

61-F-2380

W.P. 102-60

Hwy. # 11



Mr. A. H. Toye,

September 12, 1961.

Bridge Engineer.

FOUNDATION INVESTIGATION REPORT  
By: E. G. Golder & Associates,  
Limited.

Materials & Research Section,

(Foundations Office).

Attention: Mr. S. McCashie.

Re: Proposed Eri-County Bypass,  
Highway 11, New Liskeard, Ont.  
W.P. 102-60-3

Attached to this memo, we are forwarding to you,  
two copies of the above-mentioned report submitted by the  
Consultant, E. G. Golder & Associates of Toronto.

We have reviewed the report and find the information  
well presented, and the data self-explanatory. However, if  
clarification or any additional information is required, please  
feel free to call on our Office.

AMG/MCG  
attach.

*A. D. Sterns*  
A. D. Sterns,  
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. A. H. Toye (2)

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Foundations Office

Gen. Files.



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TORONTO 9  
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61-F-238C

REF TO 62-F-99

REPORT  
TO  
DEPARTMENT OF HIGHWAYS, ONTARIO  
ON  
SOIL CONDITIONS  
PROPOSED TRI-COUNTY BYPASS  
HIGHWAY 11  
NEW LISKEARD ONTARIO

Distribution:

- 18 Copies - Department of Highways, Ontario.  
Toronto, Ontario.
- 2 Copies - H. Q. Golder & Associates Ltd.,  
Toronto, Ontario.

August, 1961.

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## ABSTRACT

The factual results of a reconnaissance soil survey to the west of New Liskeard, Ontario, and of a soils investigation along the route of the proposed Highway 11 Tri-County Bypass in New Liskeard, Ontario, are reported.

It was found that the thickness of clay to the west and east of the initially proposed line "A" bypass route does not significantly decrease from that along line "A".

The site along line "A" is underlain by a stratum of layered clay and silt which increases in thickness from zero feet at Highway 65 to about 150 feet at the Ontario Northland Railway. Between the railway and the Wabi River the thickness of the clay and silt is relatively constant at about 150 to 170 feet. The upper 7 to 12 feet of the stratum has been desiccated to a very stiff to firm consistency and the lower portion is generally firm to stiff with increasing depth. The clay and silt is underlain by a relatively thin deposit of dense to very dense glacial silty sand with gravel till which in turn overlies limestone bedrock. The thickness of the silty sand with gravel increases to the south of the railway and the stratum forms the ridge at and to the south of Highway 65.



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The locations of the wash borings put down to the west and east of the proposed crossing together with the locations of wells in the area are shown on Figure 1. Sections of the soil stratigraphy inferred from the wash borings and well information are also shown on Figure 1.

Upon completion of the reconnaissance work it was decided by the Department of Highways, Ontario that, since the thickness of clay did not significantly decrease to the west or east of the initially proposed line "A" crossing and considering alignment requirements, the line "A" crossing would be maintained. It was further decided that additional information was required along this line, between Highway 65 and the Wabi River to supplement the localized information given in the Geocon Ltd. report dated June 17th, 1960. The purpose of this additional work was to confirm the uniformity of the soil conditions across the site and more specifically to determine the thickness of the silty clay stratum and the shear strength profile of the clay to a depth of 60 feet.

For the investigation along line "A" borings were put down at 100 foot intervals between chainages 783+00 and 798+00 and between 803+00 and 816+00. Two types of borings were put down. In the first type of boring the borehole was advanced to a depth of 60 feet in the clay using 3 inch size casing. Shelby tube samples of the clay were taken at 5 foot intervals of depth and in situ vane shear measurements carried



out between the sampling depths. The borehole below the 60 foot depth was advanced by jetting AX casing through the clay and into the underlying glacial till. The second type of boring, located between the more detailed first type borings, was put down by jetting AX casing through the silty clay stratum and into the glacial till. In all a total of 15 detailed exploratory boreholes and 14 jetted borings were put down along line "A" to a maximum depth of about 325 feet.

A further 3 boreholes were put down along line "A" at the proposed bridge pier locations near the Wabi River. These borings were put down to determine the elevation of the glacial till and bedrock surface. The boreholes were washed through the clay and till stratum using BX casing and the bedrock core-drilled for a distance of 10 feet in AXT size.

The locations of all the borings put down along the proposed line "A" crossing together with a section of the inferred soil stratigraphy are shown on Figure 2. Detailed logs of each borehole along line "A" are given on the Records of Boreholes.

The soil samples obtained in this investigation were dispatched to our laboratory for examination and testing. Laboratory testing was carried out on samples from 3 of the detailed boreholes put down at chainages 793+00, 806+00 and 814+00. Samples from a further 7 boreholes were extruded from the Shelby tubes for detailed visual examination. The results



of the testing are plotted on the Records of Boreholes and on the enclosed figures. Representative samples of those remaining will be stored until February 1st, 1962 at which time you will be notified regarding their disposal.

All elevations given in this report are referred to Geodetic datum and were obtained from the bench marks of the Ontario Department of Highways, in the area.

#### SITE TOPOGRAPHY AND GEOLOGY

The line of the proposed Tri-County Bypass is located approximately 1 mile northwest of New Liskeard, in the County of Temiskaming, Ontario, as shown on Figure 2. The bypass at this location crosses Highway 65, the Ontario Northland Railroad and the Wabi River to the north. The ground surface along the route between about the railway and the river is essentially level. To the south of the railway the ground surface is also relatively flat up to within about 500 feet of Highway 65. At this point the ground surface rises to the south and at Highway 65 is about 20 feet higher. The ground surface continues to rise to the south past the highway, which runs along the bottom of a ridge, for a further height of about 150 feet in a distance of about 2,500 feet.

From available geological information and previous work at this site, it is known that the area of investigation is located near the edge of a clay plain deposited during recent geological times. The clay which in some places in



this region is up to 400 feet thick is underlain by glacial till which at the proposed crossing rises above the clay and forms the silty sand and gravel ridge at and to the south of Highway 65. Bedrock underlies the till and consists of a banded grey and white limestone.

#### SOIL CONDITIONS

The following main soil strata were encountered by the borings put down along line "A".

##### Layered Clay and Silt

A stratum of layered clay and silt was encountered in all the borings below a layer of dark brown topsoil about 1 foot in thickness. The stratum increases in thickness from about 10 feet at chainage 783+00 near Highway 65 to about 150 feet at the Ontario Northland Railway. Between the railway and the Wabi River to the north the thickness is generally of the order of 170 feet except at chainage 809+00 where it is greater than 300 feet. At the Wabi River the stratum is about 165 feet thick on top of the banks and about 100 feet thick at the centre of the river channel. The colour of the stratum is grey except in about the upper 7 to 12 feet where it is a mottled grey brown as a result of desiccation and oxidation. Grass roots are present within this upper desiccated zone.



Based on an examination of samples extruded from Shelby tubes for boreholes 4, 8, 10, 12, 14, 17, 19, 23, 27 and 29 to a depth of 60 feet, the upper 15 to 20 feet of the stratum have a typical varved structure particularly in the vicinity of and to the south of the railway. The separate layers of the varves are comprised of dark grey silty clay and light grey clayey silt. The dark clay layers range from about  $\frac{1}{4}$  to 1 inch in thickness and are typically about  $\frac{1}{2}$  inch thick. They comprise about 60 to 70 percent of the total thickness of the upper portion of the stratum. The light silt layers vary from about  $\frac{1}{8}$  to  $\frac{1}{2}$  inch in thickness and are generally about  $\frac{3}{8}$  inch thick. The individual clay and silt layers are sensibly horizontal, although towards Highway 65 they are occasionally slightly contorted and have an inclination of up to about 15 degrees to the horizontal.

Below a depth of about 45 to 50 feet from ground surface to the maximum depth of sampling of 60 feet, the dark grey silty clay layers range from about  $\frac{1}{4}$  to 1 inch in thickness and the light grey clayey silt to silt layers vary from about  $\frac{1}{4}$  to  $1\frac{1}{2}$  inches. There appears to be no general trend in the increase or decrease in the size of the individual layers. The alternate silt and clay layers each form approximately 50 percent of the total thickness of this portion of the stratum and are horizontal. Below 60 foot depth from ground surface, based on the results



of the previous investigation, the stratum is varved throughout, with the layers inclined up to about 30 degrees to the horizontal in the lower 20 to 30 feet of the stratum.

Between a 20 to 50 foot depth from ground surface across the site and in the upper .0 feet to the north of chainage 810+00 the varved structure of the stratum is generally indistinct. The samples from this portion of the stratum when in the natural state exhibit a homogeneous structure. However, on drying a sample a laminated to layered structure is evident. The laminations consist of thin alternate grey and light grey silty clay layers of the order of  $1/32$  to  $1/16$  inch thick. The separate layers generally represent a minor variance in the composition with the lighter lamination having a slightly higher silt content. Occasionally in this portion of the stratum, the samples exhibited distinct horizontal layers of dark grey silty clay up to about  $\frac{1}{2}$  inch thick and light grey clayey silt layers up to about  $1/8$  inch thick.

The stratum throughout contains occasional dark grey subrounded to subangular gravel particles up to about  $1\frac{1}{2}$  inches in size.



Atterberg limit determinations were carried out on bulk samples and on the individual clay and silt layers of the stratum. The liquid limits obtained for the dark layers ranged between 60 and 85 with an average value of about 65, while the plasticity index ranged from about 33 to 55 with an average value of about 40. Liquid limits and plasticity indices ranging from 25 to 35 and 2 to 20 respectively with an average value of about 28 for the liquid limit and 5 for the plasticity index were obtained for the light layers. For the bulk samples where the individual layers were not separated liquid limits ranging from 30 to 80 with an average value of about 55 and plasticity indices ranging from 10 to 50 with an average value of about 30 were obtained. The results of all the Atterberg limit tests carried out are plotted on the plasticity chart in Figure 3 together with the Casagrande "A" line. Based on the plasticity chart classification the dark layers are essentially a silty clay of high plasticity while the light layers are clayey silt to silt of low plasticity.

From the Atterberg limits and natural water content determinations the liquidity index, which is the ratio of water content minus plastic limit to the plasticity index, has been computed to have an average value of about 0.4 in the upper desiccated crust and about 1.0 below the crust for the bulk samples, except in borehole 27 near the Wabi



River where the average liquidity index below the crust is about 0.8. The average liquidity index for the dark clay and light silt layers is about 1.0 and 0.9 respectively.

Two grain size distribution curves on bulk samples from the laminated portion of the stratum are shown on Figure 4. These indicate that this portion of the stratum contains about 85 percent clay sizes and 15 percent silt sizes. Thus the activity of this portion of the stratum is about 0.5. (Activity =  $\frac{\text{P.I.}}{\text{Clay fraction}}$  )

Two typical grain size distribution curves for each of the separate layers from the stratum are plotted on Figure 5. These show that the dark layer is comprised of 80 to 85 percent clay sizes and the light layer contains from about 25 to 30 percent clay sizes. The activity of the dark and light layers is about 0.5 and 0.1 respectively.

Unit weight determinations carried out on samples from the stratum gave values ranging from 95 to 119 pounds per cubic foot with an average value of about 105 pounds per cubic foot.

The shear strength of the stratum was determined by both in situ vane shear measurements in the field and laboratory undrained triaxial compression tests. The resulting shear strength profiles obtained are shown on the Records of Boreholes and on Figure 6. In general, below the desiccated



upper crust the shear strength increases from a minimum of about 500 pounds per square foot at a 10 foot depth to about 1,000 pounds per square foot at a 60 foot depth. The shear strength in the crust ranges from over 2,000 pounds per square foot to about 1,000 pounds per square foot. Based on these values the stratum is generally very stiff to stiff in the crust and firm to a depth of 60 feet. Below 60 feet from the previous investigation, the stratum is known to be essentially stiff.

The sensitivity of the stratum as determined by the vane tests ranges from 3 to 10 and is generally about 5.

Typical stress-strain curves from the undrained triaxial compression tests are shown on Figure 7. The laboratory compression tests generally gave a lower shear strength value for the stratum than that obtained by the vane tests. This may be attributed to the sensitivity of the silty clay which would result in some unavoidable disturbance during sampling operations.

#### Silty Sand with Gravel

At ground surface at Highway 65 and underlying the layered clay and silt in all the borings along line "A", a stratum of glacial grey silty sand with gravel was encountered. The stratum was only completely penetrated at boreholes 30, 31 and 32 at the Wabi River where it is



about 2 feet in thickness. In borehole 13 it was penetrated for a maximum distance of 21 feet. In the remainder of the borings it was penetrated for an average distance of about 5 feet before refusal to wash boring penetration was met. The stratum is essentially comprised of silt and sand in all grain sizes with some gravel. From visual examination of the soil samples obtained and the results of a previous investigation we estimate that the silt forms about 30 percent of the stratum, the sand 45 percent and the gravel about 25 percent. The individual sand and gravel particles are generally subangular in shape. Occasional boulders are present within the stratum and in boreholes 16, 18 and 29 the wash boring method was not successful in effecting penetration into the stratum due to the presence of cobbles or boulders.

Standard penetration resistance of "N" values ranging from 36 blows per foot to several values greater than 100 blows per foot were obtained in the silty sand with gravel. These indicate that the relative density of the stratum is dense to very dense and generally very dense.

#### Bedrock

Bedrock was encountered beneath the stratum of silty sand with gravel at about elevations 455 to 460 in boreholes 30, 31 and 32 put down at the proposed Wabi River bridge pier locations. It was proved by core drilling in AXT size for



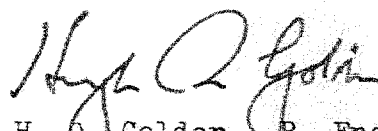
depths ranging from 11 feet in borehole 31 to 15 feet in borehole 32. The core recovery obtained was generally 100 percent with the exception of the upper 12 to 18 inches where the bedrock is weathered and fractured. Bedrock is a sound banded grey and white limestone.

#### WATER CONDITIONS

Water level readings taken in the completed boreholes during the period of the investigation indicate that the ground water level ranges from 1 to 7 feet below ground surface and is generally at about 2 foot depth.



J. L. Seychuk, P. Eng.

  
H. Q. Golder, P. Eng.

JLS/jb  
6117

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



## RECORD OF BOREHOLE 783+00 (1)

LOCATION SEE FIG. 2

BORING DATE MAY 24 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 3"

SAMPLER HAMMER WEIGHT 40 LB DROP 20 INCHES

PEN TEST HAMMER WEIGHT — LB DROP — INCHES

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT $L_L$		PLASTIC LIMIT $P_L$		WATER CONTENT $W$		REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE	BLOWS / FT	ELEVATION SCALE	BLOWS / FOOT		WATER CONTENT, PER CENT		WATER CONTENT, PER CENT		
						SHEAR STRENGTH $C$ , LB / SQ FT						
								</				



# RECORD OF BOREHOLE 785+00 (2)

LOCATION: DET. 1112.2 BOREHOLE TYPE: WASH BOREHOLE BOREHOLE DIAMETER: 3" DATUM: GEOD. 11.0  
SAMPLER HAMMER WEIGHT: 40 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> <span style="margin-left: 20px;">P<sub>L</sub> W L<sub>L</sub></span> WATER CONTENT W			REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		SHEAR STRENGTH C, LB./SQ. FT					WATER CONTENT, PER CENT			
					0	100	200	300	400				
835.5	GRAVELLY SILT			0									WL PL 833.5
835.0	TOP SOIL			0									MAY 28 1961
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				2									
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				99									
860.5	END OF HOLE			100									







# RECORD OF BOREHOLE 787 + 00 (4)

LOG IN SEE FIG 2

BORING DATE MAY 6 1961

DATUM GEODETTIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 3" TO 60 DEPTH 8X TO END OF HOLE

SAMPLER HAMMER WEIGHT 10 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 $P_L$ $\frac{P_L}{W} \frac{L_L}{L_L}$ WATER CONTENT $W$			REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		SHEAR STRENGTH $C$ , LB / SQ. FT.					WATER CONTENT, PER CENT			
					400	800	1200	1600	2000				
6.50	GROUND LEVEL				SAND, SILTY, TOP SOIL								W. C. 40.0 MAY 25 1961
6.40													
6.30													
6.20													
6.10													
6.00													
5.90													
5.80													
5.70													
5.60													
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FROM TO VERY  
STIFF GREY  
LAYERED CLAY  
AND SILT

SAND, SILTY  
SAND  
WITH GRAVEL  
END OF LOG

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN G. J.  
CHECKED A. A.



# RECORD OF BOREHOLE 788 +00 (5)

LOCATION SEE FIG. 2

BORING DATE MAY 8 1961

DATUM CEGDETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 4X

SAMPLER HAMMER WEIGHT --- LB. DROP --- 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. PLCT	NUMBER	TYPE		SHEAR STRENGTH C, LB./SQ. FT.		WATER CONTENT, PER CENT		
545.0	GROUND LEVEL				545.0					NO. 1015 MAY 26 1961
544.0					544.0					
543.0					543.0					
542.0					542.0					
541.0					541.0					
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## RECORD OF BOREHOLE 789 + 00 (6)

LOCATION: 2000 1000 1000

BOOKING DATE 7/24/00

**DATUM**      **SECRET**

BOREHOLE TYPE WASH STATION

BOREHOLE DIAMETER XX TO 40' CORREL. 4X TO END OF HOLE

SAMPLE HANDED WEIGHT 40 LB. DROP 20 INCHES

PEW TEST HAMMER WEIGHT LB GROW INCHES

[illegible]

### VERTICAL SCALE

INCH TO 0 1/2 INCH

**GOLDER & ASSOCIATES**

DRAWN 66.

CHECKED *h*



# RECORD OF BOREHOLE 790 + 00 (7)

LOCATION SEE FIG. 2

BORING DATE MAY 8 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 4 X

SAMPLER HAMMER WEIGHT — LB. DROP — 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. FLOT	NUMBER	TYPE		SHEAR STRENGTH C, LB./SQ.FT.		WATER CONTENT, PER CENT		
63.2	GROUND LEVEL				63.2					W.L. EL. 639.0 MAY 25 1961
63.0					63.0					
62.8					62.8					
62.6					62.6					
62.4					62.4					
62.2					62.2					
62.0					62.0					
61.8					61.8					
61.6					61.6					
61.4					61.4					
61.2	DATA BEGIN TOP SOIL				61.2					
61.0					61.0					
60.8					60.8					
60.6					60.6					
60.4					60.4					
60.2					60.2					
60.0					60.0					
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RECORD OF BOREHOLE 791 + 00 (8)

LOCATION OF THE FUGITIVE

[illegible]

DATE: 10/10/68

BOREHOLE TYPE

BOREHOLE DIAMETER 3' TO 60' DEPTH, 3X TO 5X

SAFETY HAZARD WEIGHT 40 LB 2000 00 0000

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

[illegible]

### VERTICAL SCALE

INCH TO 10 FEET

DRAWN 

CHECKED ☒ ☐

GOLDER & ASSOCIATES



## RECORD OF BOREHOLE 792+00 (9)

LOCATION SEE FIG. 2

BOOKING DATE MAY 10 1961

**DATUM**      **GEODESY**

BOREHOLE TYPE VACUUM BORING

BOREHOLE DIAMETER AS

SAMPLE HANMER WEIGHT 16 PPSZ 1 INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

[illegible]

1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 2680, 26

1. 1000 2. 1000 3. 1000 4. 1000 5. 1000

GOLDER &amp; ASSOCIATES

... ..

2000



## RECORD OF BOREHOLE 793+00 (10)

LOCATION SEE FIG 2

BOBING DATE 25 - 20 - 1961

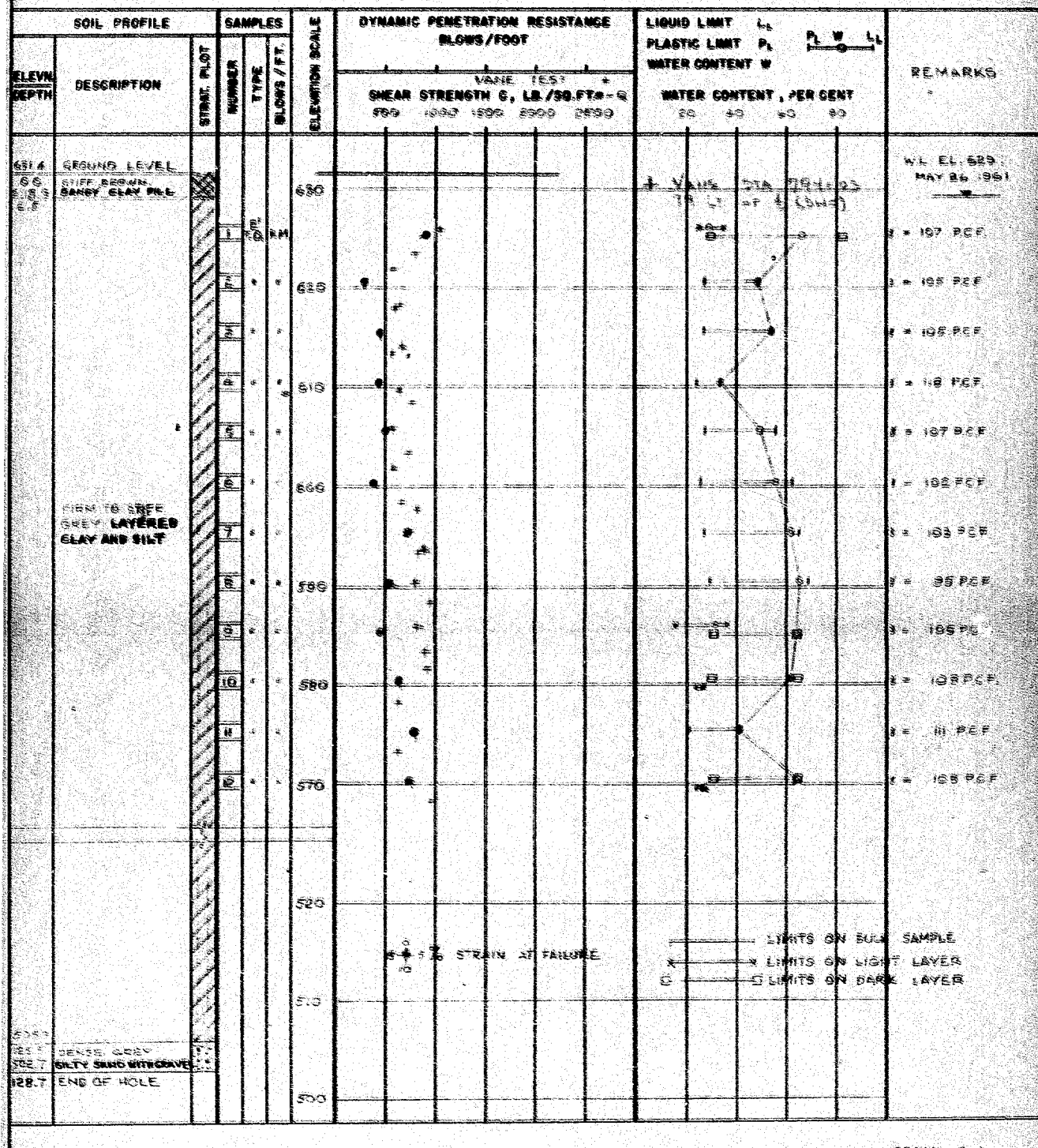
**DATUM** GEODETIC

BOREHOLE TYPE WASH SOFTING

BOREHOLE DIAMETER 3" TO 60" AX TO END OF HOLE

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES



### VERTICAL SCALE

1 INCH TO 10 FEET

DRAWN G.J.

CHECKED *L. A.*



## RECORD OF BOREHOLE 794 + 00 (11)

LOCATION SEE FIG. 2

BORING DATE MAY 11 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 4.5

SAMPLER HAMMER WEIGHT — LB. DROP — INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT		LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE	BLOWS / FT.	ELEVATION SCALE	SHEAR STRENGTH $C$ , LB./SQ.FT.	WATER CONTENT, PER CENT		
935.0	GROUND LEVEL								NO. 21 935.0 MAY 26 1961
934.0									
933.0									
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745.0									
744.0									
743.0									
742.0									
741.0									
740.0									
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738.0									
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725.0									
724.0									
723.0									
722.0									
721.0									
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719.0									
718.0									
717.0									
716.0									
715.0									
714.0									
713.0									
712.0									
711.0									
710.0									
709.0									
708.0									
707.0									



## RECORD OF BOREHOLE 795 + 00 (12)

LOCATION: 200 70 0

BOILING DATE MAY 11 1964

DATUM GEODETIC.

BORCHOLT TYPE 2000 4000000

BOREHOLE DIAMETER 2' TO 60' AT TO END OF HOLE

① 第 1 章 緒 論  
 ② 第 2 章 基礎知識  
 ③ 第 3 章 基礎知識  
 ④ 第 4 章 基礎知識  
 ⑤ 第 5 章 基礎知識  
 ⑥ 第 6 章 基礎知識  
 ⑦ 第 7 章 基礎知識  
 ⑧ 第 8 章 基礎知識  
 ⑨ 第 9 章 基礎知識  
 ⑩ 第 10 章 基礎知識  
 ⑪ 第 11 章 基礎知識  
 ⑫ 第 12 章 基礎知識  
 ⑬ 第 13 章 基礎知識  
 ⑭ 第 14 章 基礎知識  
 ⑮ 第 15 章 基礎知識  
 ⑯ 第 16 章 基礎知識  
 ⑰ 第 17 章 基礎知識  
 ⑱ 第 18 章 基礎知識  
 ⑲ 第 19 章 基礎知識  
 ⑳ 第 20 章 基礎知識  
 ㉑ 第 21 章 基礎知識  
 ㉒ 第 22 章 基礎知識  
 ㉓ 第 23 章 基礎知識  
 ㉔ 第 24 章 基礎知識  
 ㉕ 第 25 章 基礎知識  
 ㉖ 第 26 章 基礎知識  
 ㉗ 第 27 章 基礎知識  
 ㉘ 第 28 章 基礎知識  
 ㉙ 第 29 章 基礎知識  
 ㉚ 第 30 章 基礎知識  
 ㉛ 第 31 章 基礎知識  
 ㉜ 第 32 章 基礎知識  
 ㉝ 第 33 章 基礎知識  
 ㉞ 第 34 章 基礎知識  
 ㉟ 第 35 章 基礎知識  
 ㊱ 第 36 章 基礎知識  
 ㊲ 第 37 章 基礎知識  
 ㊳ 第 38 章 基礎知識  
 ㊴ 第 39 章 基礎知識  
 ㊵ 第 40 章 基礎知識  
 ㊶ 第 41 章 基礎知識  
 ㊷ 第 42 章 基礎知識  
 ㊸ 第 43 章 基礎知識  
 ㊹ 第 44 章 基礎知識  
 ㊺ 第 45 章 基礎知識  
 ㊻ 第 46 章 基礎知識  
 ㊼ 第 47 章 基礎知識  
 ㊽ 第 48 章 基礎知識  
 ㊾ 第 49 章 基礎知識  
 ㊿ 第 50 章 基礎知識  
 ㊿ 第 51 章 基礎知識  
 ㊿ 第 52 章 基礎知識  
 ㊿ 第 53 章 基礎知識  
 ㊿ 第 54 章 基礎知識  
 ㊿ 第 55 章 基礎知識  
 ㊿ 第 56 章 基礎知識  
 ㊿ 第 57 章 基礎知識  
 ㊿ 第 58 章 基礎知識  
 ㊿ 第 59 章 基礎知識  
 ㊿ 第 60 章 基礎知識  
 ㊿ 第 61 章 基礎知識  
 ㊿ 第 62 章 基礎知識  
 ㊿ 第 63 章 基礎知識  
 ㊿ 第 64 章 基礎知識  
 ㊿ 第 65 章 基礎知識  
 ㊿ 第 66 章 基礎知識  
 ㊿ 第 67 章 基礎知識  
 ㊿ 第 68 章 基礎知識  
 ㊿ 第 69 章 基礎知識  
 ㊿ 第 70 章 基礎知識  
 ㊿ 第 71 章 基礎知識  
 ㊿ 第 72 章 基礎知識  
 ㊿ 第 73 章 基礎知識  
 ㊿ 第 74 章 基礎知識  
 ㊿ 第 75 章 基礎知識  
 ㊿ 第 76 章 基礎知識  
 ㊿ 第 77 章 基礎知識  
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 ㊿ 第 79 章 基礎知識  
 ㊿ 第 80 章 基礎知識  
 ㊿ 第 81 章 基礎知識  
 ㊿ 第 82 章 基礎知識  
 ㊿ 第 83 章 基礎知識  
 ㊿ 第 84 章 基礎知識  
 ㊿ 第 85 章 基礎知識  
 ㊿ 第 86 章 基礎知識  
 ㊿ 第 87 章 基礎知識  
 ㊿ 第 88 章 基礎知識  
 ㊿ 第 89 章 基礎知識  
 ㊿ 第 90 章 基礎知識  
 ㊿ 第 91 章 基礎知識  
 ㊿ 第 92 章 基礎知識  
 ㊿ 第 93 章 基礎知識  
 ㊿ 第 94 章 基礎知識  
 ㊿ 第 95 章 基礎知識  
 ㊿ 第 96 章 基礎知識  
 ㊿ 第 97 章 基礎知識  
 ㊿ 第 98 章 基礎知識  
 ㊿ 第 99 章 基礎知識  
 ㊿ 第 100 章 基礎知識

PEN. TEST HAMMER WEIGHT LB DROP INCHES

[illegible]

### VERTICAL SCALE

1 INCH TO 10 FEET

**GOLDER & ASSOCIATES**

DRAWN S.S.

CHECKED J. A.



## RECORD OF BOREHOLE 796 +00 (13)

LOCATION SEE FIG 2

BORING DATE MAY 12 1961

DATUM GEODETIC

BOREHOLE TYPE

WASH BORING

BOREHOLE DIAMETER

8.1

SAMPLER HAMMER WEIGHT

LB.

DROP

INCHES

PEN. TEST HAMMER WEIGHT

LB.

DROP

INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$				REMARKS
ELEVATION DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH $C$ , LB./SQ. FT.				WATER CONTENT, PER CENT				
465.2 6.8 1.1	GROUND LEVEL													W. EL 627.8 MAY 26 1961

VERTICAL SCALE

1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN S.J.

CHECKED J.A.



# RECORD OF BOREHOLE 796 +00 (13)

LOCATION SEE FIG 2

BORING DATE MAY 12 1961

DATUM GEODETIC

BOREHOLE TYPE


WASH BORING

BOREHOLE DIAMETER

5.1

SAMPLER HAMMER WEIGHT --- LB. DROP --- INCHES

PEN. TEST HAMMER WEIGHT --- LB. DROP --- INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT				LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$			REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH $C$ , LB./SQ. FT.				WATER CONTENT, PER CENT			
4832 6.9 1.1	GROUND LEVEL				4830								W. L. 627.9 MAY 26 1961
						520							
						560							
						600							
						640							
						680							
						720							
						760							
						800							
						840							
4832 16.0	END OF HOLE				880								

DARK REGION TOPSOIL

GREY LAYERED  
CLAY AND SILTGREY SILTY  
SAND WITH GRAVELVERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN G.J.  
CHECKED J.A.



## RECORD OF BOREHOLE 797+00 (14)

LOCATION SEE FIG 2

BORING DATE MAY 2, 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 3"

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT LB. DROP INCHES

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT		LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER TYPE	BLOWS / FT. ELEVATION SCALE	WATER TEST SHEAR STRENGTH $C$ , LB./SQ.FT. 500 1000 1500 2000 2500	FL W PL		
660.1 19	GROUND LEVEL			570				WL EL 627.6 MAY 26 1961
					DARK BROWN TOPSOIL			
			PH	565				+ WAT @ 50 797+00
				560				(1961) + WAT @ 50 797+00 = 10.5% W
				555				(1961) + WAT @ 50 797+00 = 10.5% W
				550				
				545				
				540				
				535				
				530				
				525				
				520				
				515				
				510				
				505				
				500				
				495				
				490				
				485				
				480				
				475				
				470				
				465				
				460				
				455				
				450				
				445				
				440				
				435				
				430				
				425				
				420				
				415				
				410				
				405				
				400				
				395				
				390				
				385				
				380				
				375				
				370				
				365				
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				300				
				295				
				290				
				285				
				280				
				275				
				270				
				265				
				260				
				255				
				250				
				245				
				240				
				235				
				230				
				225				
				220				
				215				
				210				
				205				
				200				
				195				
				190				
				185				
				180				
				175				
				170				
				165				
				160				
				155				
				150				
				145				
				140				
				135				
				130				
				125				
				120				
				115				
				110				
				105				
				100				
				95				
				90				
				85				
				80				
				75				
				70				
				65				
				60				
				55				
				50				
				45				
				40				
				35				
				30				
				25				
				20				
				15				
				10				
				5				
				0				

VERTICAL SCALE

1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN G.S.

CHECKED J.A.







# RECORD OF BOREHOLE 803+00 (16)

LOCATION SEE FIG. 2

BORING DATE MAY 15 1961

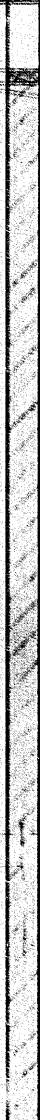
DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER AX.

SAMPLER HAMMER WEIGHT -- LB. DROP -- 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> $\frac{P_L}{W}$ L <sub>L</sub> WATER CONTENT W				REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH C, LB./SQ. FT.				WATER CONTENT, PER CENT				
625.5	GROUND LEVEL				625.0									WL EL 583.9 MAY 26 1961 v
622.16					625.0									
					620.0									
					618.0									
					616.0									
					614.0									
					612.0									
					610.0									
					608.0									
					606.0									
					604.0									
				602.0									GREY LAYERED CLAY AND SILT	
				600.0										
				598.0										
				596.0										
				594.0										
				592.0										
				590.0										
				588.0										
				586.0										
				584.0										
				582.0										
				580.0									END OF HOLE 557.16	
				578.0										
				576.0										
				574.0										
				572.0										
				570.0										
				568.0										
				566.0										
				564.0										
				562.0										
				560.0										
463.8					463.8								END OF HOLE 463.7	
463.7					462.0									
					460.0									
					458.0									
					456.0									
					454.0									
					452.0									
					450.0									
					448.0									
					446.0									
					444.0									

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN G.J.  
CHECKED J.A.



# RECORD OF BOREHOLE 804+00 (17)

LOCATION SEE FIG. 2

BORING DATE MAY 13-15, 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 3" TO 40' AX. TO END OF HOLE

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 $P_L$ $P_L$ $W$ $L_L$ WATER CONTENT $W$		REMARKS
ELEV. DEPTH	DESCRIPTION	STRET. PLOT	NUMBER	TYPE		VANE TEST SHEAR STRENGTH $C$ , LB./SQ. FT. 500 1000 1500 2000 2500		WATER CONTENT, PER CENT		
66.6	GROUND LEVEL				66.6	BASE ROCK IN TOPSOIL				WL EL 622.8 MAY 26, 1961
6.6					66.6					
1.5					65.1					
					64.6					
					64.1					
					63.6					
					63.1					
					62.6					
					62.1					
					61.6					
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					60.6					
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					8.6					
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					7.6					
					7.1					
					6.6					
					6.1					
					5.6					
					5.1					
					4.6					
					4.1					
					3.6					
					3.1					
					2.6					
					2.1					
					1.6					
					1.1					
					0.6					
					0.1					
460.5					460.5					
460.0					460.0					
457.8	DENSE GRAY SILTY SAND WITH GRAVEL				457.8					
457.7	END OF HOLE				457.7					

VERTICAL SCALE

1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN G.S.

CHECKED J.A.



# RECORD OF BOREHOLE 805+00 (18)

LOCATION SEE FIG 2

BORING DATE MAY 17, 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 4X

SAMPLER HAMMER WEIGHT - LB. DROP - INCHES

PEN. TEST HAMMER WEIGHT - LB. DROP - INCHES

SOIL PROFILE		SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT		LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLCT	NUMBER		TYPE	SHEAR STRENGTH $C$ , LB./SQ.FT.	WATER CONTENT, PER CENT		
626.2 626 1.8	GROUND LEVEL				630				W.L. EL 623.5 MAY 26 1961
					620				
					610				
					600				
					590				
					580				
					570				
					560				
					550				
					540				
					530				
					520				
					510				
					500				
					490				
					480				
					470				
					460				
					450				
					440				
					430				
					420				
					410				
					400				
					390				
					380				
					370				
					360				
					350				
					340				
					330				
					320				
					310				
					300				
					290				
					280				
					270				
					260				
					250				
					240				
					230				
					220				
					210				
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					180				
					170				
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					150				
					140				
					130				
					120				
					110				
					100				
					90				
					80				
					70				
					60				
					50				
					40				
					30				
					20				
					10				
					0				

GREY LAYERED  
CLAY AND SILT

452.4  
167.8 END OF HOLE  
RECEIVED

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN S.S.  
CHECKED J.A.



## RECORD OF BOREHOLE 806 + 00 (19)

LOCATION      CBR    FIG 2

BOILING DATE MAY 12 16 47 1961

DATUM      GEODETIC.

BOREHOLE TYPE: 4-2-1 BOREHOLE

BOREHOLE DIAMETER 3" TO 60" 34" TO 42" 42" TO 48" 48" TO 54" 54" TO 60"

SAMPLER HANMER BRIGHT 10 LB 1400 10 10000

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

[illegible]

### VERTICAL SCALE

1 IN. TO 10 FEET

**GOLDER & ASSOCIATES**

DRAWN 64

CHECKED J. A.



# RECORD OF BOREHOLE 807 + 00 (20)

LOCATION SEE FIG 2      BORING DATE MAY 17 1961      DATUM GEODETIC  
BOREHOLE TYPE WASH BORING      BOREHOLE DIAMETER 12"  
SAMPLER HAMMER WEIGHT 140 LB      DROP 18 INCHES      PEN. TEST HAMMER WEIGHT 140 LB      DROP 18 INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT				LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$				REMARKS
ELEVATION DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH $C$ , LB./SQ. FT.				WATER CONTENT, PER CENT				
625.8 2.5 1.6	GROUND LEVEL				630									W.L. EL. 522.9 MAY 26 1961
					620									
					610									
					600									
					590									
					580									
					570									
					560									
					550									
					540									
460.5 165.0					460									GREY SILTY SAND WITH GRAVEL
					450									
					440									
					430									
					420									
413.3 19.0					410									END OF LOG
					400									

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN G.S.  
CHECKED J.A.



DRAWN G.C.  
CHECKED J.A.



## PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

DRAWN G.W.  
CHECKED J.A.







**RECORD OF BOREHOLE 811+00 (24)**

LOCATION SEE FIG. 2

BOBING DATE MAY 20 1964

**DATUM**      **GEOGRAPHIC**

BOREHOLE TYPE WASH BOREHOLE

BOREHOLE DIAMETER AX

SAMPLER HAMMER WEIGHT = LB DROP = INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

[illegible]

### VERTICAL SCALE

1 INCH TO 10 FEET

**GOLDER & ASSOCIATES**

DRAWN G L

CHECKED J. A.



**RECORD OF BOREHOLE 812 + 00 (25)**

LOCATION      REF      F2      F3

**BORING DATE** MAY 22 1961

**DATUM**      **GEODETIC**

BOREHOLE TYPE WASH LOGS

BOREHOLE DIAMETER 3

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT - LB. DROP - INCHES

[illegible]

WTS: 42 SCALE

1 INCH TO 10 FEET

**BROWN G. C.**

CHECKED *L.A.*

**GOLDER & ASSOCIATES**



## RECORD OF BOREHOLE 813+00 (26)

LOCATION SEE FIG. 2

BORING DATE MAY 23 1961

DATUM GEODETTIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER AX.

SAMPLER HAMMER WEIGHT — LB. DROP — INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$			REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FT.	ELEVATION SCALE	SHEAR STRENGTH $C$ , LB. / SQ. FT.			WATER CONTENT, PER CENT	
624.6 621.6	GROUND LEVEL						550	550	550	550	WL EL. 623.6 MAY 26 1961
							620				
							610				
							600				
							590				
							580				
							570				
							560				
							550				
							540				
							530				
							520				
							510				
							500				
							490				
							480				
							470				
							460				
							450				
							440				
							430				
							420				
							410				
							400				
							390				
							380				
							370				
							360				
							350				
							340				
							330				
							320				
							310				
							300				
							290				
							280				
							270				
							260				
							250				
							240				
							230				
							220				
							210				
							200				
							190				
							180				
							170				
							160				
							150				
							140				
							130				
							120				
							110				
							100				
							90				
							80				
							70				
							60				
							50				
							40				
							30				
							20				
							10				
							0				
			</								

VERTICAL SCALE

1 INCH TO 10 FEET

DRAWN G.S.

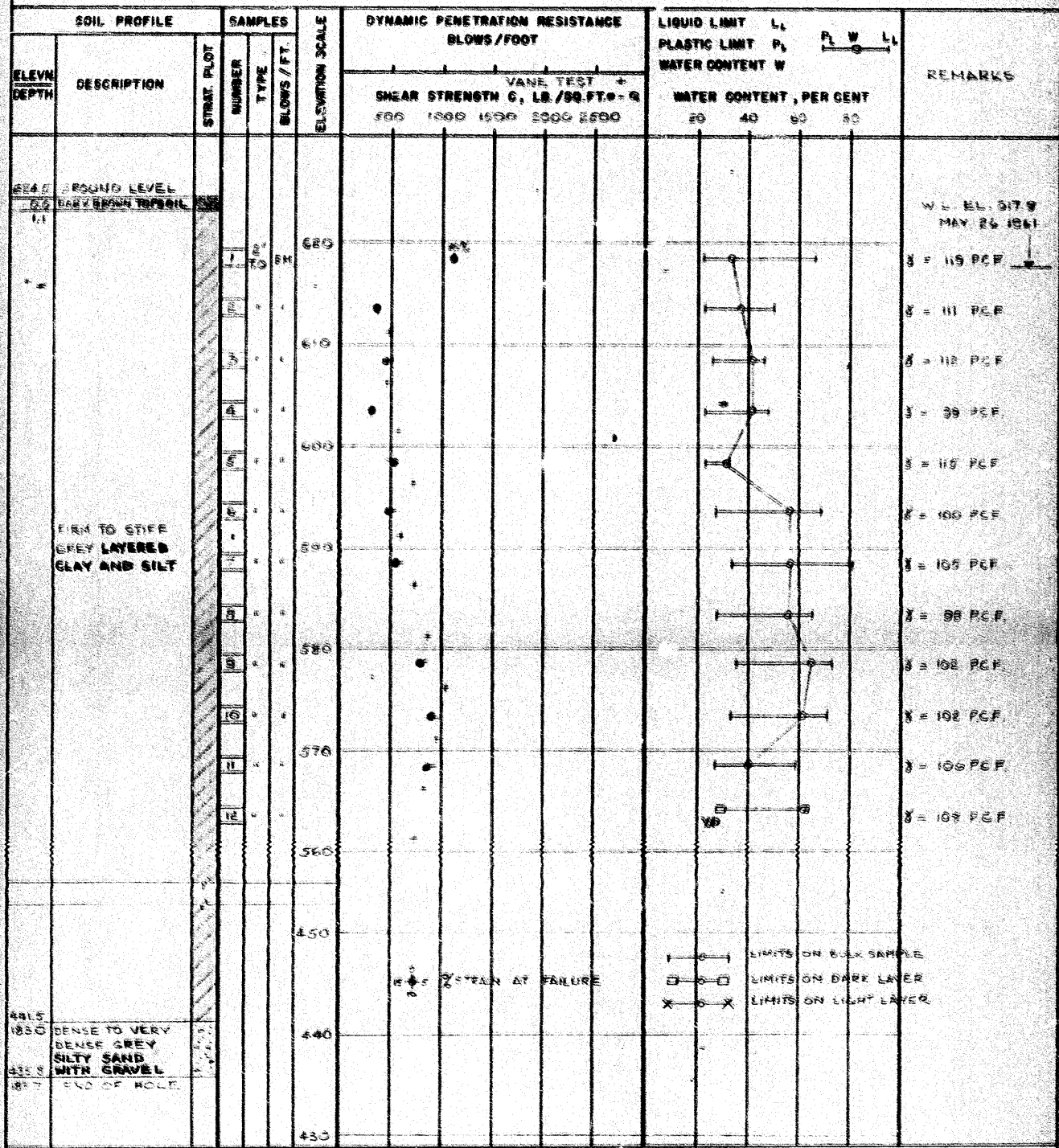
CHECKED J.A.

GOLDER &amp; ASSOCIATES



RECORD OF BOREHOLE 814 + 00 (27)

LOCATION SEE FIG 2 BORING DATE MAY 24 1961 DATUM GEODETIC  
BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER 3" TO 60" AX TO END OF HOLE  
SAMPLER HAMMER WEIGHT 142 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT -- LB. DROP -- INCHES



VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN G.S.  
CHECKED J.A.



## RECORD OF BOREHOLE 815 + 00 (28)

LOCATION SEE FIG. 2

BORING DATE MAY 24 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 8 IN.

SAMPLER HAMMER WEIGHT — LB. DROP — INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT				LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$				REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		BLOWS / FT.	SHEAR STRENGTH $C$ , LB./SQ.FT.				WATER CONTENT, PER CENT				
624.1 2.6 FE	GROUND LEVEL													WL EL 622.9 MAY 26 1961	
							</								

VERTICAL SCALE

1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN G.J.

CHECKED J.A.



## RECORD OF BOREHOLE 816+00 (29)

LOCATION SEE FIG. 2

BORING DATE MAY 24, 1961


DATUM GEODETTIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER 3" TO 60" AX TO END OF HOLE

SAMPLER HAMMER WEIGHT LB DROP INCHES

PEN TEST HAMMER WEIGHT - LB DROP - INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$  WATER CONTENT $W$			REMARKS
ELEVATION DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		VANE TEST					WATER CONTENT, PER CENT			
						SHEAR STRENGTH $C$ , LB./SQ. FT. 500 1000 1500 2000 2500								
6239 66 1.8	GROUND LEVEL													WL EL. 6193 MAY 26 1961
			1	1	67.0									
			2	1	68.0									
			3	1	69.0									
			4	1	70.0									
			5	1	71.0									
			6	1	72.0									
			7	1	73.0									
			8	1	74.0									
			9	1	75.0									
			10	1	76.0									
			11	1	77.0									
			12	1	78.0									
					79.0									
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					214.0									
					215.0									
					216.0									



**RECORD OF BOREHOLE 817 + 65 - 15' LT. (30)**

LOCATION SEE FIG. 2

BORING DATE MAY 24, 27, 1961

DATUM GEODETIC

BOREHOLE TYPE WASH BORING

**BOREHOLE DIAMETER**      **A x**

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT - LB. DROP - INCHES

SOIL PROFILE			SAMPLES	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. PLT.	NUMBER TYPE BLOWS / FT.	ELEVATION SCALE	WATER CONTENT, PER CENT	
60.0	GROUND LEVEL					WL EL. 595.3 MAY 30 1961
58.0						
57.0						
56.0						
55.0						
54.0						
53.0						
52.0						
51.0						
50.0						
49.0						
48.0						
47.0						
46.0						
45.0						
44.0						
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9.0						
8.0						
7.0						
6.0						
5.0						
4.0						
3.0						
2.0						
1.0						
0.0						

VERTICAL SCALE  
1 INCH TO 10 FEET

**GOLDER & ASSOCIATES**

DRAWN G.S.  
CHECKED J.A.



## RECORD OF BOREHOLE 817 + 65 — 15' RT. (31)

LOCATION SEE FIG. 2

BORING DATE MAY 29 1961

DATUM GEODETTIC

BOREHOLE TYPE WASH BORING

BOREHOLE DIAMETER A X

SAMPLER HAMMER WEIGHT — LB. DROP — INCHES

PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE		SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		BLOWS / FT.	SHEAR STRENGTH $C$ , LB. / SQ. FT.	WATER CONTENT, PER CENT	
439.3 5.5 19	GROUND LEVEL			600				WL EL. 597.1 MAY 30 1961
				590				
				580				
				570				
				560				
				550				
				540				
				460				
458.3 141.0				450				
142.8	BANDED GREY AND WHITE LIMESTONE BEDROCK		1 2 3					
446.1								
153.2	END OF HOLE							

VERTICAL SCALE

1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

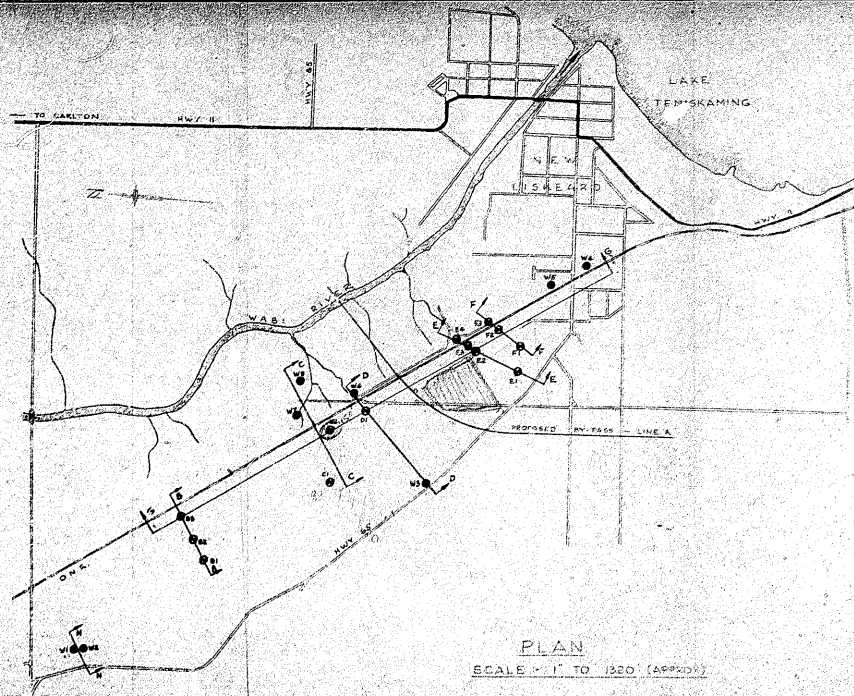
DRAWN G.S.

CHECKED J.A.









ELEVATION IN FEET

700

600

500

400

83

ASSUMED GROUND LEVEL

82

81

SECTION G G

SCALE HORIZONTAL 1" TO 400' (APPROX)  
VERTICAL 1" TO 100'

ELEVATION IN FEET

700

600

500

400

83

82

81

80

ASSUMED GROUND LEVEL

83

82

ASSUMED GROUND LEVEL

SECTION C C

SCALE HORIZONTAL 1" TO 400' (APPROX)  
VERTICAL 1" TO 100'

SECTION D D

SCALE HORIZONTAL 1" TO 400' (APPROX)  
VERTICAL 1" TO 100'



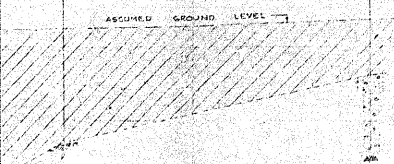
C2 C1 E2 F2 W5 W4 B3 B2 B1



SECTION G G

SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

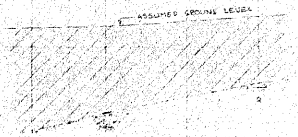
D1 W3



SECTION D D

SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

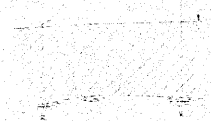
E4 E3 E2 E1



SECTION E E

SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

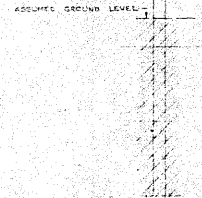
F2 F1



SECTION F F

SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

W1 W2



SECTION H H

SCALE HORIZ. 1" TO 400' (APPROX.)  
VERT. 1" TO 100'

ELEVATION IN FEET  
700  
600  
500  
400

LEGEND

- ◆ BOREHOLE
- WELL — PLAN
- BOREHOLE — ELEVATION
- WELL — ELEVATION

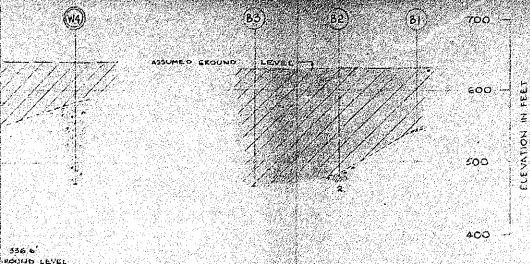
STRATIGRAPHY

- CLAY
- SILT, SAND AND GRAVEL
- BEDROCK (FELSIC)
- REFUSAL — AS SHOWN

REFERENCE

DRWG. No.	DESCRIPTION
—	DEPARTMENT OF LANDS AND FORESTS AIR PHOTOS NOS 53-47E/20-162 AND 59-47E/20-85



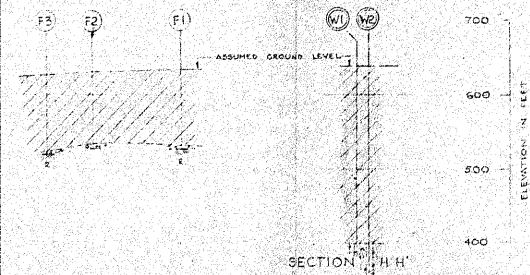


SECTION B-B

SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

### LEGEND

- ◆ BOREHOLE — PLAN
- WELL — PLAN
- BOREHOLE — ELEVATION
- WELL — ELEVATION

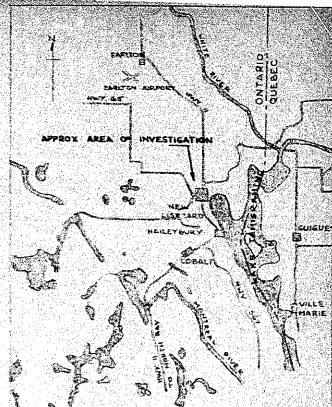


SECTION F-F

SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

### STRATIGRAPHY

- CLAY
- SILT, SAND AND GRAVEL
- BEDROCK (FROM WELL INFORMATION)
- REFUSAL — ASSUMED BEDROCK



KEY MAP  
SCALE: 1" TO 5 MILES

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

SECTION F-F  
SCALE HORIZONTAL 1" TO 400' (APPROX.)  
VERTICAL 1" TO 100'

REFERENCE	
DRWG. No.	DESCRIPTION
—	DEPARTMENT OF LANDS AND FORESTS AIR PHOTOS Nos 53-4721/20-162 AND 59-4726/20-85

DEPARTMENT OF HIGHWAYS, ONTARIO  
TORONTO  
PROPOSED TRITON BYPASS  
HIGHWAY IN NEW LESTER, ONTARIO  
BORING PLAN AND SOIL STRATIGRAPHY  
RECONNAISSANCE SURVEY

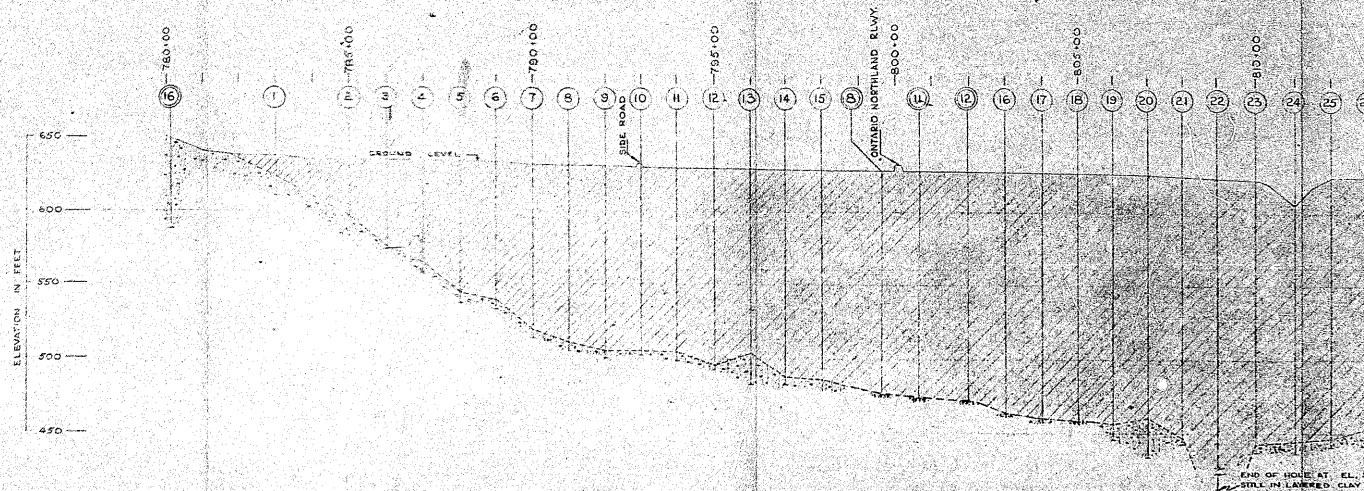
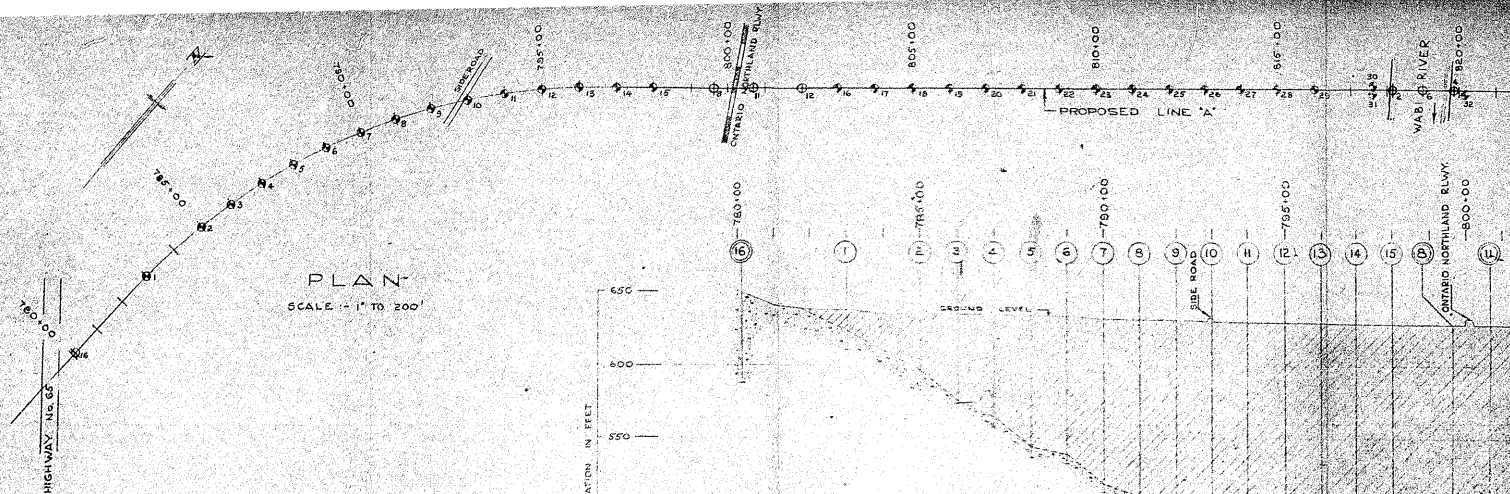
**GOLDER & ASSOCIATES**  
CONSULTING CIVIL ENGINEERS

DATE JULY 21, 1961 SCALE AS INDICATED

MADE BY G.W. CHKD BY J.A. APPD BY J.S.

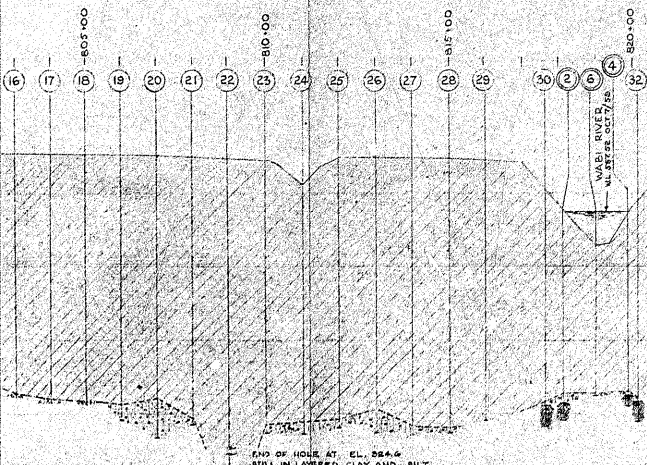
FIGURE 1





SCALE: HORIZONTAL 1" TO 200'  
VERTICAL 1" TO 50'





PROPOSED LINE 'A' CROSSING

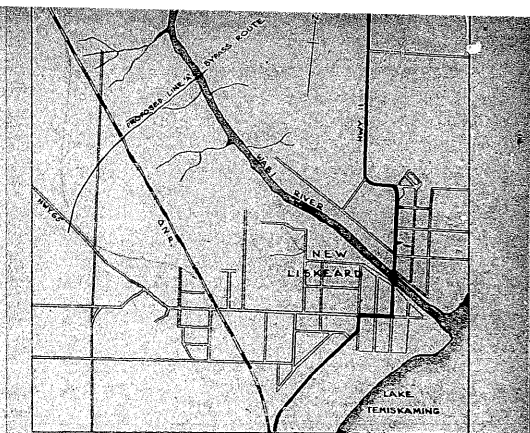
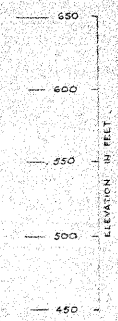
TO 200'  
TO 30'

### LEGEND

- ✦ BOREHOLE IN PLAN - GOLDER AND ASSOCIATES
- ⊕ BOREHOLE IN PLAN - PREVIOUS INVESTIGATION
- BOREHOLE IN ELEVATION - GOLDER AND ASSOCIATES
- ⊙ BOREHOLE IN ELEVATION - PREVIOUS INVESTIGATION

### STRATIGRAPHY

- FIRM TO STIFF GREY LAYERED CLAY AND SILT
- DENSE TO VERY DENSE GREY SILTY SAND WITH GRAVEL
- GREY LIMESTONE BEDROCK



KEY PLAN  
SCALE 1" = 1320' (APPROX)

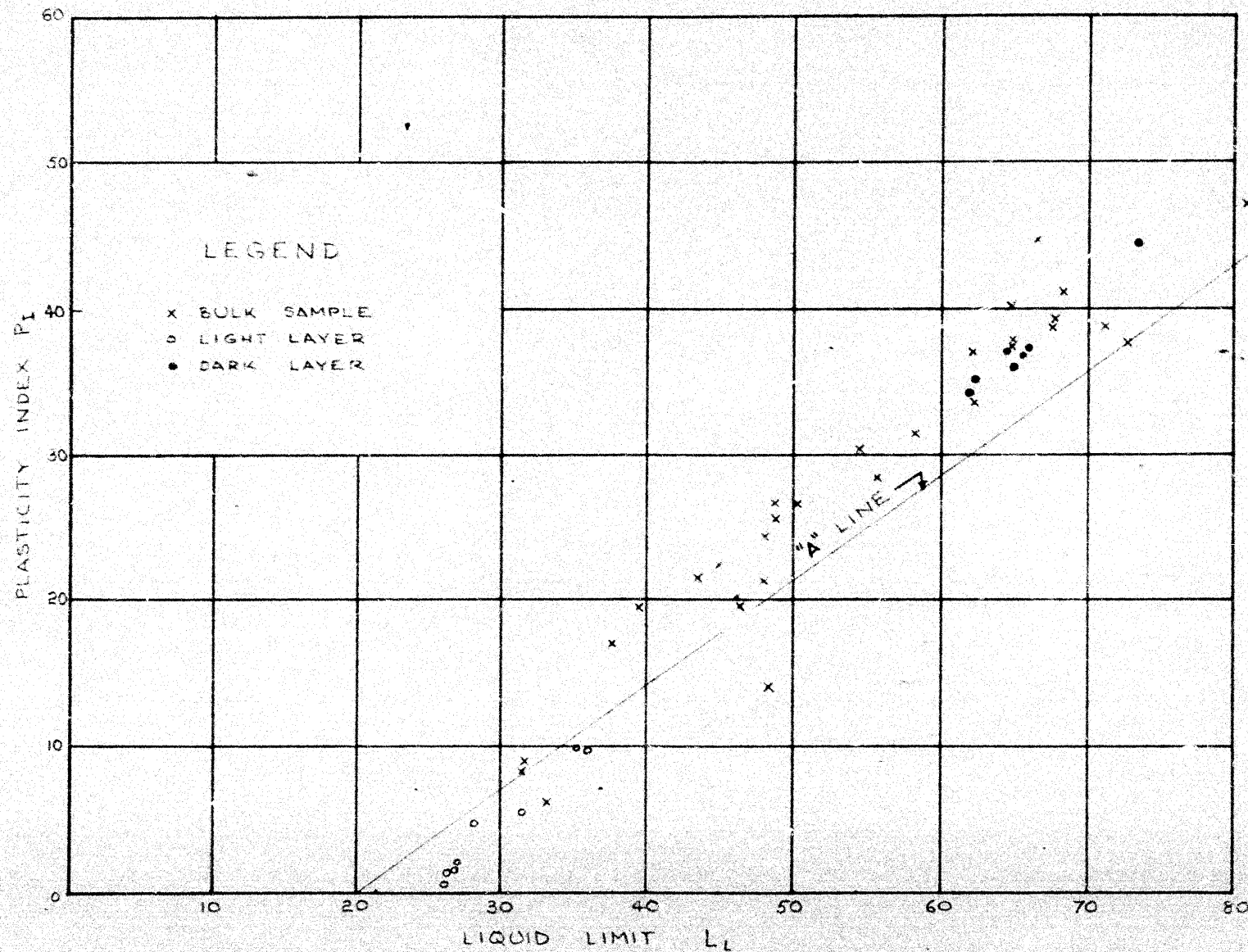
SPECIAL NOTE: DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT BOREHOLE LOCATIONS. HOWEVER, THE TRUE STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SOILS DATA FROM THAT QUOTED.

REFERENCE		DEPARTMENT OF HIGHWAYS, ONTARIO TORONTO	GOLDER & ASSOCIATES CONSULTING CIVIL ENGINEERS
DRWG. No.	DESCRIPTION		
	DEPARTMENT OF LANDS AND FORESTS AIR PHOTOS No's 52-4721/20-162 53-4720/20-85	PROPOSED TRI-TOWN BYPASS LINE 'A' ROUTE HIGHWAY 11 NEW LISKEARD, ONTARIO	DATE: AUG/56/ SCALE AS INDICATED



## PLASTICITY CHART

FIGURE 3

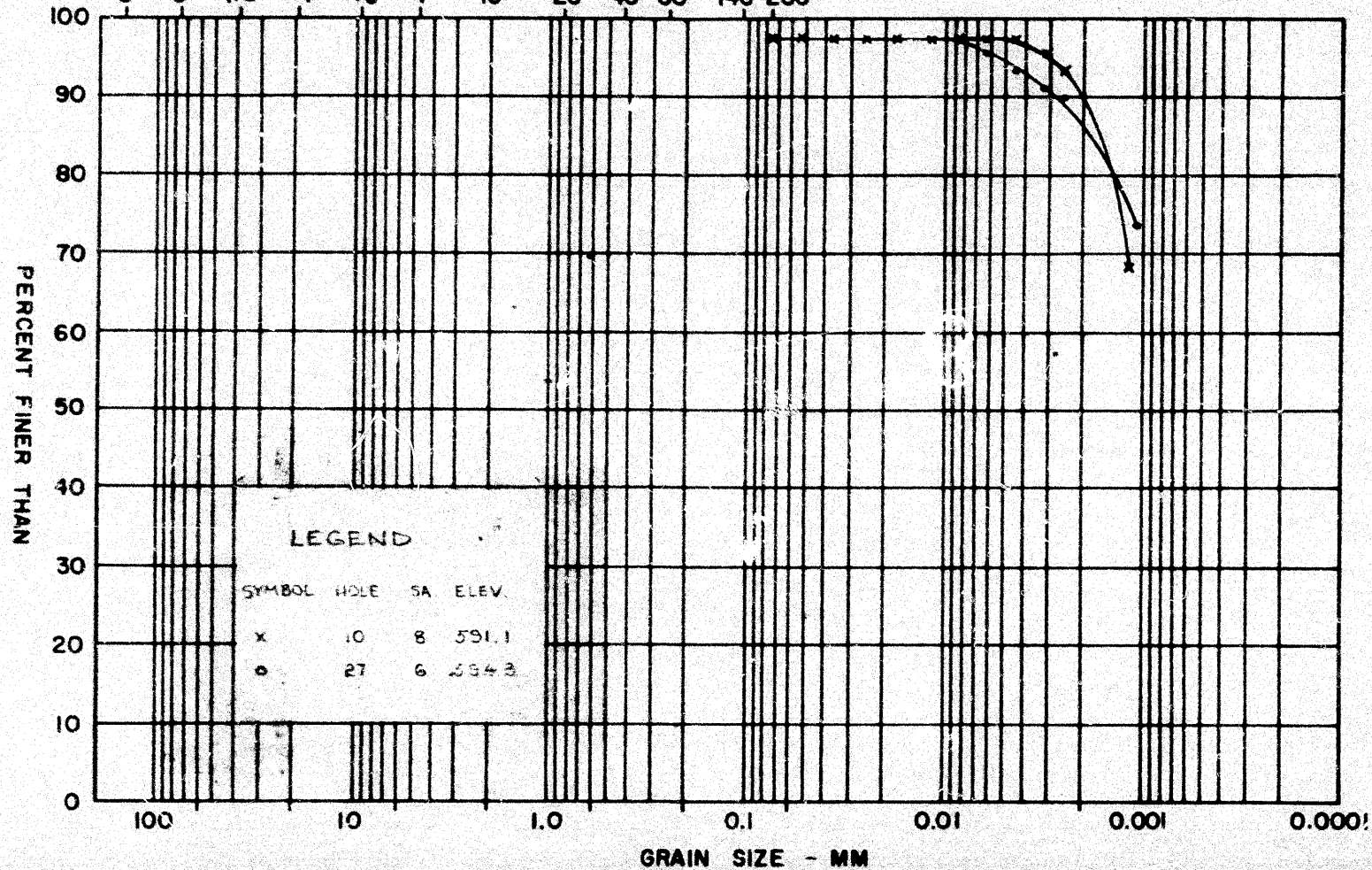




M.I.T. GRAIN SIZE SCALE

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

6" 3" 1 1/2" 3/4" 3/8" 4 10 20 40 60 140 200



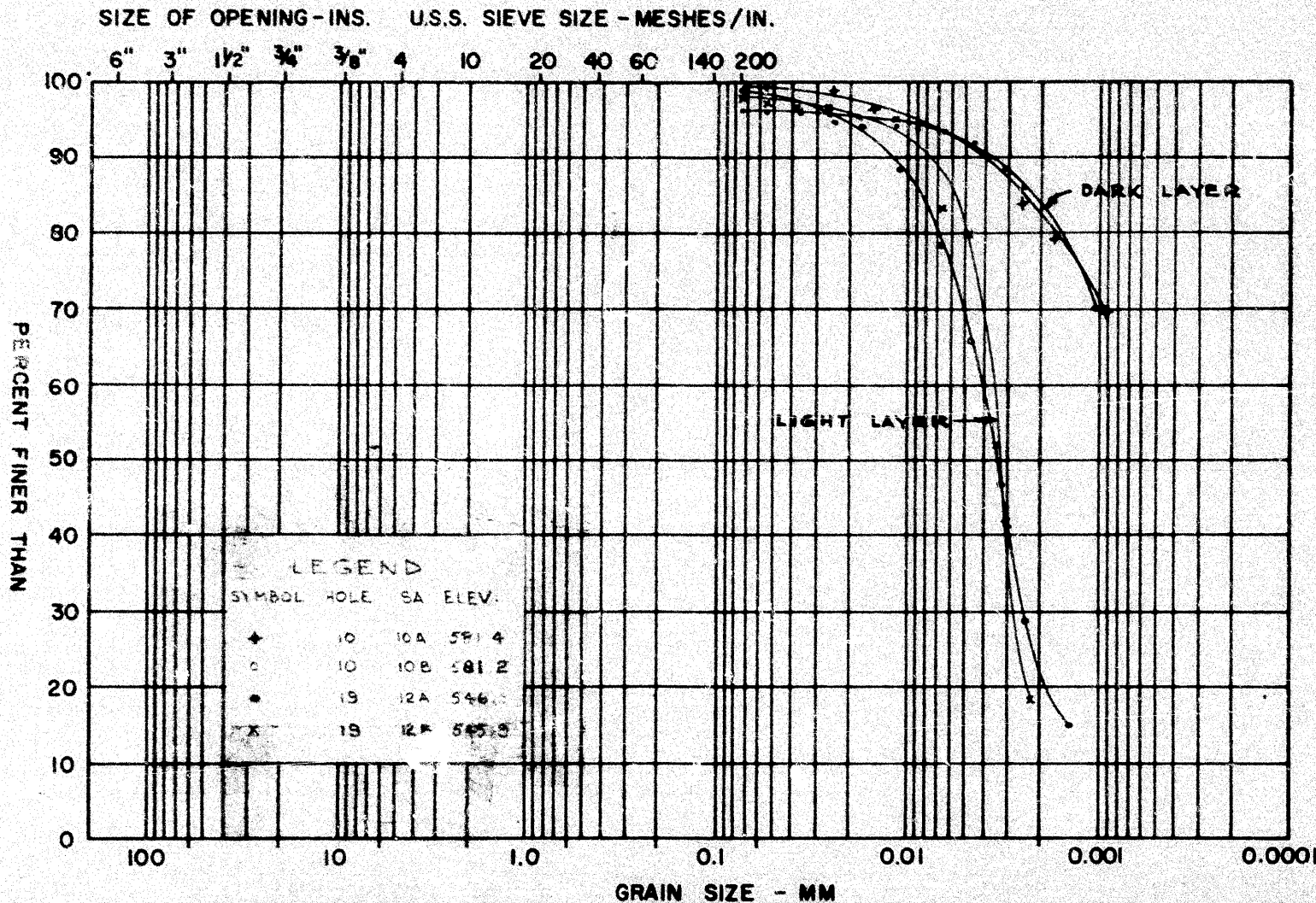
GOLDER & ASSOCIATES

GRAIN SIZE DISTRIBUTION  
BULK SAMPLES

FIGURE 4



M.I.T. GRAIN SIZE SCALE



GOLDER & ASSOCIATES

GRAIN SIZE DISTRIBUTION  
LIGHT AND DARK LAYERS

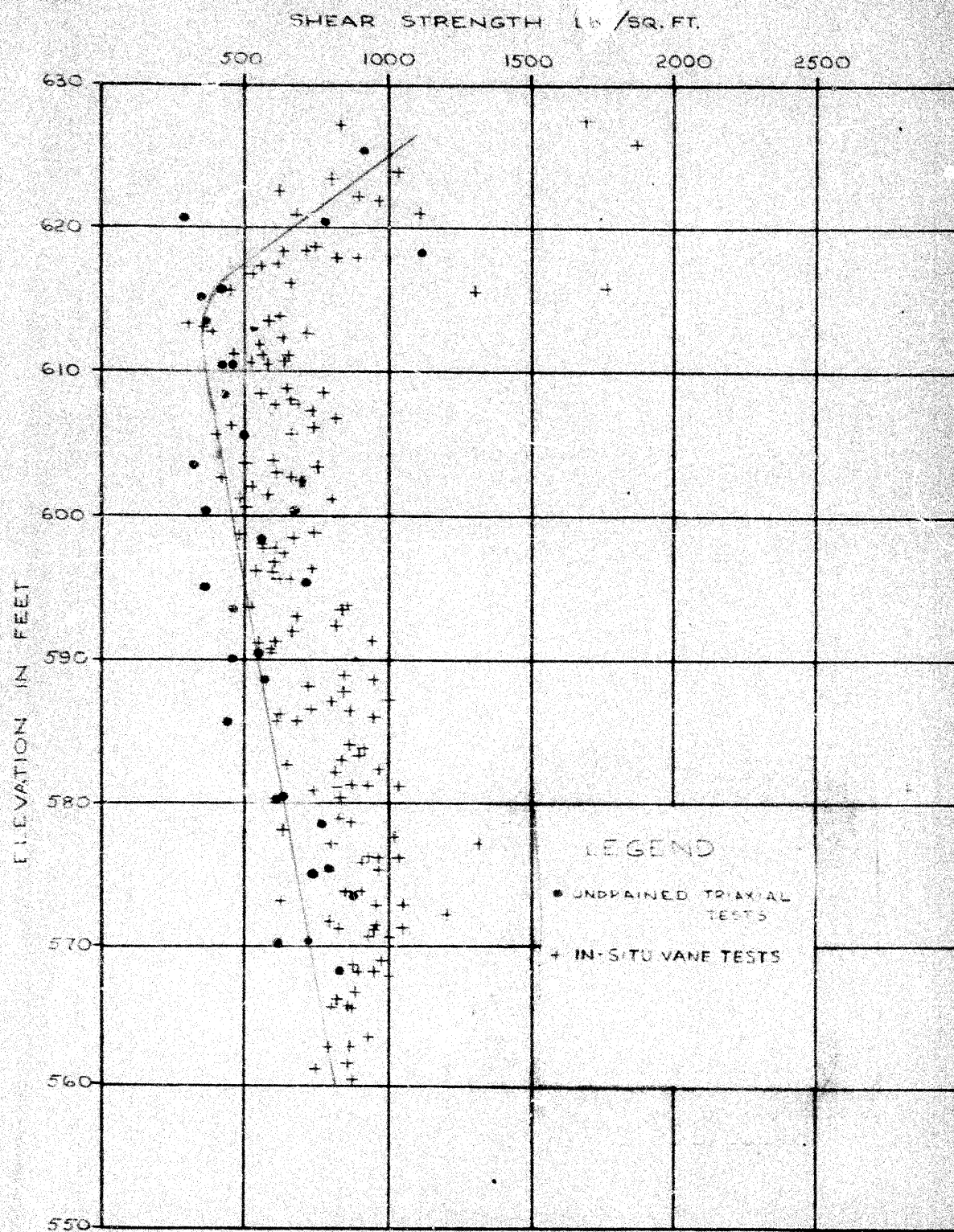
FIGURE 5

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



SHEAR STRENGTH VS. ELEVATION  
LAYERED CLAY & SILT

FIGURE 6



GOLDER & ASSOCIATES



# UNDRAINED TRIAXIAL COMPRESSION TESTS TYPICAL STRESS-STRAIN CURVES

FIGURE 7

