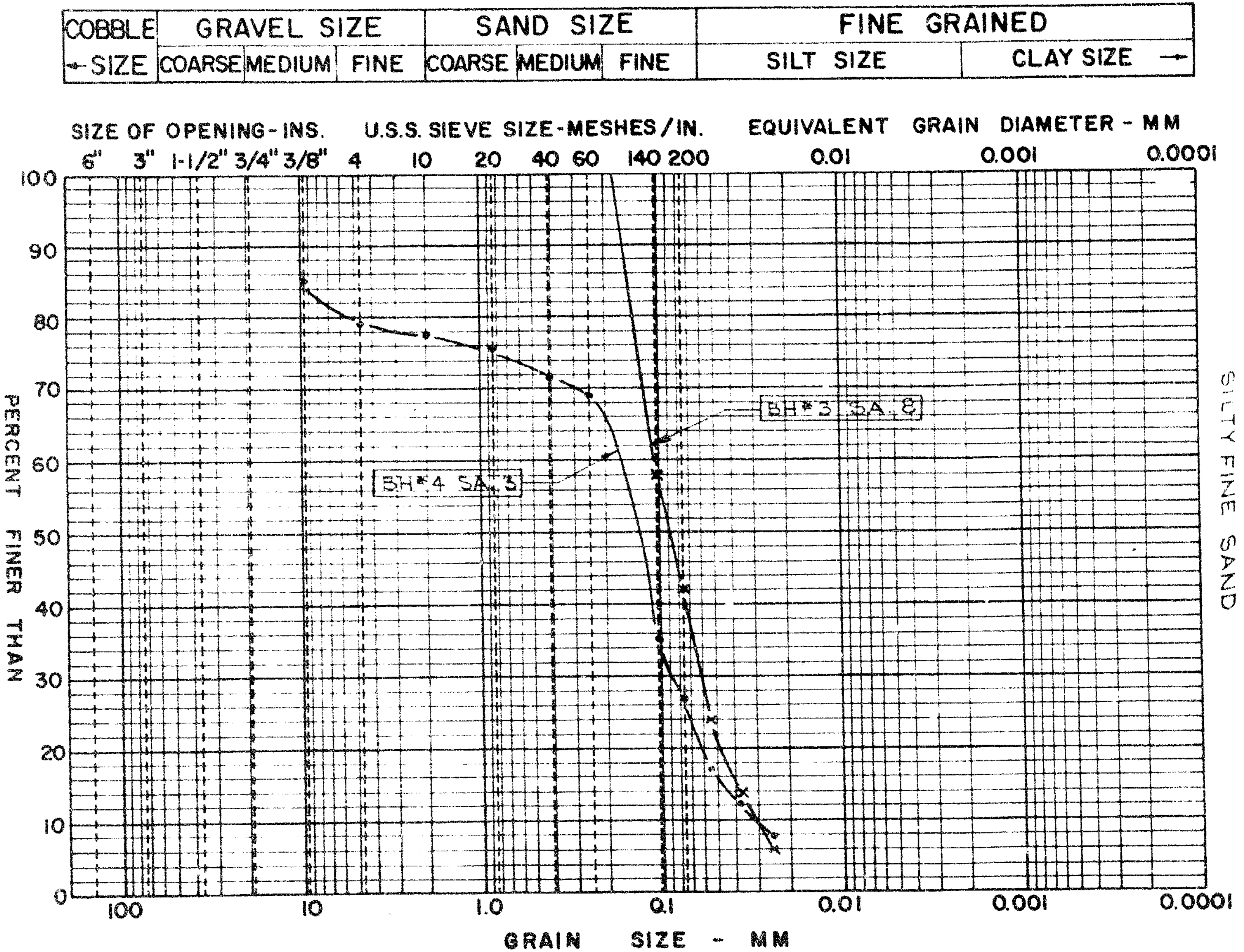
APPENDIX II
FIGURE I
PROJECT T7594



GRAIN SIZE DISTRIBUTION

APPENDIX II
FIGURE 2
PROJECT 17594

GRAIN SIZE DISTRIBUTION

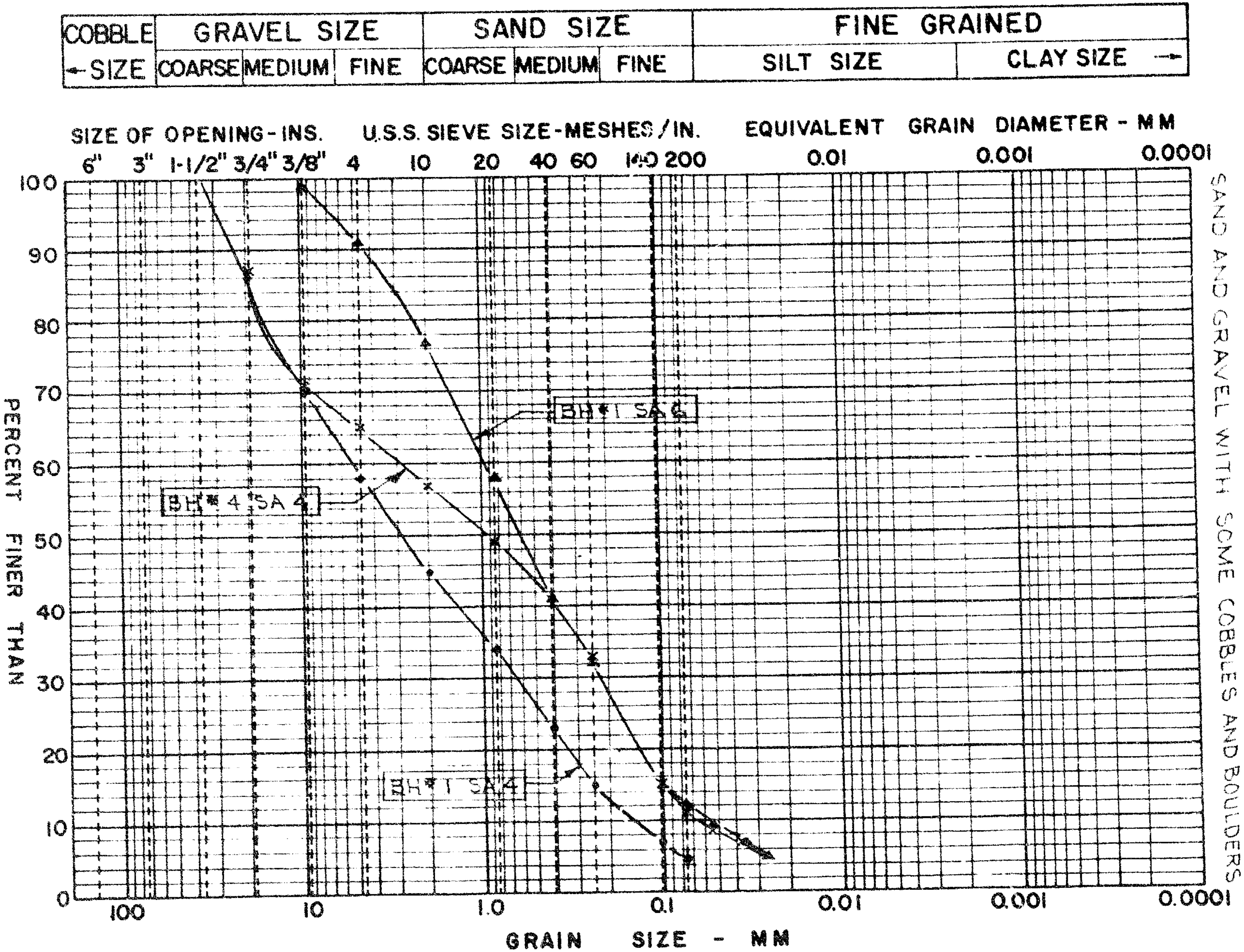


GEOCON

M.I.T. GRAIN SIZE SCALE

APPENDIX II
FIGURE 3
PROJECT T7594

GRAIN SIZE DISTRIBUTION



GEOCON

M.I.T. GRAIN SIZE SCALE

APPENDIX II
FIGURE 4
PROJECT T7594

#64-F-214-C

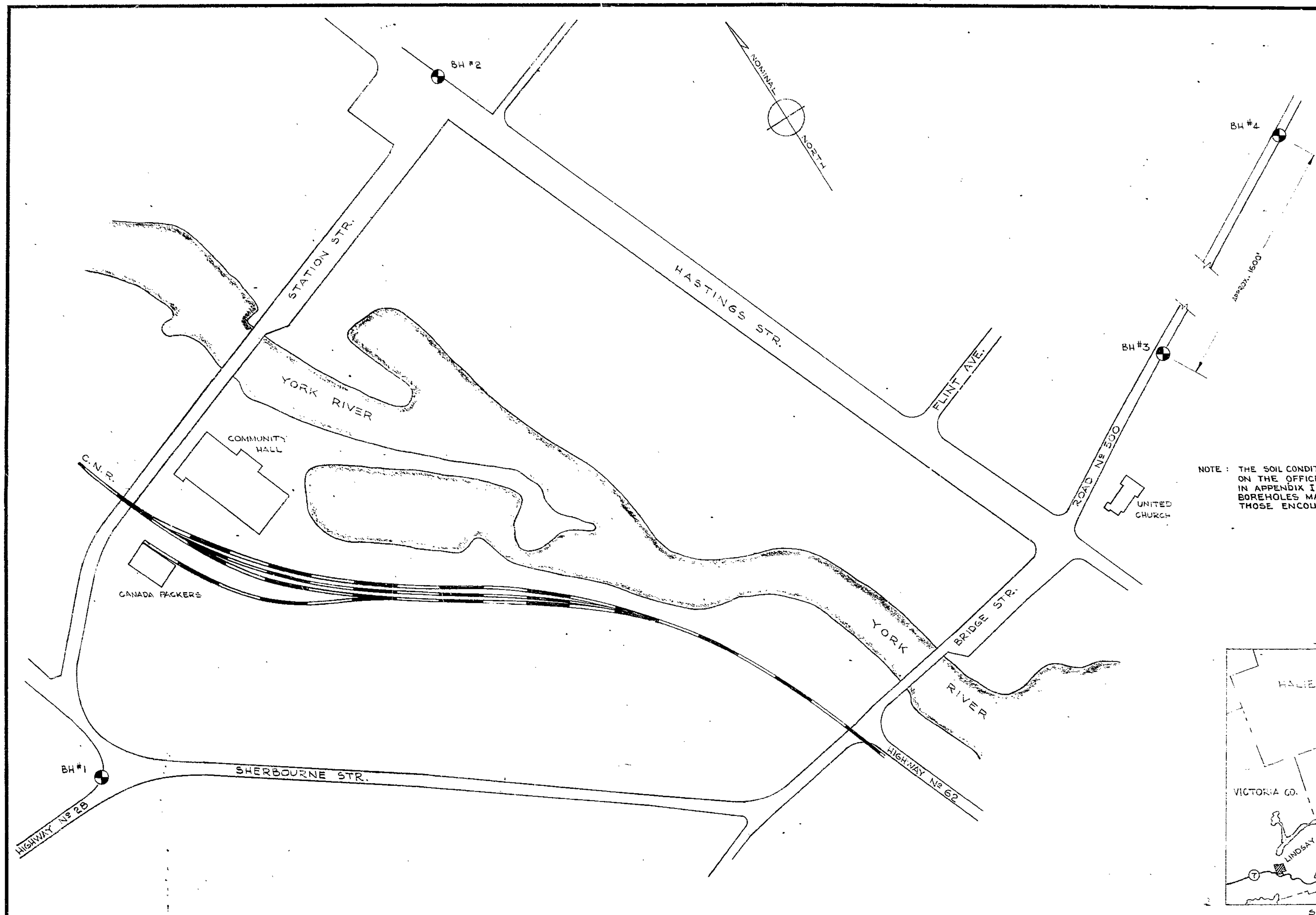
W.P. #26-63

Hwy. #62 &

Hwy. #500

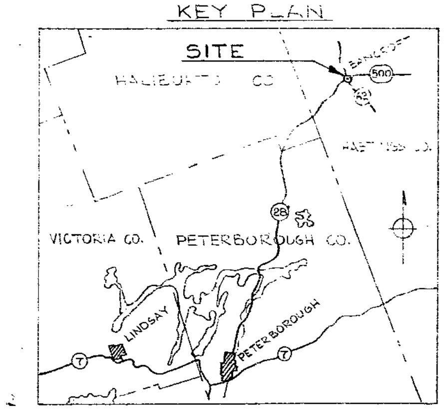
PROP. SEWER

BANCROFT



NOTE : THE SOIL CONDITIONS AT EACH BOREHOLE ARE GIVEN ON THE OFFICE REPORTS ON SOIL EXPLORATION IN APPENDIX I. THE SOIL CONDITIONS BETWEEN BOREHOLES MAY BE SUBJECT TO VARIATION FROM THOSE ENCOUNTERED AT THE BOREHOLES.

KEY PLAN



SCALE: 1" = 14 MILES

REVISIONS			REFERENCE		REFERENCE	
MARK	DATE	DESCRIPTION	DWG. NO.	DESCRIPTION	DWG. NO.	DESCRIPTION
					—	DEPARTMENT OF HIGHWAYS PLAN - COUNTY OF HASTINGS, TOWNSHIP OF FARADAY

DEPARTMENT OF HIGHWAYS, ONTARIO

PROPOSED SEWER

BANCROFT ONTARIO

BORING PLAN

GEOCON LTD.

DATE MARCH 9, 1964 SCALE 1" = 100'-0"

MADE VTG CHKD. DBO APPD.

No. T-7594-1