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Department of Public Works
John A. Volpe, Commissioner

U. S. Department of the Interior
Geological Survey
W. E. Wrather, Director

Cooperative Geologic Project

File Report

Geologic Reconnaissance in Longmeadow and East Longmeadow, Massachusetts, with special reference to the relocation of Route 5 in Longmeadow

by

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Geologist, U. S. Geological Survey

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with attachments

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General Statement

This investigation was undertaken to determine the geology along the proposed relocation of Route 5 in Longmeadow, and to outline areas that might yield granular materials suitable for highway construction purposes.

Two problems were involved in the study. In view of the fact that varved clays crop out along the scarp at the South End Bridge in Springfield, a tentative relocation of Route 5 along the base or slope of the scarp facing the Connecticut River seemed unwise; the first problem, therefore, was to locate the surface of the varved clays in the town of Longmeadow. The second problem was to find suitable quantities of construction sand and gravel near the proposed highway. Inasmuch as the area is underlain mostly by sand and clay, this involved a reconnaissance study of the surrounding area to delineate sources of possible "borrow" material.

A reconnaissance geologic map on a scale of two inches to one mile was prepared and is included as a part of this report (plate I, surficial geologic map of Longmeadow and East Longmeadow, Massachusetts, and adjacent parts of Connecticut).

The work was done in portions of May and June, 1954, as a part of a cooperative program of the Massachusetts Department of Public Works and the United States Department of the Interior, Geological Survey. The soils

Laboratory of the Department of Public Works, represented by Mr. C. Giacobbe, gave much time and assistance in making soil analyses and ~~in helping to operate the power auger.~~ field work,

Location

The area examined for this report includes all of the towns of Longmeadow and East Longmeadow, Massachusetts, and parts of Enfield and Somers, Connecticut. These towns are shown on the Springfield South and Hampden 7½-minute quadrangle maps of the U. S. Geological Survey.

Geology

The areal distribution of surficial geologic units is shown on the accompanying map (plate I); the distinction between units is marked both by letter symbol and by color.

The surficial deposits are of several general types. Till is widespread in the eastern half of the area and forms a continuous cover over the bedrock. The till is a heterogeneous, unconsolidated deposit of materials ranging from boulder to clay sizes, and is easy to excavate with power tools. Red sediments derived from the Triassic bedrock formations of the Connecticut Valley are mixed with materials from igneous and metamorphic rocks of the nearby uplands, so that the till has a distinctly red to reddish brown color.

Gravel deposits are rare in the area and are generally mixed in varying degree with sand. One short esker segment (e) contains tremendous boulders in addition to sand and gravel. Three kame terraces (kt), inferred to be of dominant gravel with sand, are found in the area; the largest is occupied by the Osborn Prison Farm. Outwash deposits that extend from Wilbraham southward contain lenses of sand and gravel in the northeastern part

of the map area; however, the gravel content diminishes toward the south until finally gravel becomes uncommon in the outwash. The largest landform known to contain gravel is found south of the Connecticut line near North Thompsonville; here a kame delta (kd) nearly one mile long and three-tenths of a mile wide has topset beds over 10' thick in places composed of gravel with subordinate amounts of sand, and easterly dipping foreset beds composed of sand and smaller amounts of gravel.

Deposits primarily composed of sand are more common and include a great deal of the outwash (ow_1) and the entire surface of the Longmeadow delta plain (d). Part of the sand on the delta surface is derived from streams which once flowed over it, but a great deal of the sand is of wind-blown origin. This wind-blown sand occurs either as long, narrow dunes and rounded hillocks, or as a thick surface accumulation of irregular hills and hollows which have no regular form.

Finer-grained deposits which include silt and very fine sand, and hence are generally unsuitable for highway purposes, are shown as river terrace (rt) deposits and as modern flood-plain deposits or alluvium (al). Swamps, of course, are useless as a source of construction materials, but must be investigated because of their unsuitability as a subgrade.

Possible sources of sand and gravel

Sources of granular material suitable for highway construction purposes are shown on the accompanying map by groups of colors; the discrimination between granular textures is based on the dominance of till, gravel, or sand in the various landforms. No attempt is made to discriminate the materials on the basis of adaptability for various uses or as to suitability

for base-course material, select "borrow," or type of compaction necessary. The map thus is a guide to localities where further more detailed investigations on composition and quantity of material can be carried out by the local materials and soils engineers.

The ground moraine or till may be of value as ordinary "borrow"; the grain-size distribution or grading differs from place to place, but in general the amount that passes a 200-mesh sieve will be rather high because of the fine-grained character of much of the Triassic sandstones and shales from which the till has been derived. A sample from a pit in the red till just north of the Connecticut state line on Shaker Road shows about 45% silt and clay sizes (Figure 1).

Deposits of coarse-grained material are rare west of the till-covered hills (gm, eastern half of the mapped area) but the kame delta (kd) a short distance south of the Connecticut line and northwest of Brainard Road contains gravel and sand topset beds over 10' thick in places, foreset beds of sand and subordinate gravel, and bottomset beds of medium to fine sand and silt. This is the only source area which shows promise of very large quantities of fill material and of sand and gravel for clean base course material in addition to being within a mile and a half of the southern end of the relocation.

The numerous sand dunes (sd) are good sources of fine-grained granular material, only 3 to 5% of which passes the 200-mesh sieve. It is clean and well-sorted (very few grade sizes--see Figures 2 and 3), and occurs as long, high ridges which can be worked with an operating face of 20' or more. These ridges occur mostly in the town of Longmeadow and make up an immense reservoir of sand for construction purposes.

Most of the other mapped sources of sand and gravel are unsuitable for one or more reasons--distance from the highway site, variability in quantity and grain size, or presence of appreciable quantities of silt and clay sizes.

Relocation of Route 5

From a general knowledge of the regional geology, proposed alternate centerlines for the relocation of Route 5 from the Longmeadow town line south to the Connecticut border seemed likely to involve cuts in the varved clay along the front of the scarp facing the Connecticut River. Exploration with a jeep auger ~~A drilling program with the Geological Survey jeep auger~~ was undertaken to determine the distribution of, and depths to, the clays within the area of the proposed sites. The drill holes are marked and numbered on the accompanying map (Plate I). In brief, holes 2, 3, 4, 5, and 6 showed that the clays known to underlie much of the deltal plain (d), do not extend to the front of the scarp in the Longmeadow area, but that material ranging from medium sand to silty medium-fine sand underlie the edge of the terrace (cross-section B-B', Plate I, and Figure 4). The topography of the area shows that the early post-glacial Connecticut River must have eroded the clays away and in these places, refilled the area with river sands which have since been cut to form a high terrace (rt). Hence in this area no varved clays will be reached in cuts along the face of the scarp. South of this area (rt), however, where the deltal plain reaches to the edge of the scarp, it seems likely that varved clay will be found on the frontal slope, but the built-up area prevented an adequate drilling program; the frontal slope is covered also with sand to such an extent that no clay was seen. It is a safe inference, however, that clay is present, as shown by [redacted] hole 12 which reached varved clay

(cross-section A-A', map and Figure 4). Hole 10 shows that clay is absent at least to a depth of 42' below the surface, or 89' above sea level; holes 1, 8, and 9 were on the modern flood plain of the Connecticut River and show that the underlying materials are fine sand to silty fine sand, with varved clay at depths of 33' and more below the surface.

Table I shows the logs for the series of 12 holes. Soil analyses of the materials in the holes are contained in Appendix A (envelope), together with a series of cross sections prepared by C. Giacobbe.

Summary

In brief, gravel and sand for base-course material can be found in the kame delta (kd) in Connecticut, and sand can be found in the numerous sand dunes (sd). Till useful for ordinary "borrow" material may be found along the western border of the ground moraine area (gm), provided that analyses do not show too great a percentage of silt and clay; several open pits are shown on the map.

Relocation of the highway will involve no trouble with varved clay north of Birnie Road. From Birnie Road south to Meadow Road clay is most likely to be found within the escarpment facing the river. Where the proposed road ascends the escarpment at the southern terminus a drill hole shows clay to be absent at least to altitude 89' above sea level.

TABLE I

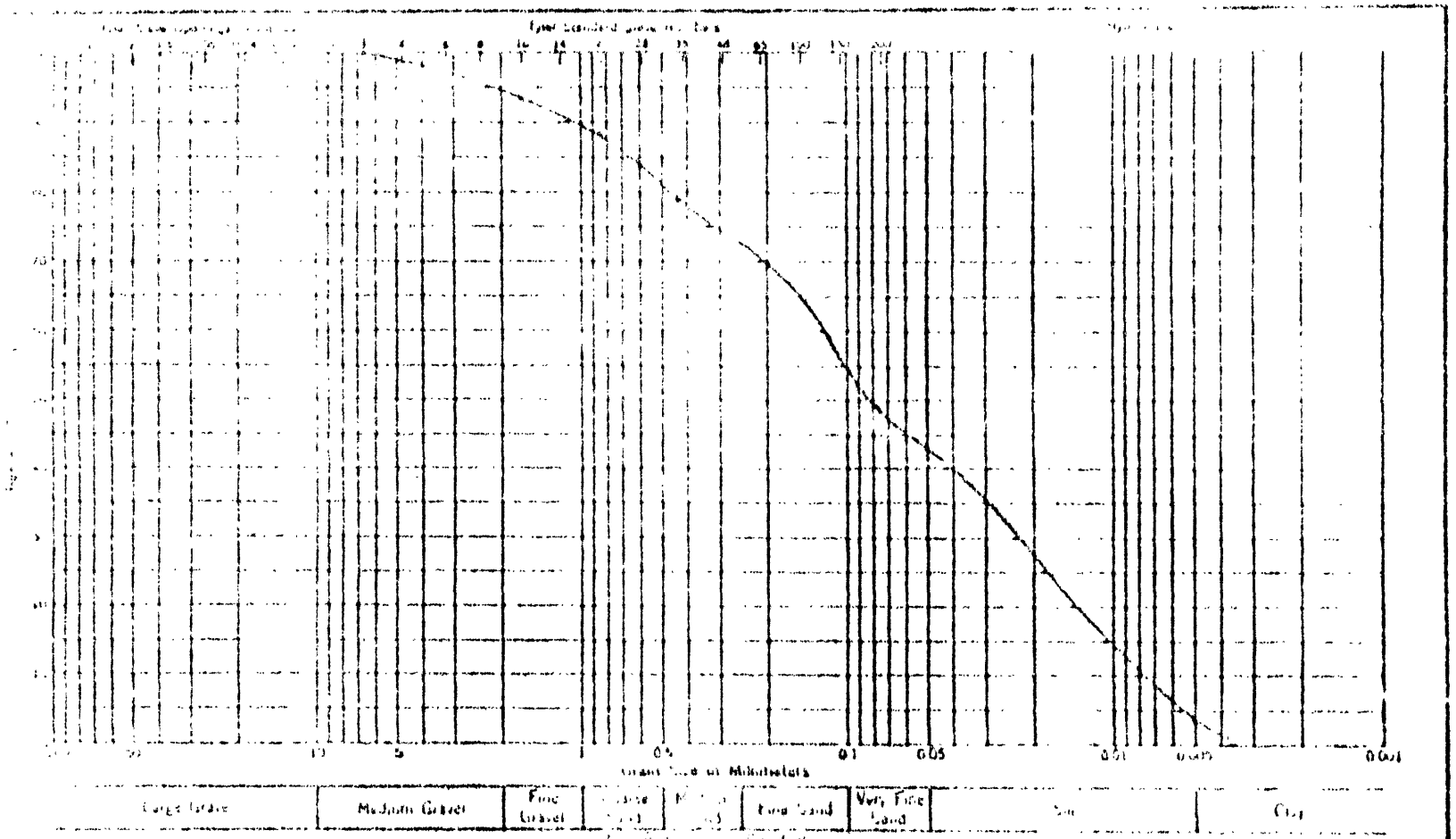
Drill logs in Springfield South quadrangle, Massachusetts

Drill hole number	Depth	Description of materials	Sample
SS1		On the floodplain; altitude 52'.	
	0-5'	Silty fine sand; dry; includes plant remains.	
	5-30'	Silty fine sand; moist;	SS1-1.
	30-33'	Coarse to very coarse grey sand; free water;	SS1-2.
	33-48'	Clay/silt; varves?; grey to pinkish; wetter than plastic limit;	SS1-3.
SS2	0-50'	On river terrace; altitude 118' Medium sand; clean; light brown.	
SS3		King Phillip's Stockade; altitude 110'	
	0-21'	Medium to fine sand; brown;	SS3-1.
	21-38'	Dirty, silty medium to fine sand; wet;	SS3-2.
SS4		King Phillip's Stockade, south end; altitude 125'	
	0-26'	Medium to fine sand; light brown; moist;	SS4-1.
	26-31'	Silty fine to medium sand; reddish-brown; moist;	SS4-2,-3.
SS5		Halfway down front of scarp; altitude 91'	
	0-18'	Medium sand; light brown; moist;	SS5-1.
	18-27'	Dirty, silty medium sand; dark;	SS5-2.
	27-37'	Silty medium sand; dark;	SS5-3.
SS6		Base of scarp; altitude 67'	
	0-13'	Medium sand; light brown;	SS6-1.
	13-27'	Silty medium to fine sand; dark brown;	SS6-2.
	27-42'	Fine sandy silt; grey;	SS6-3.
	42+	Trace of varved clay on auger bit?	
SS7		Base of scarp on Birnie Road; altitude 63'	
	0-4'	Medium sand (fill).	
	4-38'	Fine silty sand;	SS7-1.
	38'+	Some silt and clay mixed;	SS7-2.
SS8		On the floodplain, Birnie Road; altitude 50'+	
	0-33'	Silty fine sand; wet and scupy;	SS8-1.
	33-37'	Clean medium sand; grey;	SS8-2.
	37-47'	Varved (?) clays; pink; brought up on auger flights;	SS8-3.
SS9		On the floodplain; Meadowbrook Road; altitude 60'	
	0-23'	Fine sandy silt; grey;	SS9-1
	23-48'	Medium to coarse sand; grey; chunks of wood(?);	SS9-2.

TABLE I (contd.)

Drill hole number	Depth	Description of materials	Sample
SS10		At front edge of scarp near Connecticut line; alt. 137'	
	0-15'	Medium to fine sand; brown; damp;	SS10-1.
	15-48'	Fine sandy silt; very wet;	SS10-2.
SS11		Connecticut Line and Terry Road; altitude 168'	
	0-26'	Medium to fine sand; brown; damp;	SS11-1.
	26-38'	Silty sand; reddish brown; very wet;	SS11-2.
	38-48'	Fine silty sand; grey; very wet;	SS11-3.
SS12		On slope of gully in Bark Haul Road; altitude 77'	
	0-8'	Medium sand; brown;	SS12-1.
	8-20'	Varved clay; grey with some reddish fine sandy layers;	SS12-2.

COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS



Sample # S.C. 111
Lab. # 4-6178

Figure 1

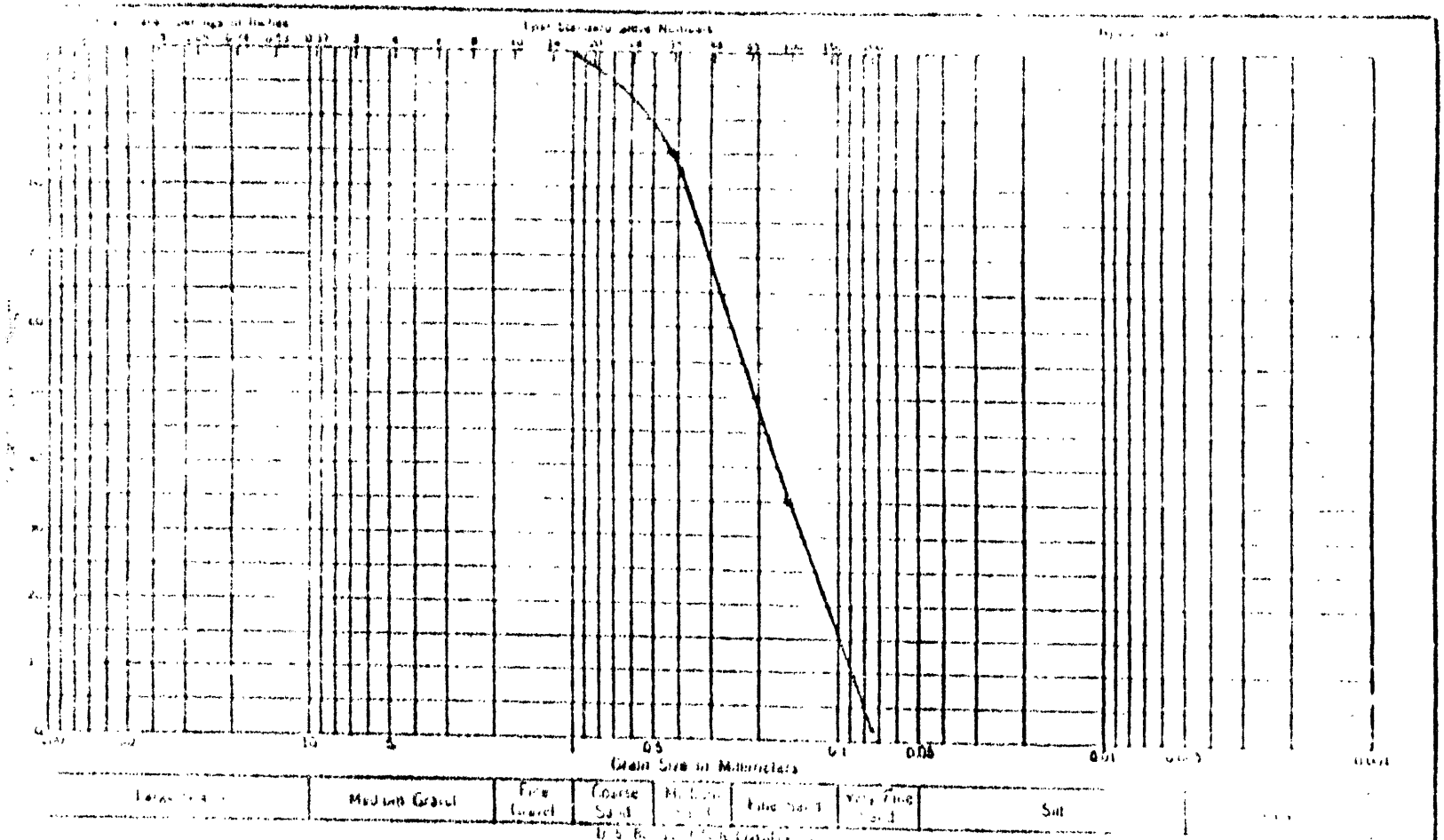


Figure 2.

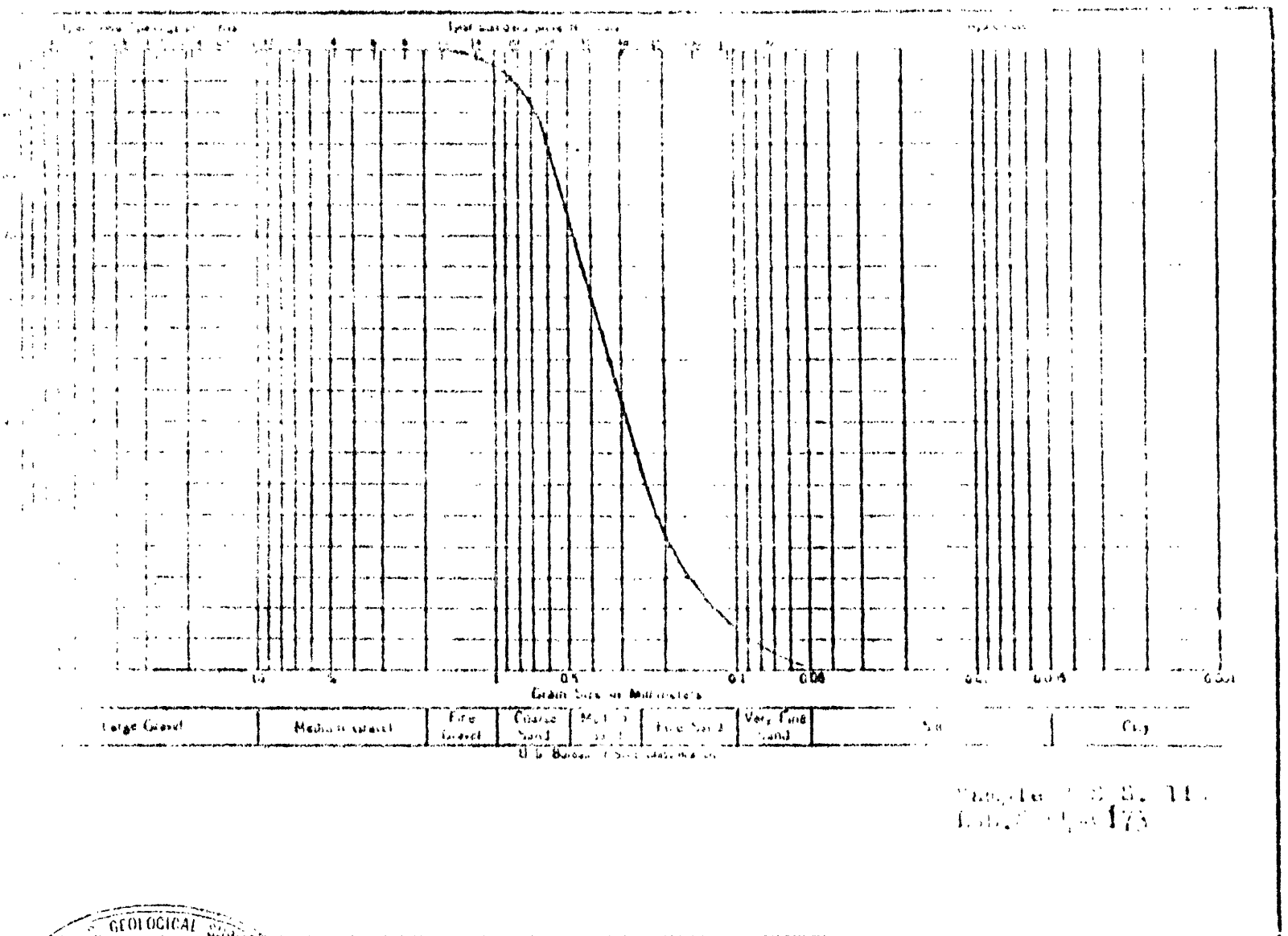
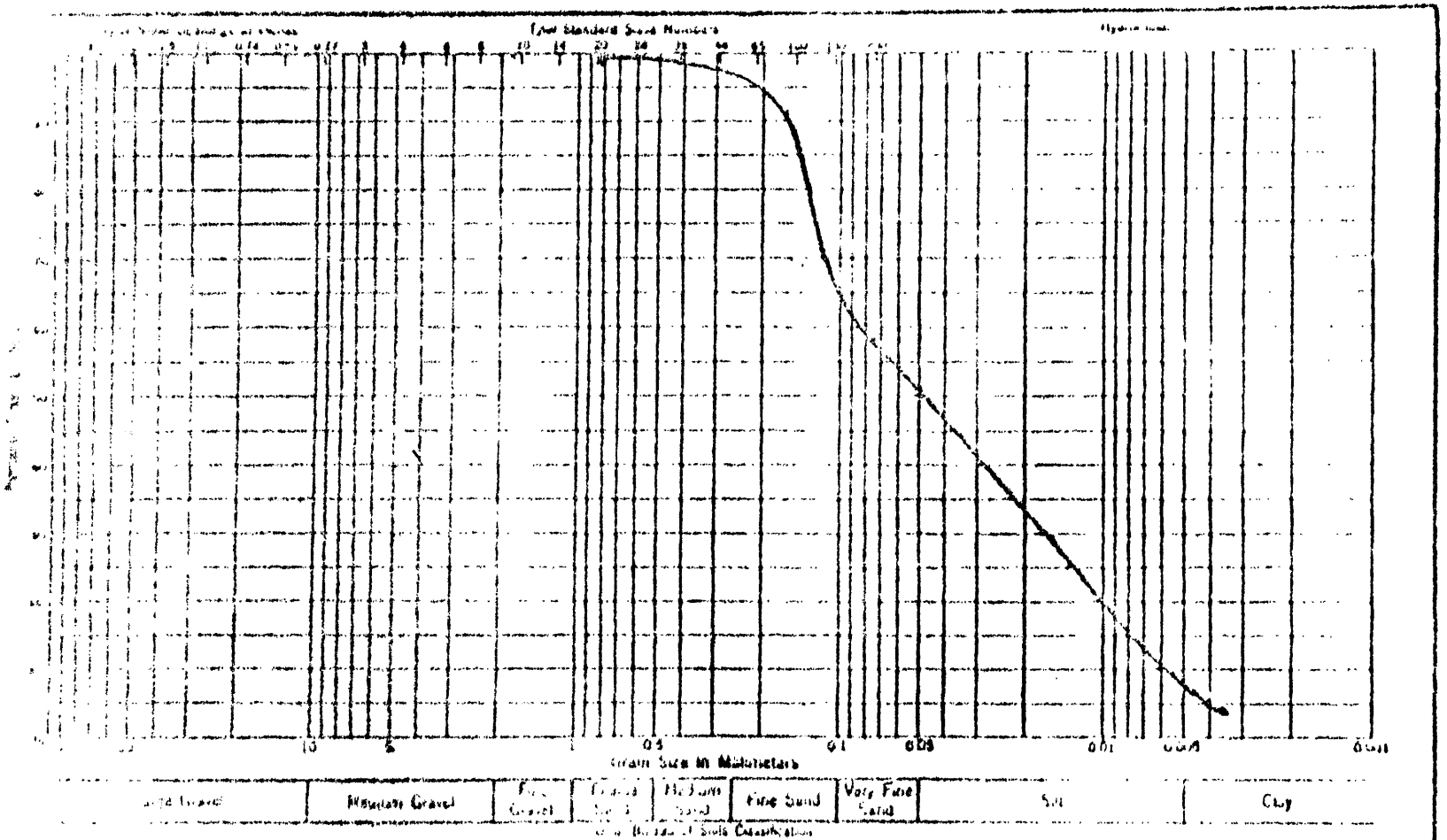


Figure 2.

COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS STATE HIGHWAY LABORATORY



Hole # S.S - 1

Sample # S.S - 1 - 1

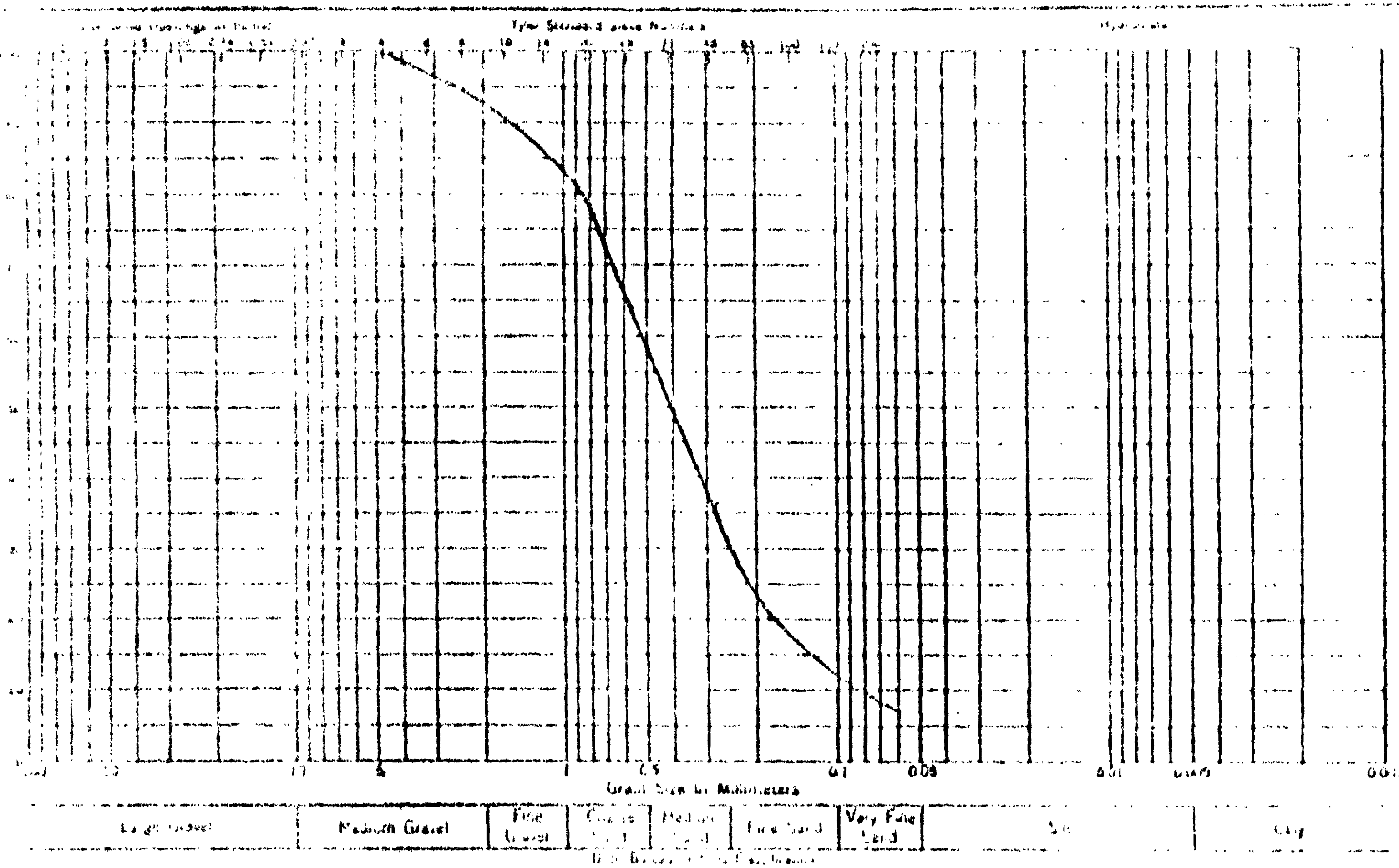
Lab. # - [illegible] - 61.0

[illegible] 19 1956

[illegible]

[illegible] OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS STATE HIGHWAY LABORATORY

Lab. 511 P.W.H. 653



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Sample # [illegible] - 1 - 2

Lab. # - [illegible] - 0121

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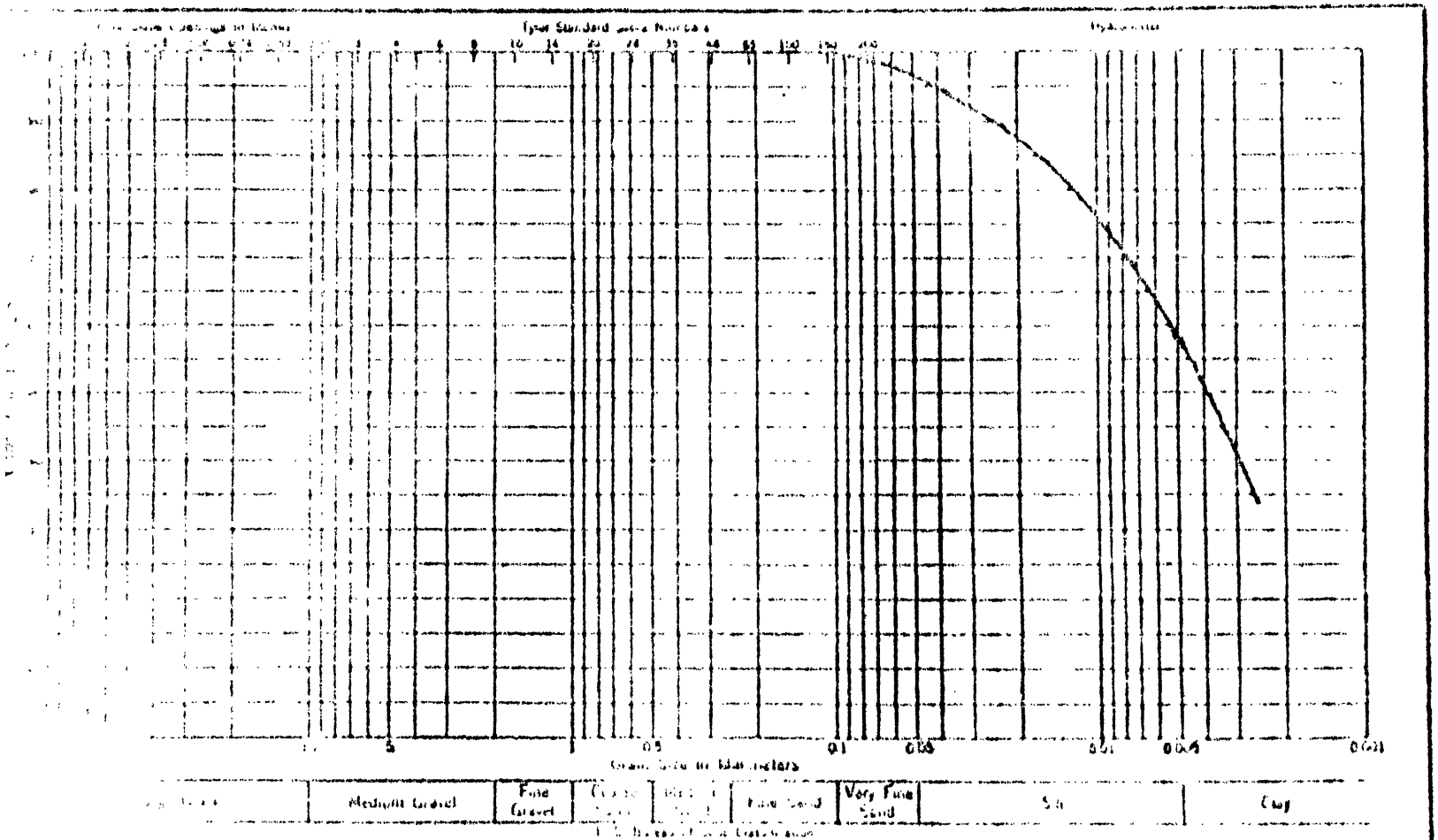
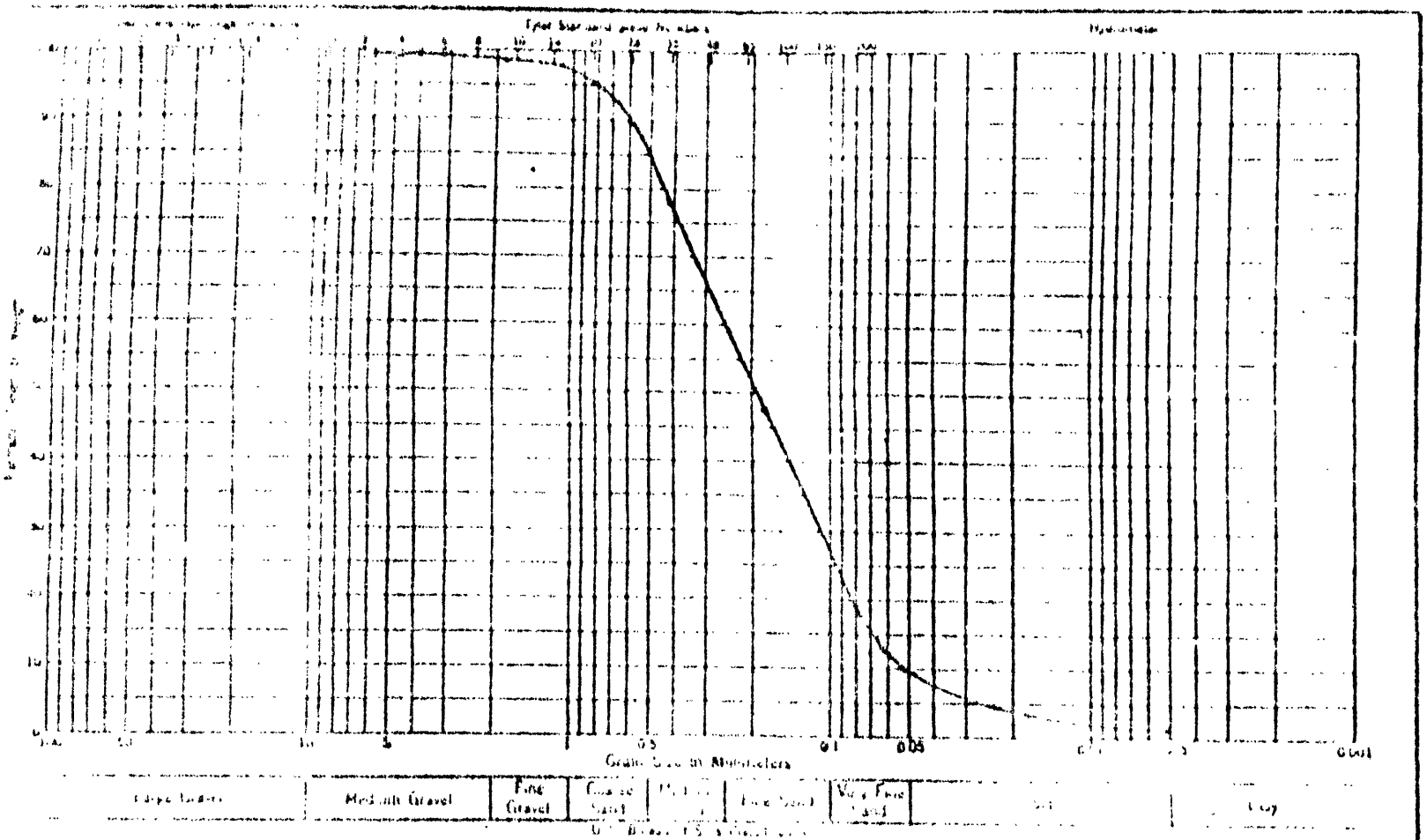


Hole # SS - 1

Sample - SS - 1 - 3

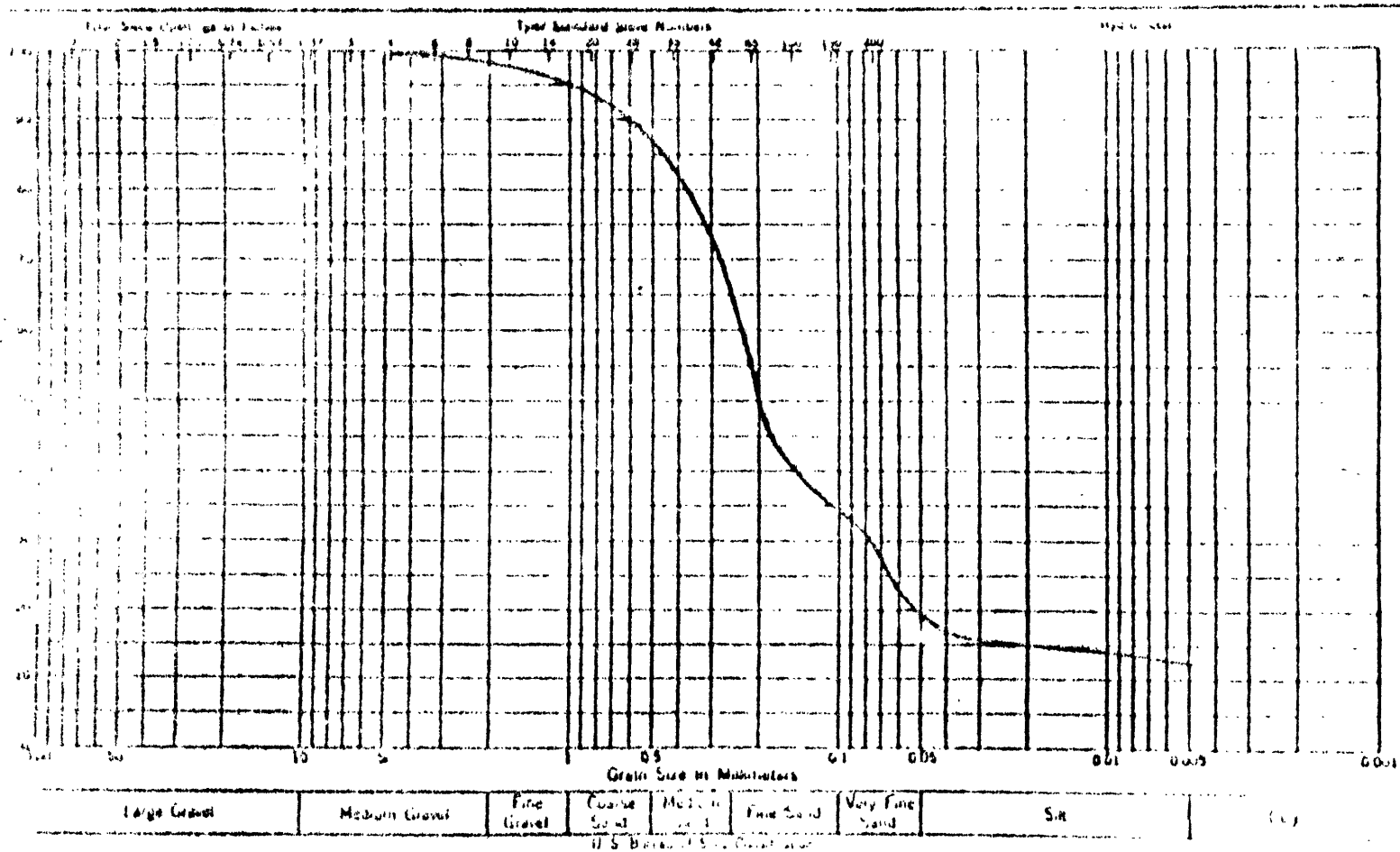
Lab. # - GL - 0122



Hole #

Sample #

Lab. # —



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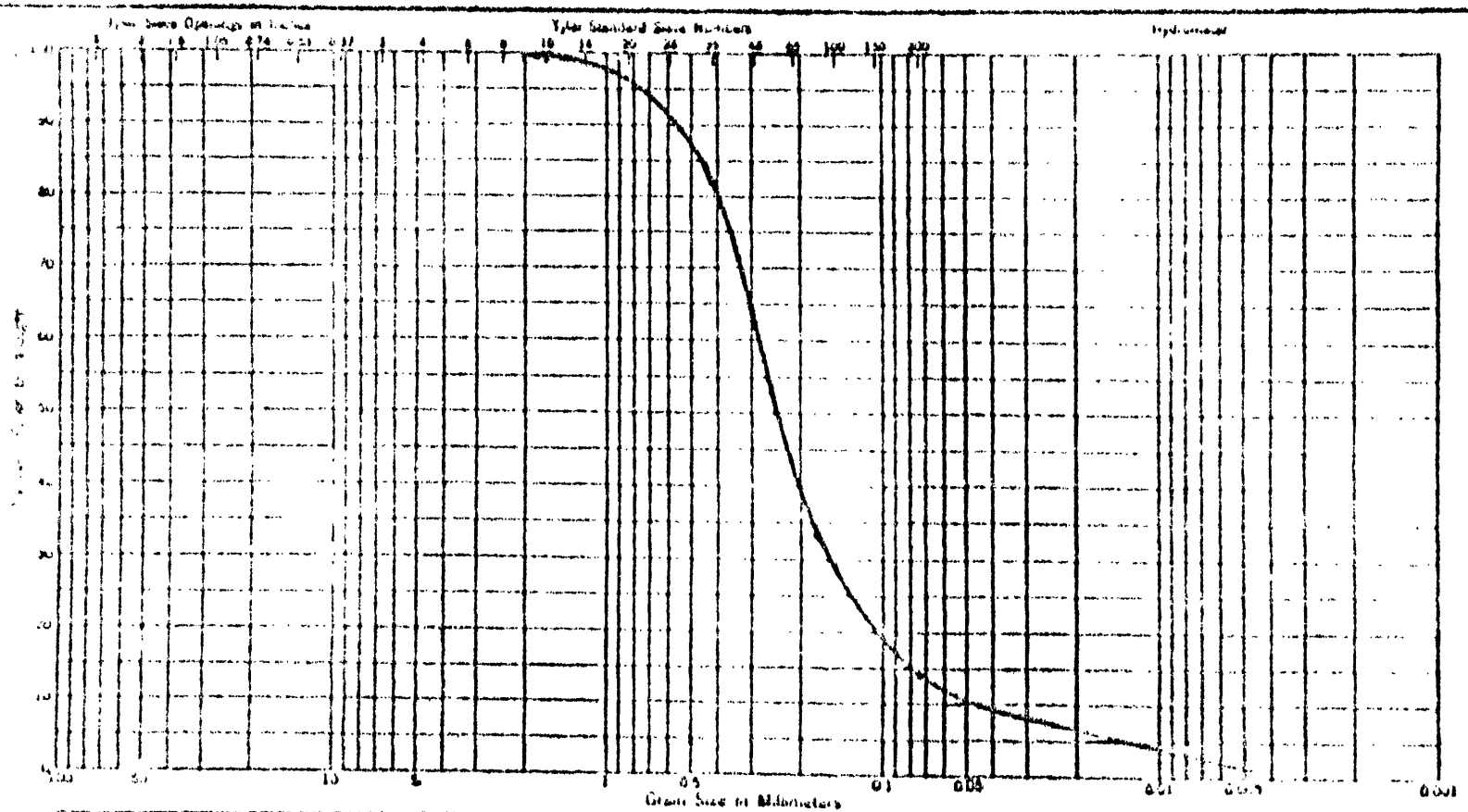

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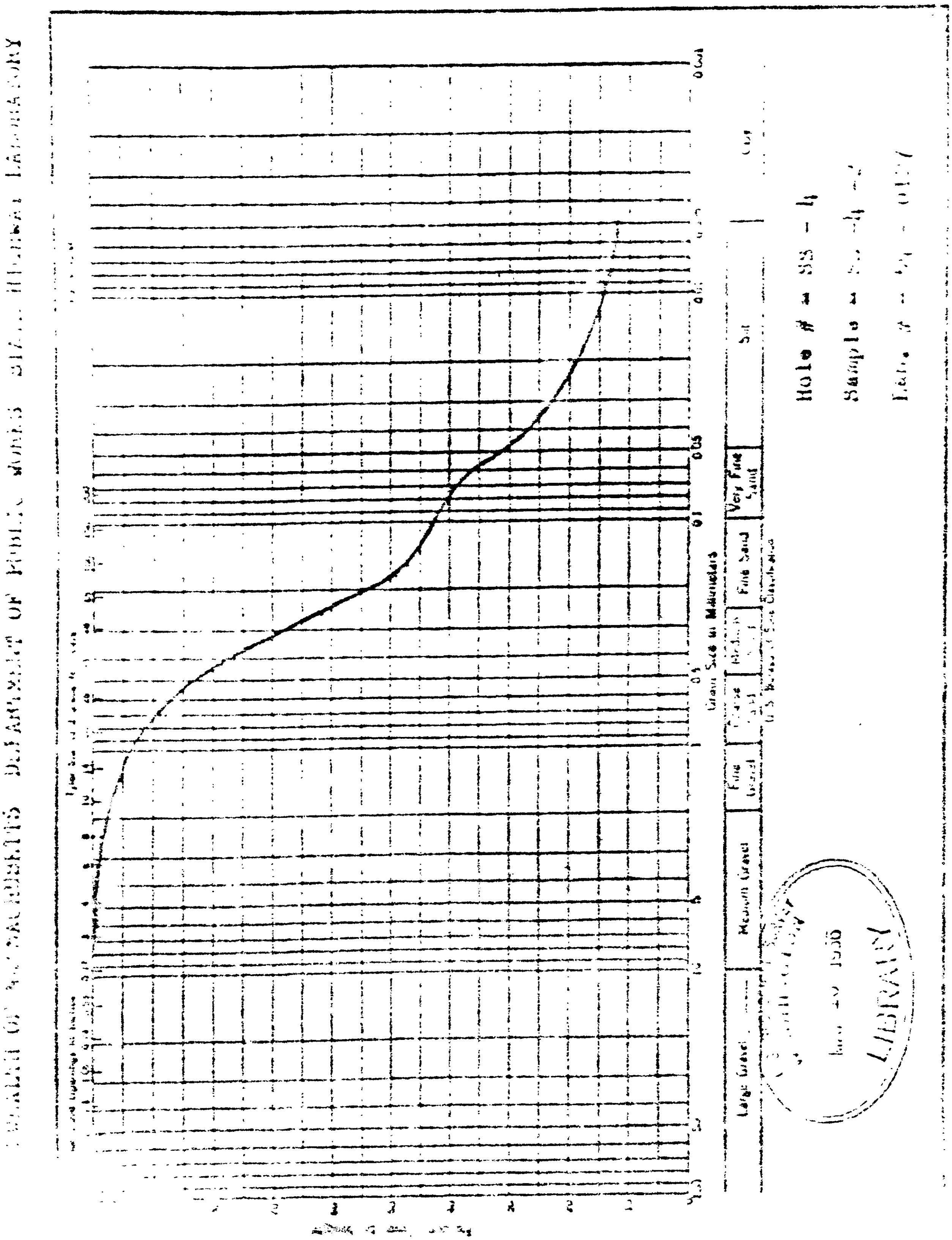

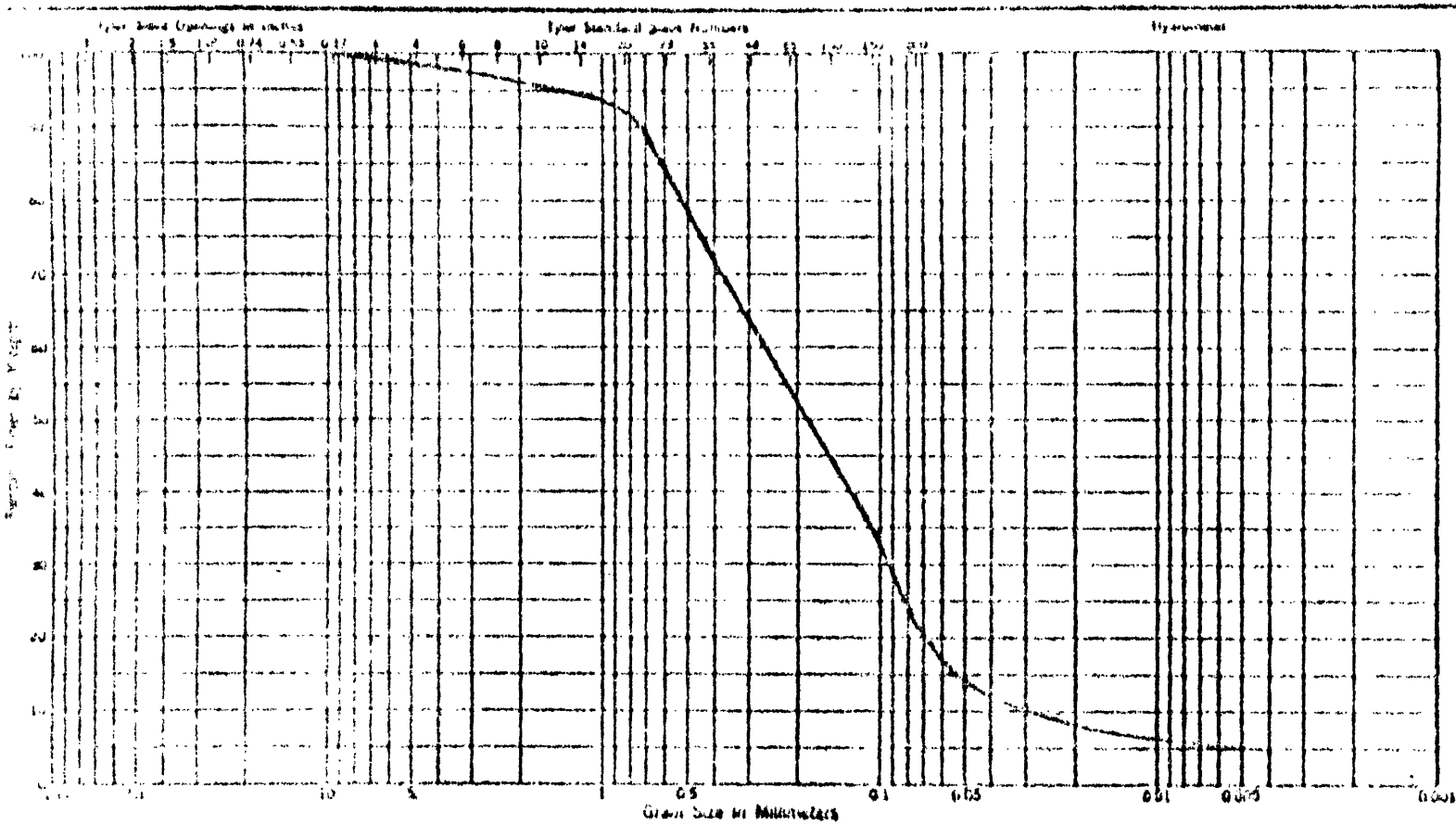

Hole # - 88 - 4

Sample - 88 - 4 - 3

Lab. # - 54 - 0178

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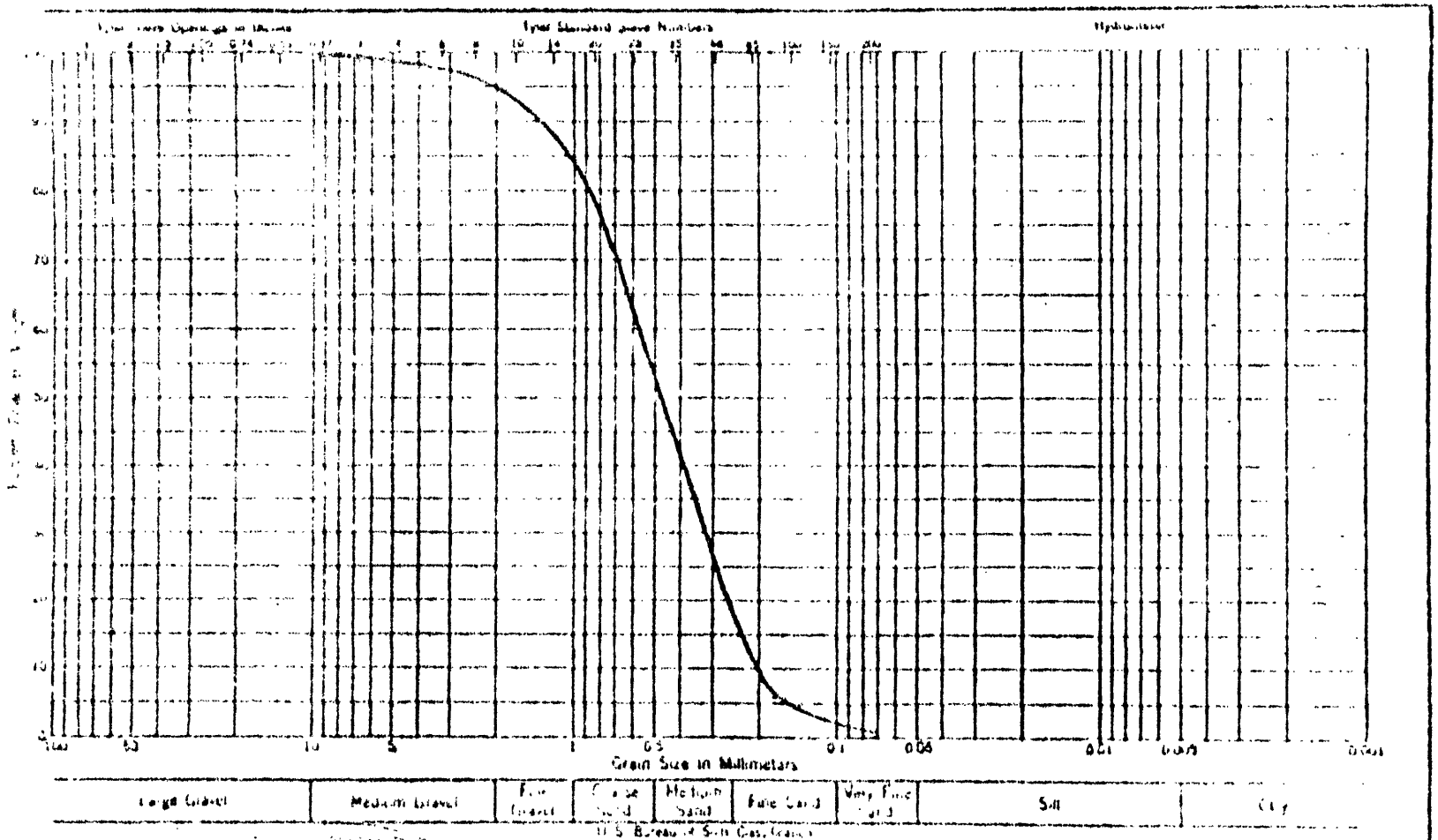

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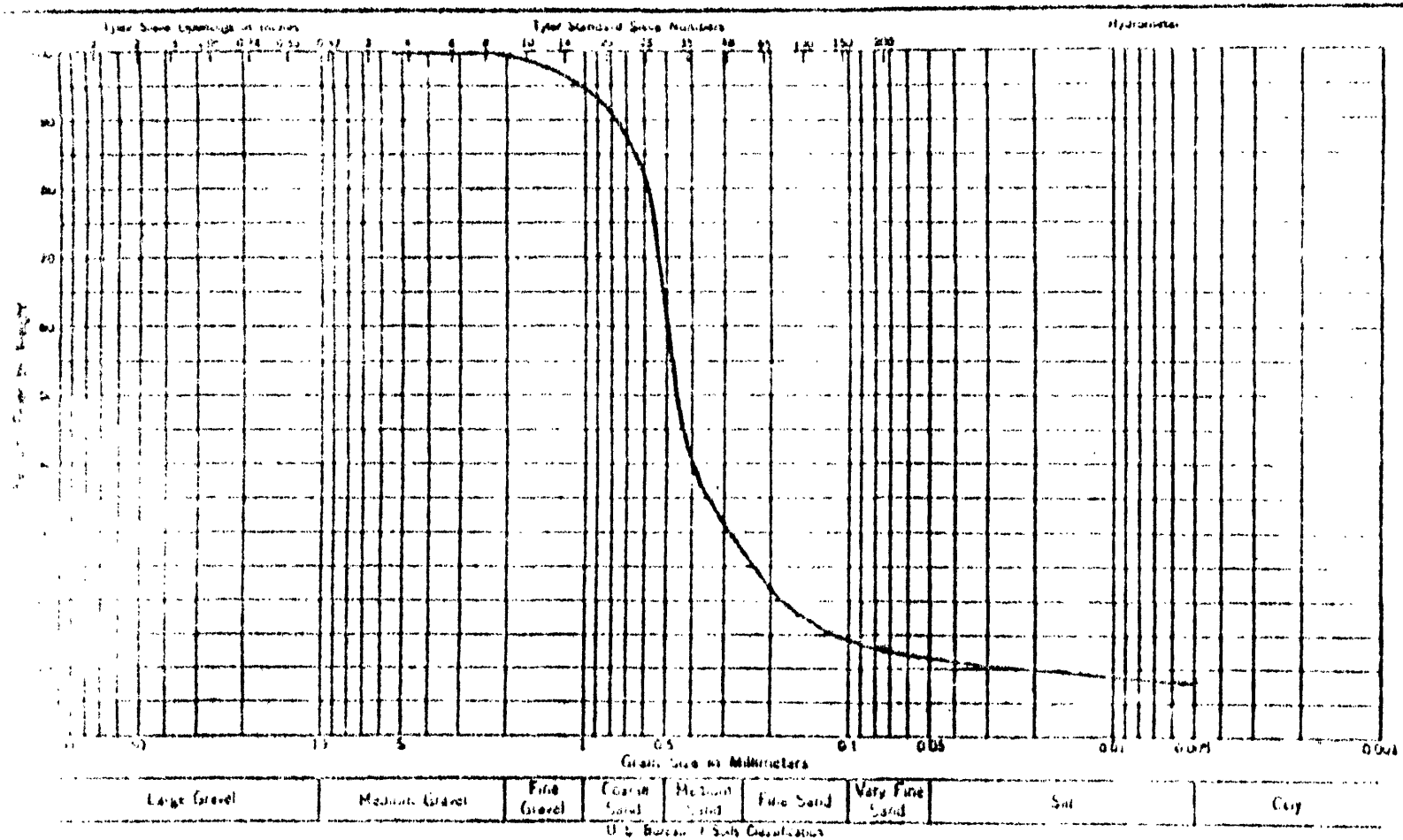
Sample = SS - 5 - 1

Lab. # = 9[illegible] - 0129

THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS STATE HIGHWAY LABORATORY



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Sample = SS - 5 - 2

Lab. # = 63-0130

Lab. 511 P.W.H. 658

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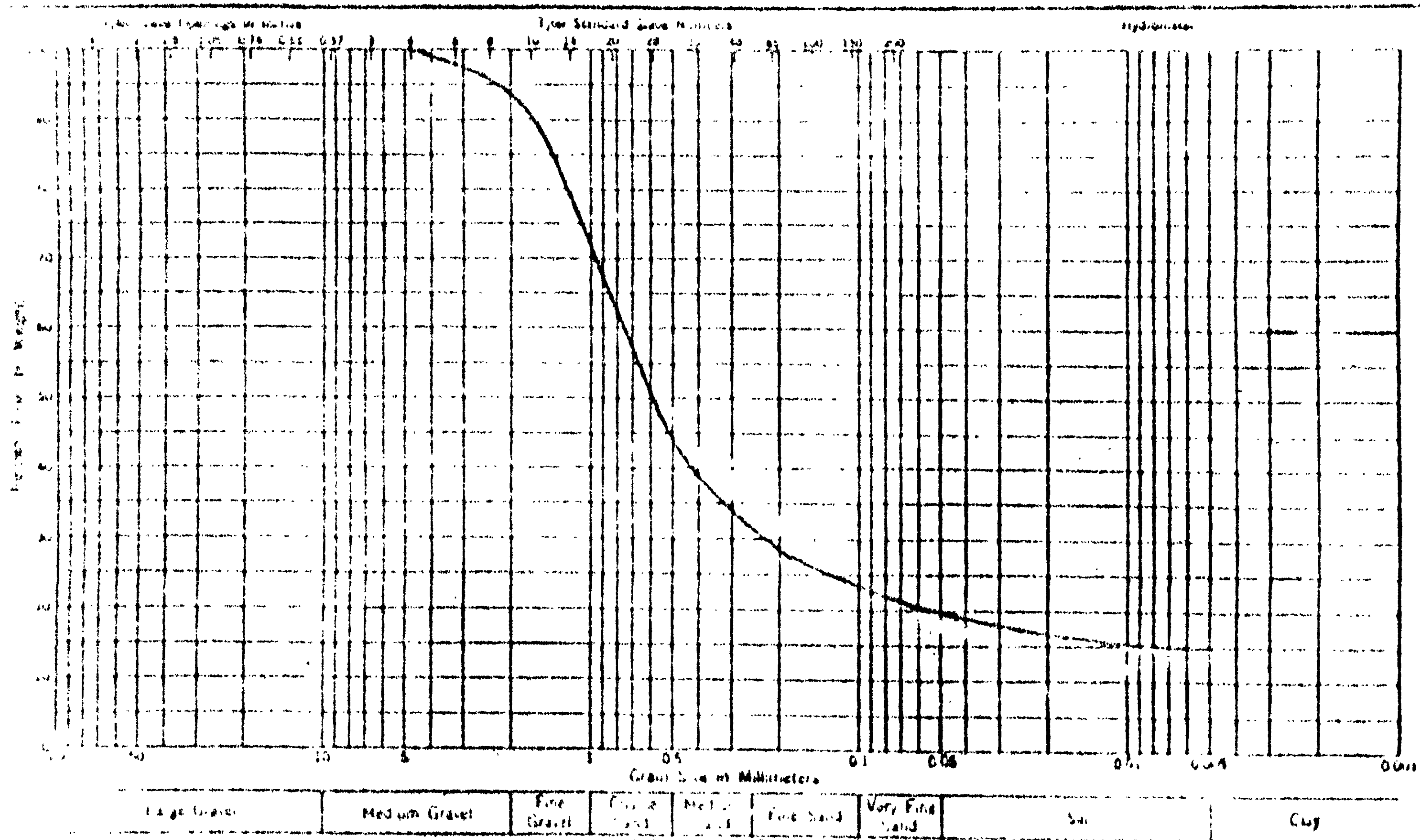

Hole # = SS - 5

Sample = SS - 5 - 3

Lab. # = 54 - 0131

Lab. 511 P.W.H. 658

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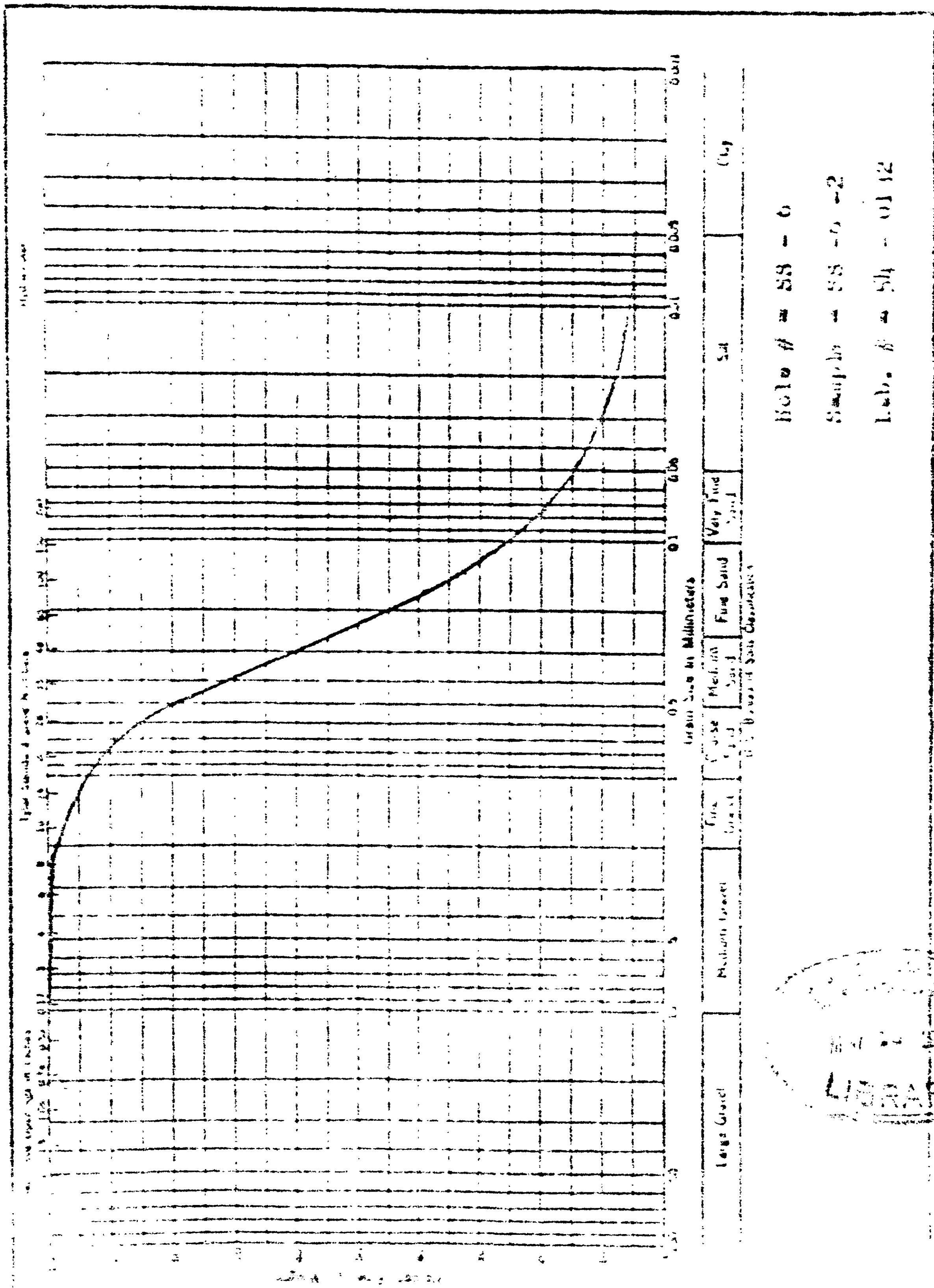
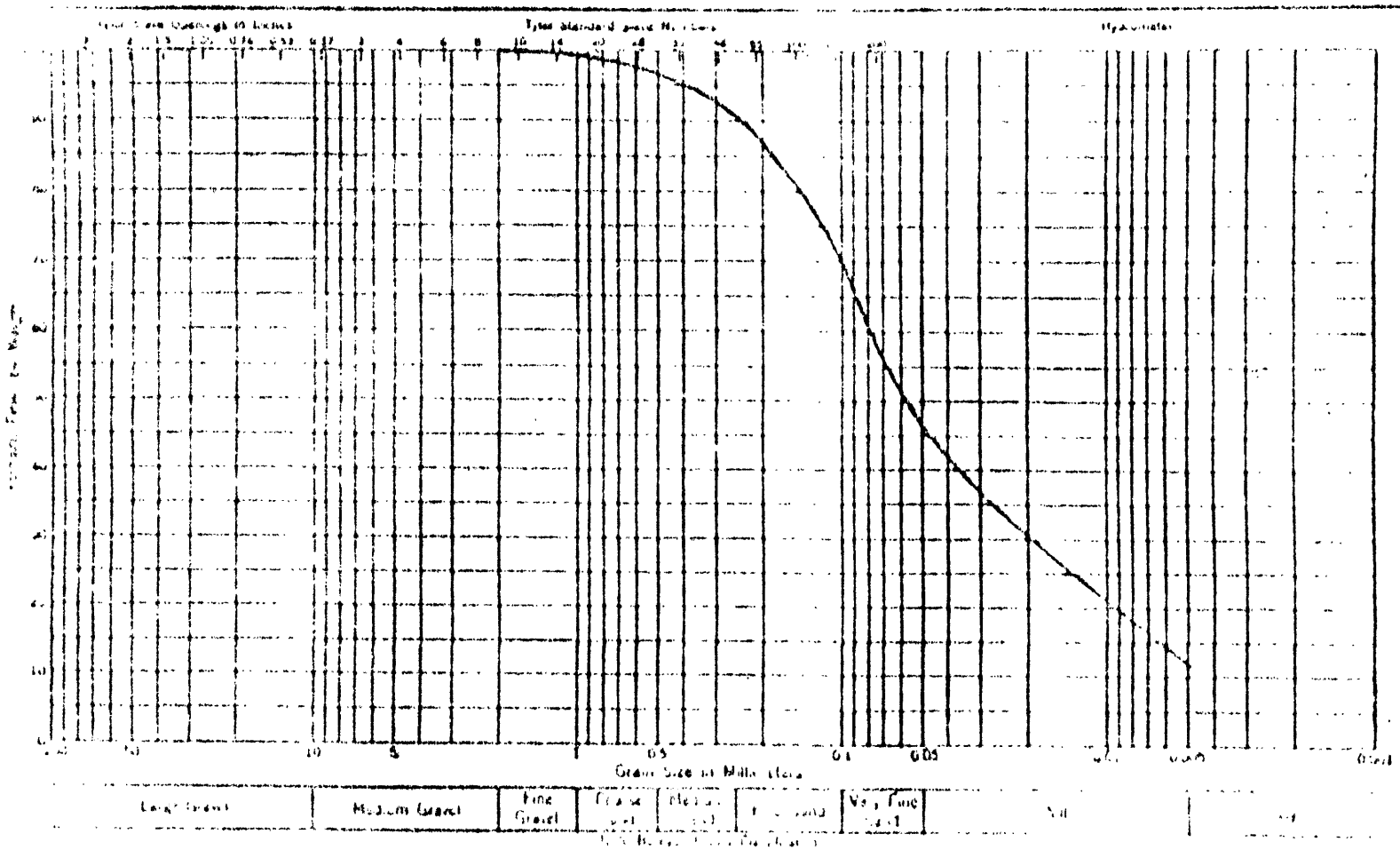
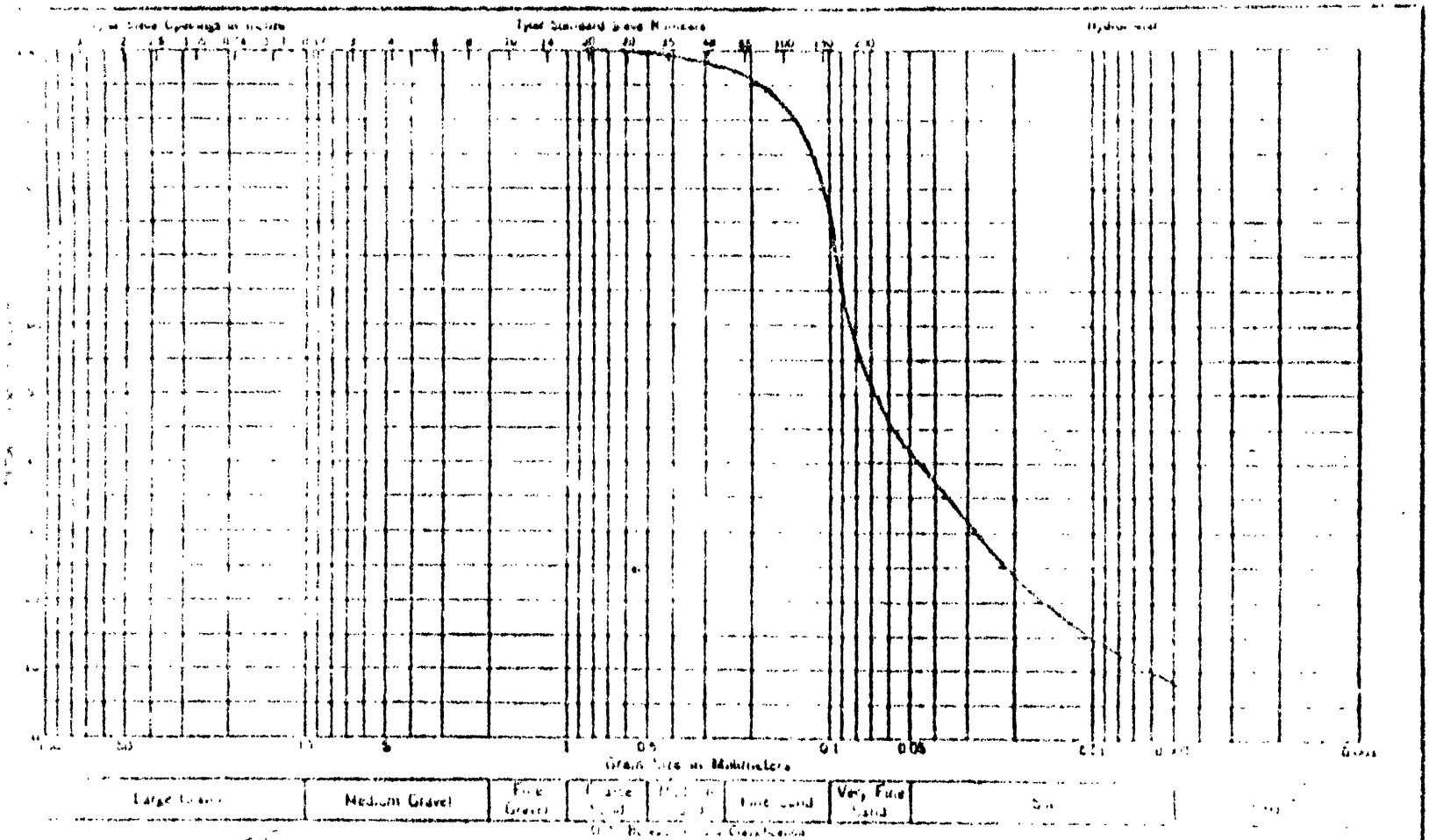




Hole # — — 6

Sample —

Lab. # — —



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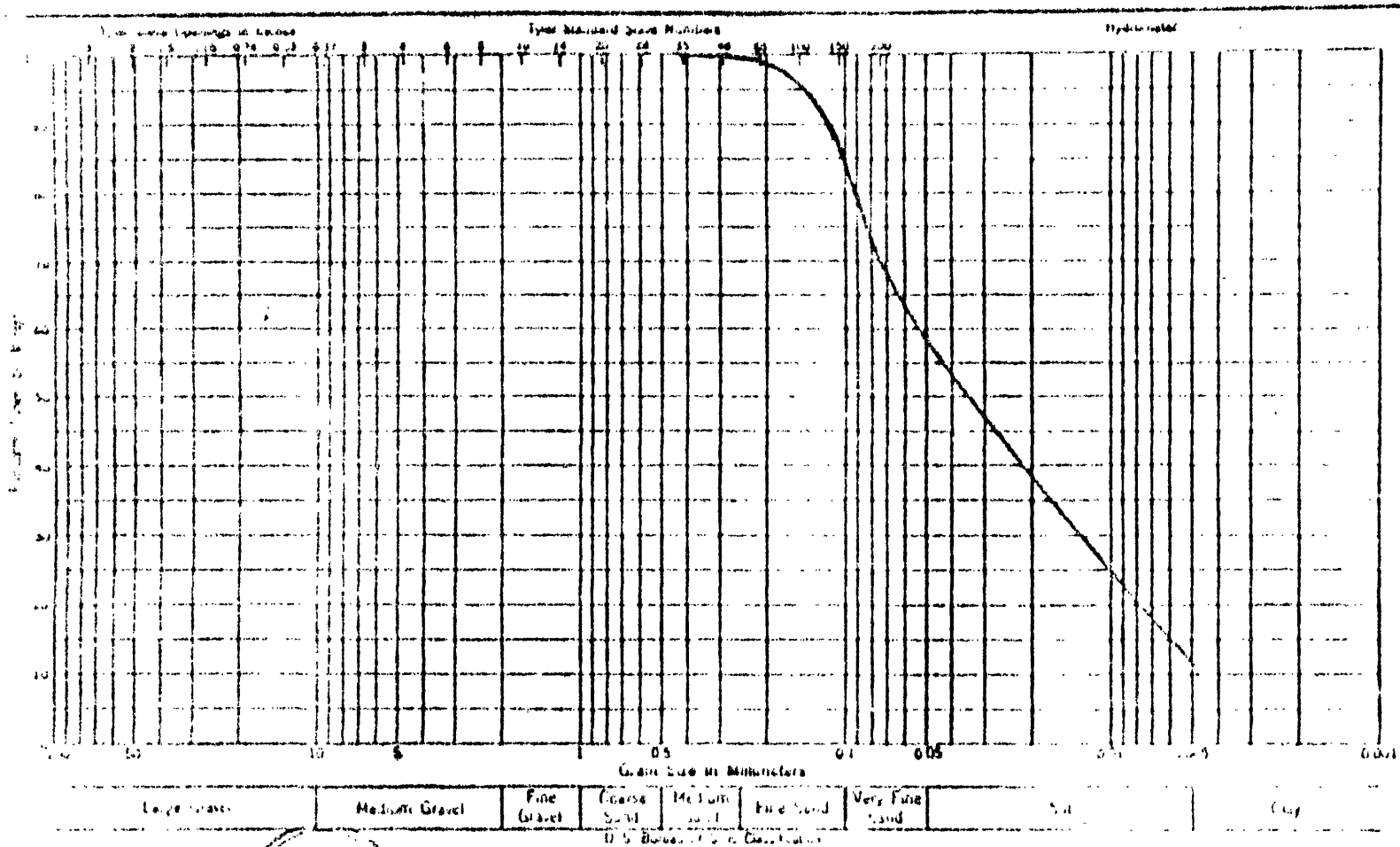

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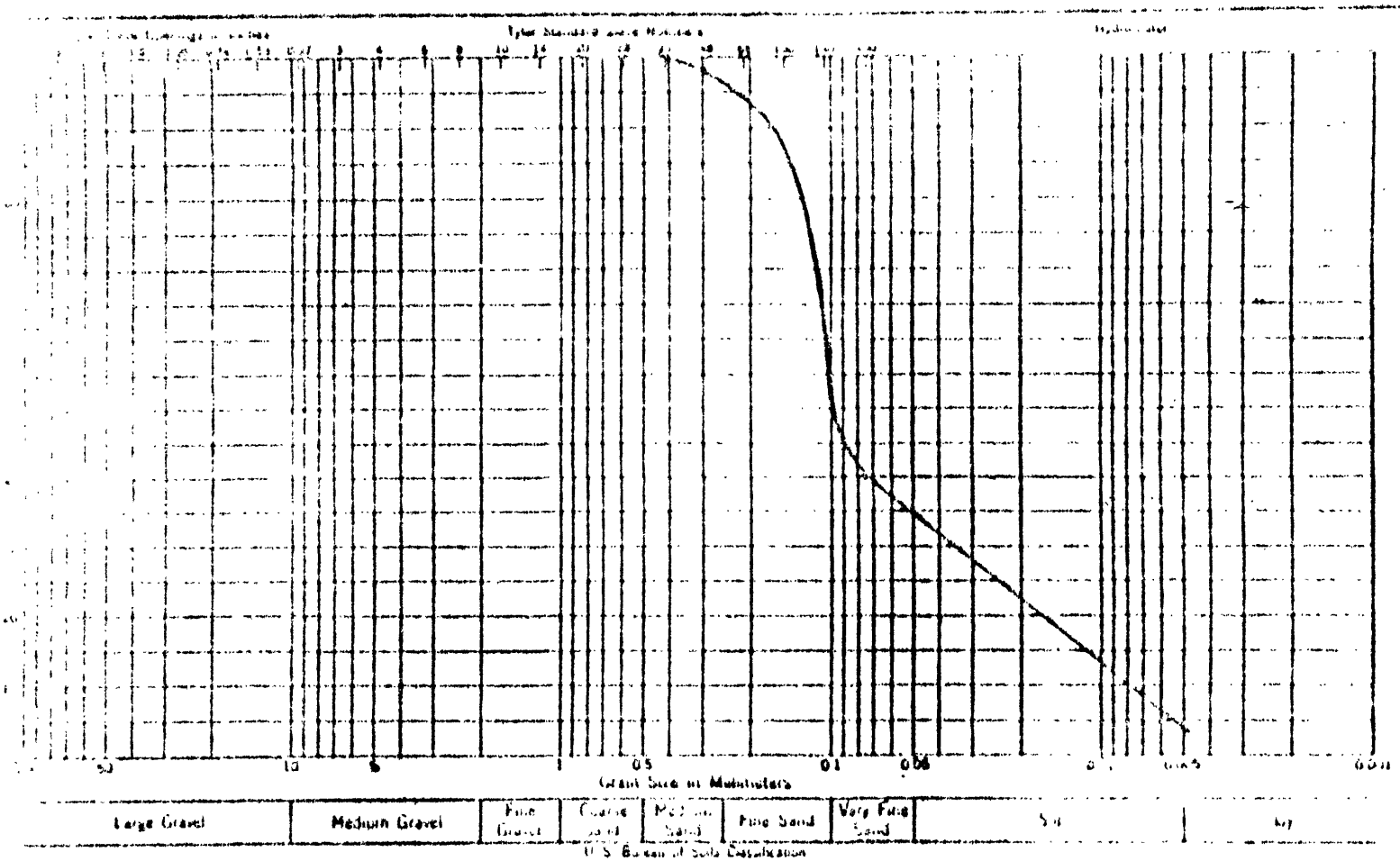
Sample - S.S - 7 - 2

Lab. # - [illegible]

E.O. S.H. P.W.D. 653



Hole # - SS - 8

Sample - SS - 8 - 1

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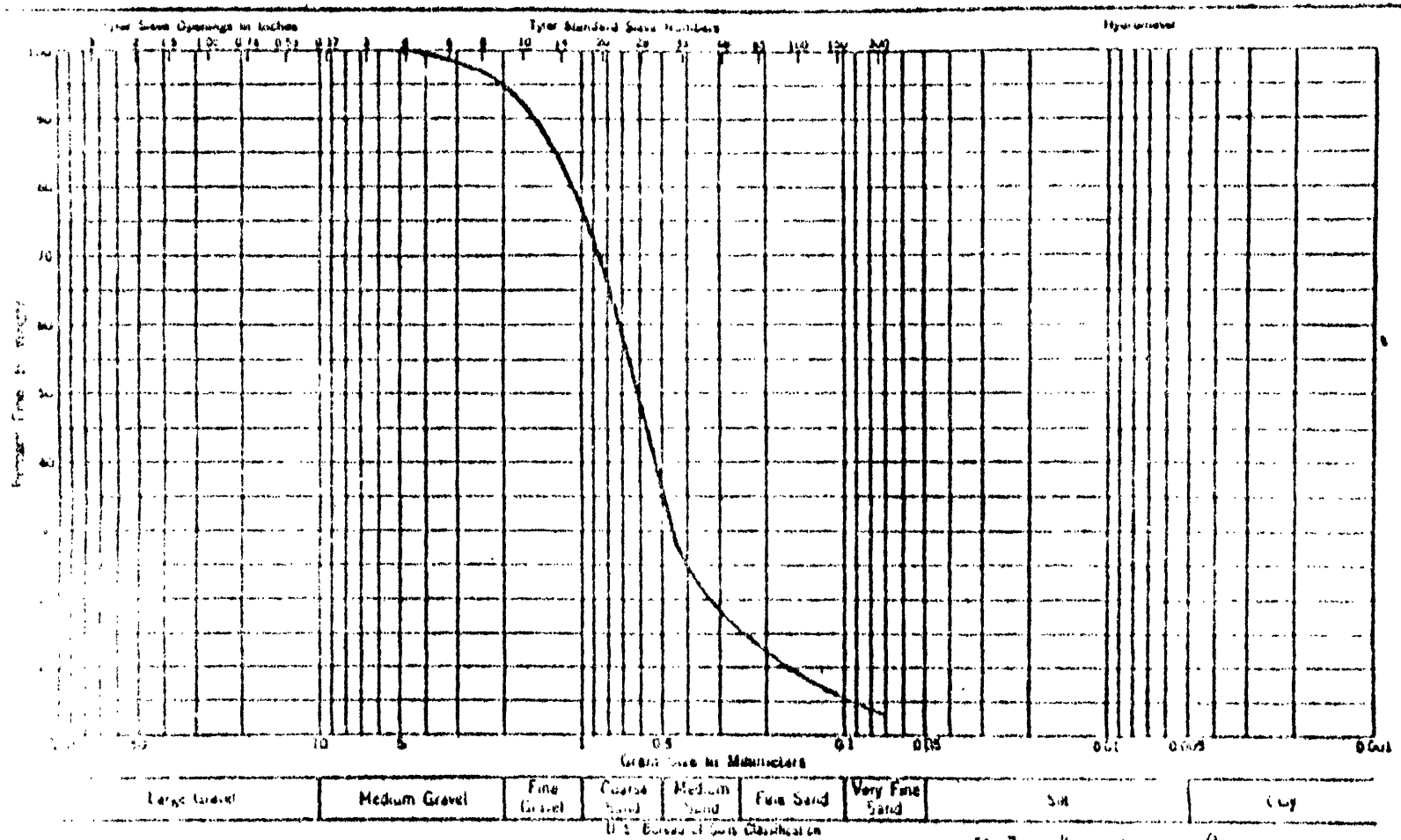

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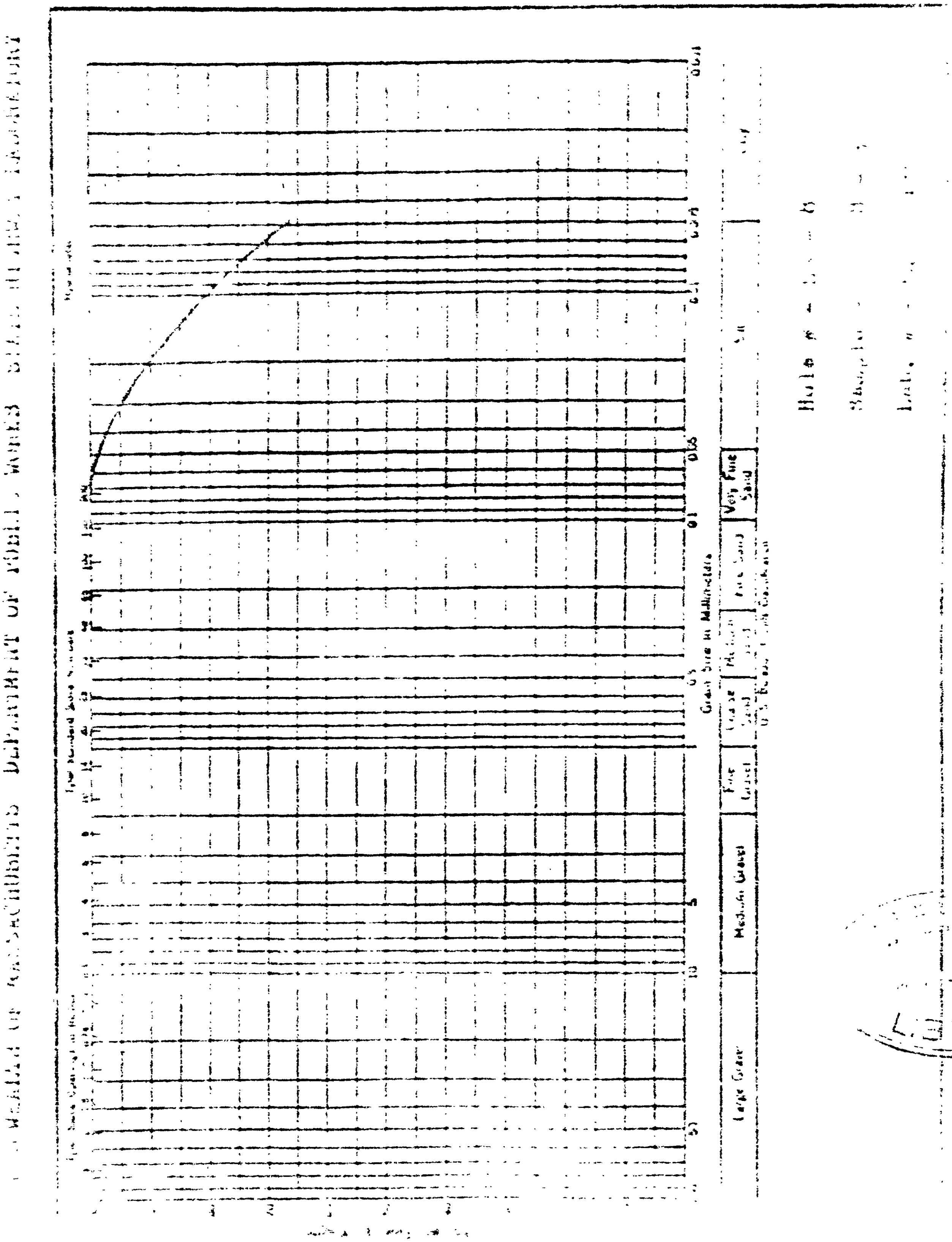
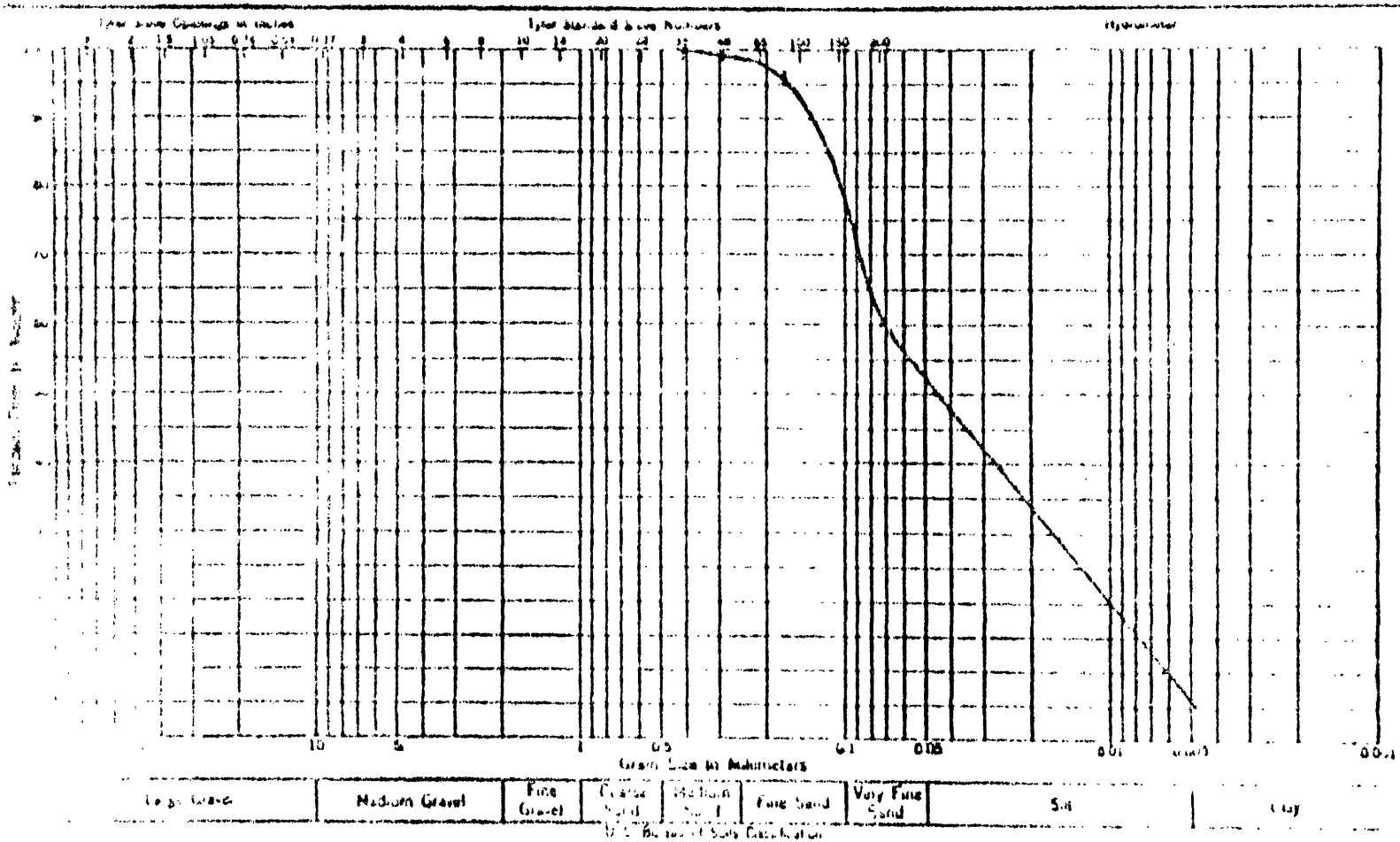
Lab.# = 94 - 0137

92

Lab. 521 P.W.H. 658





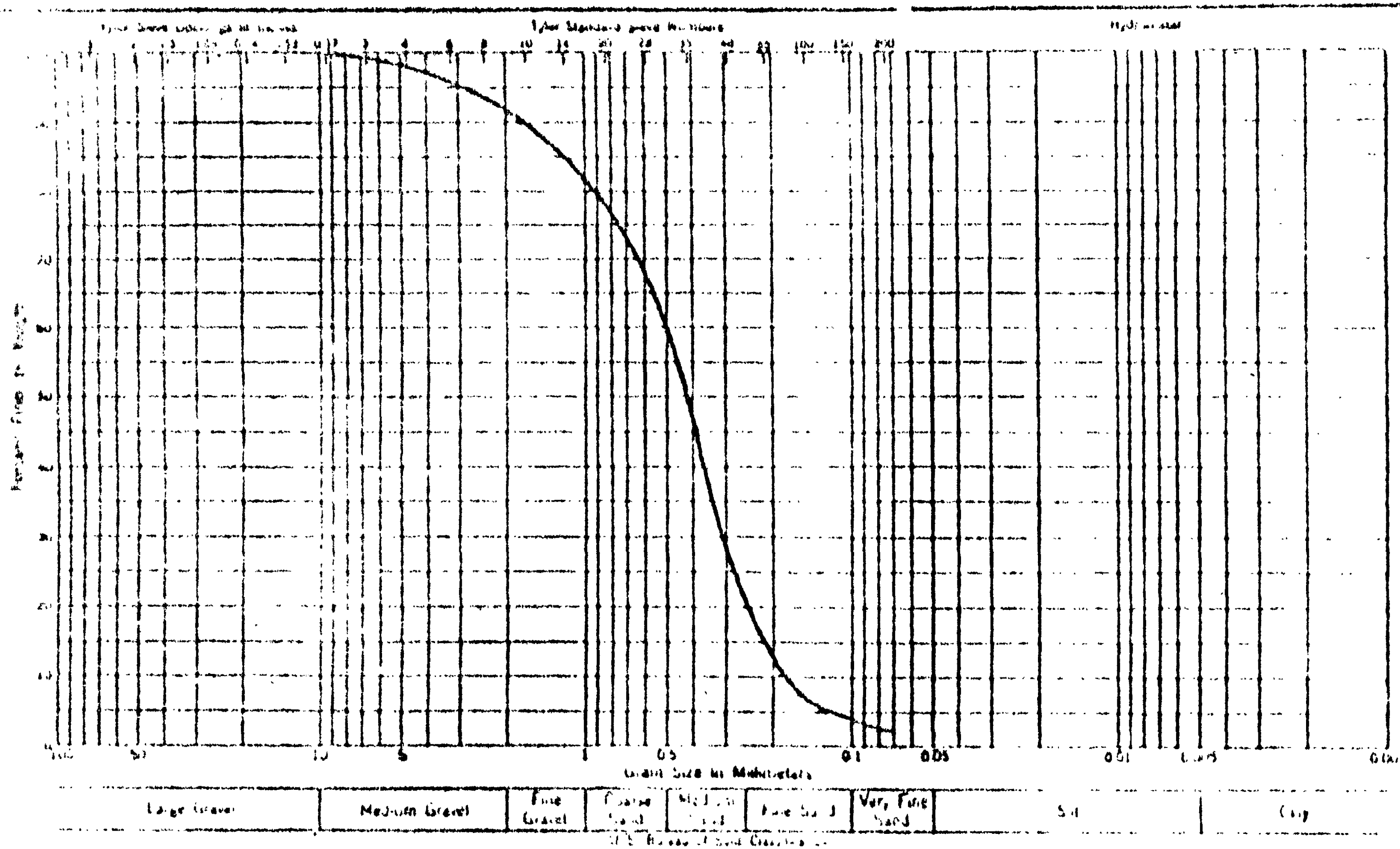
Hole # SS - 9

Sample # SS - 9 - 1

Lab. # - 69 - 0199

Lab. 511 P.W.H. 658

COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS STATE HIGHWAY LABORATORY



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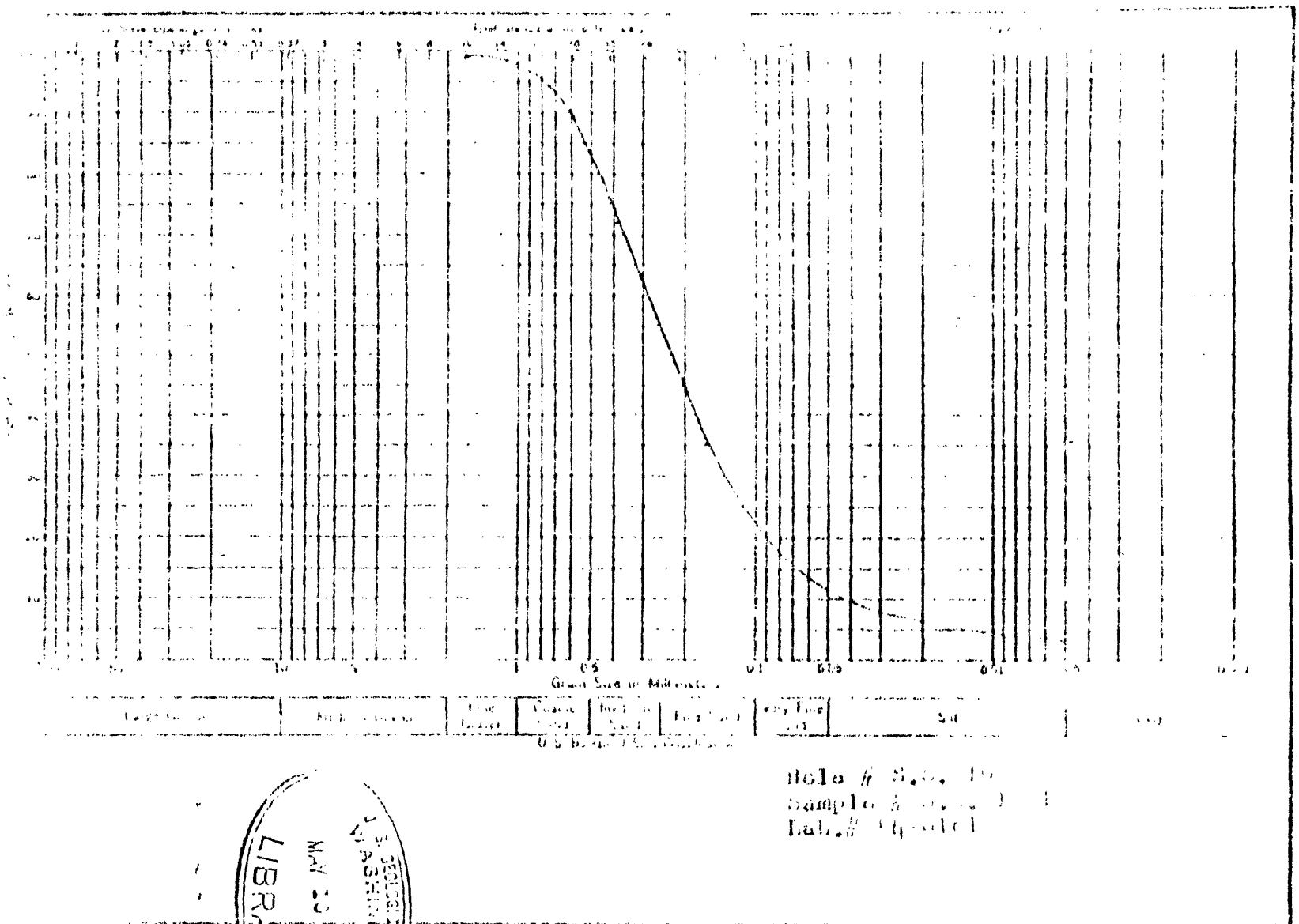
Sample - ? - ?

Lab. # - ?



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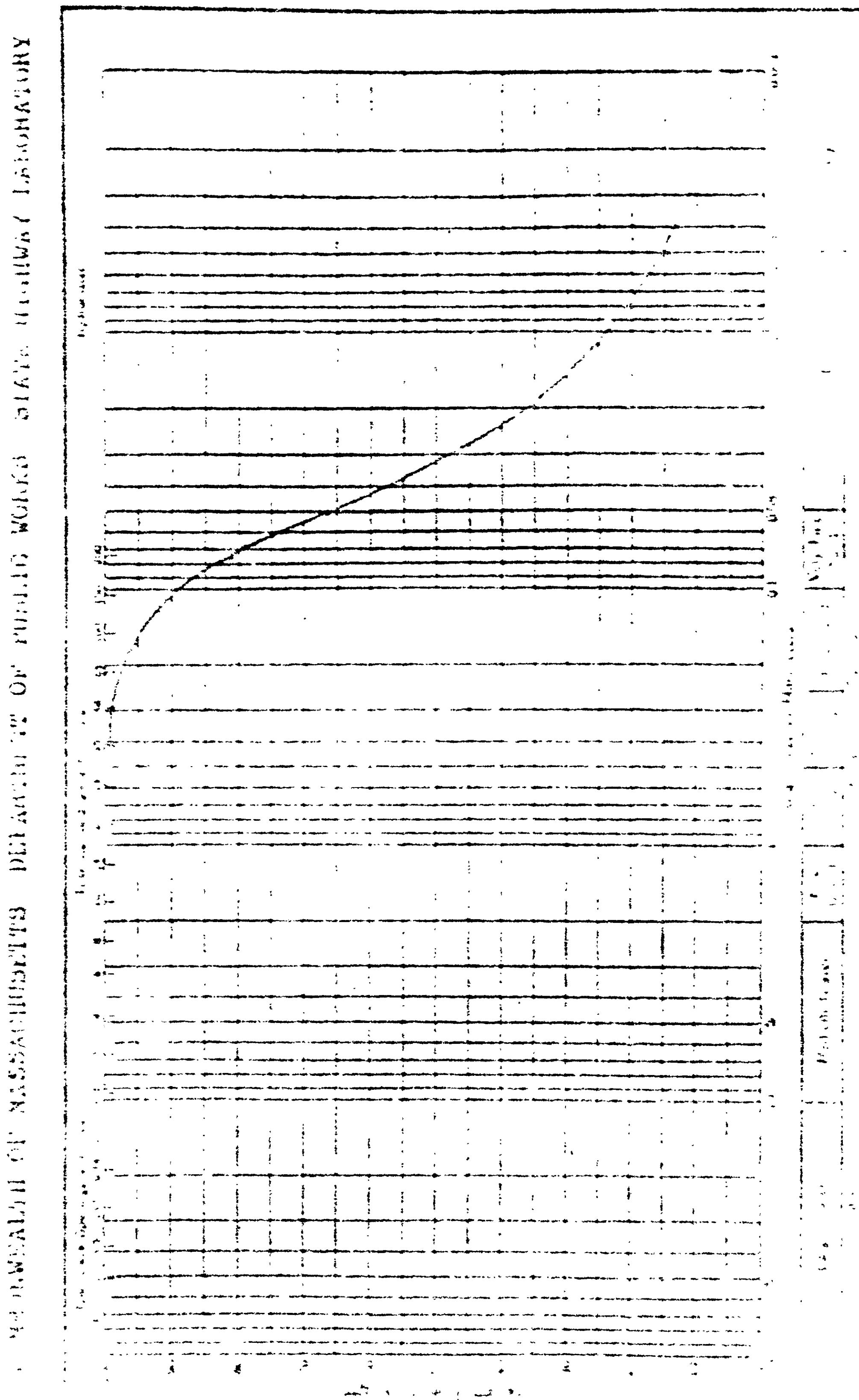

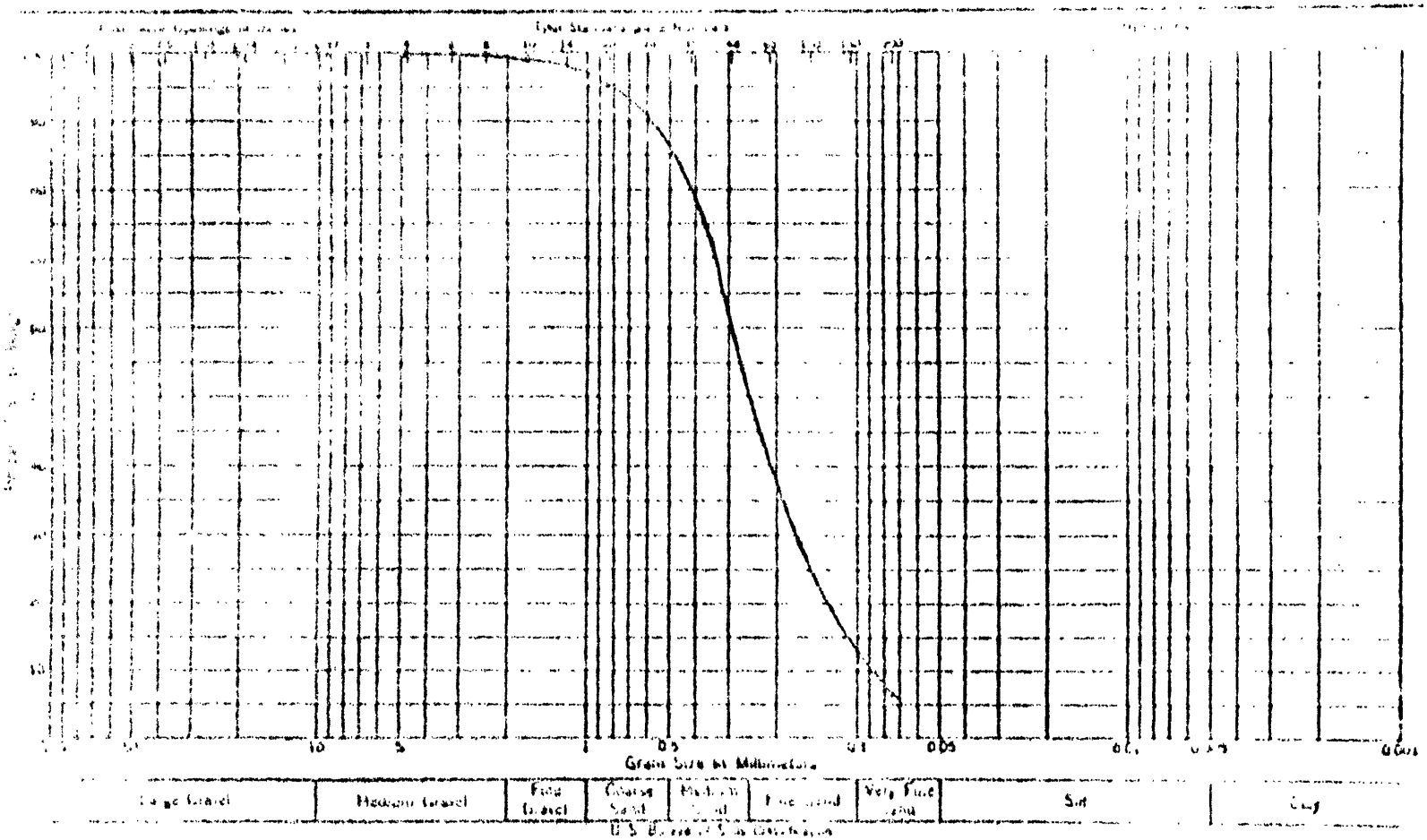

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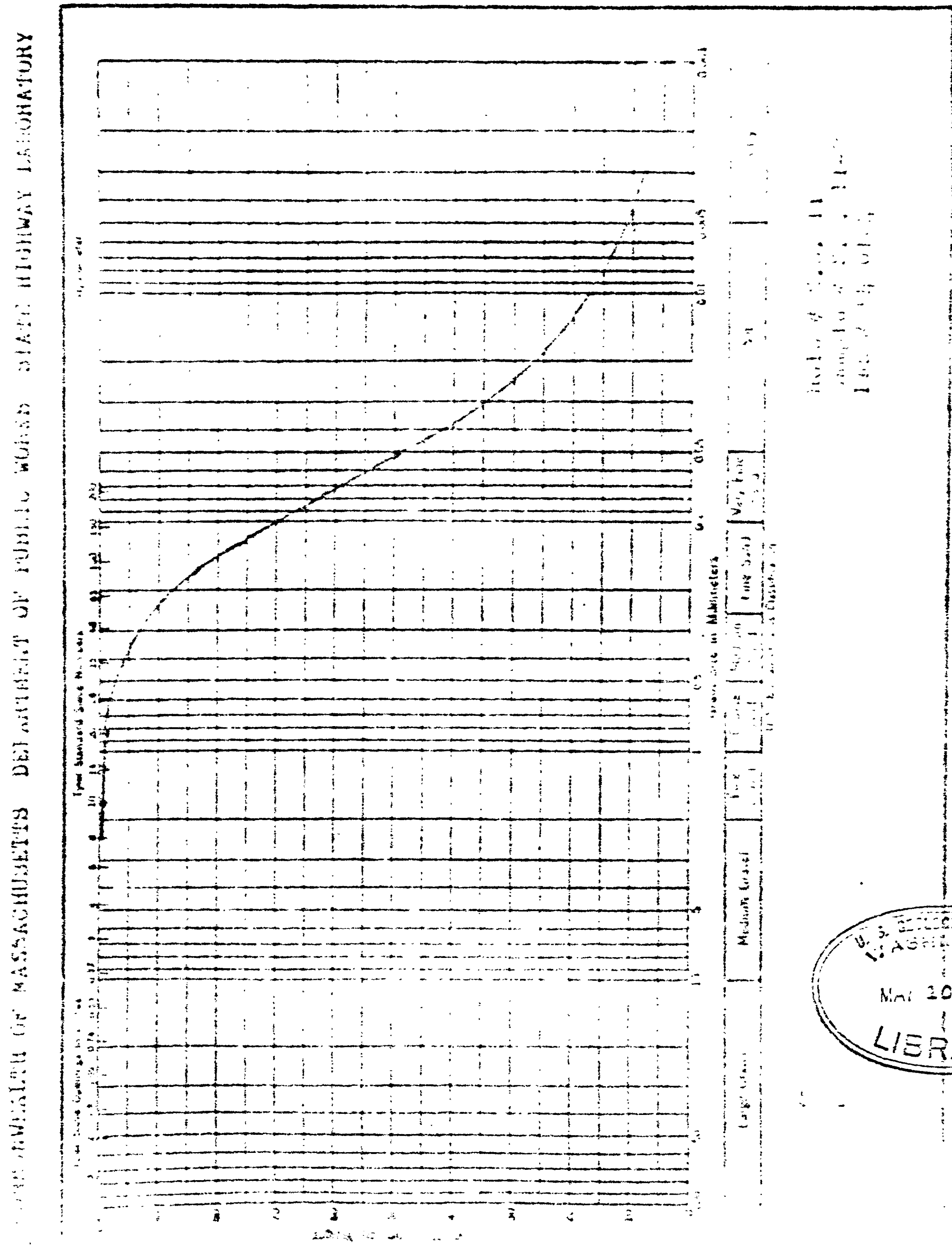
Sample # [illegible] 11-1
Lab. # [illegible]

Lab. 511 P.W.H. 658



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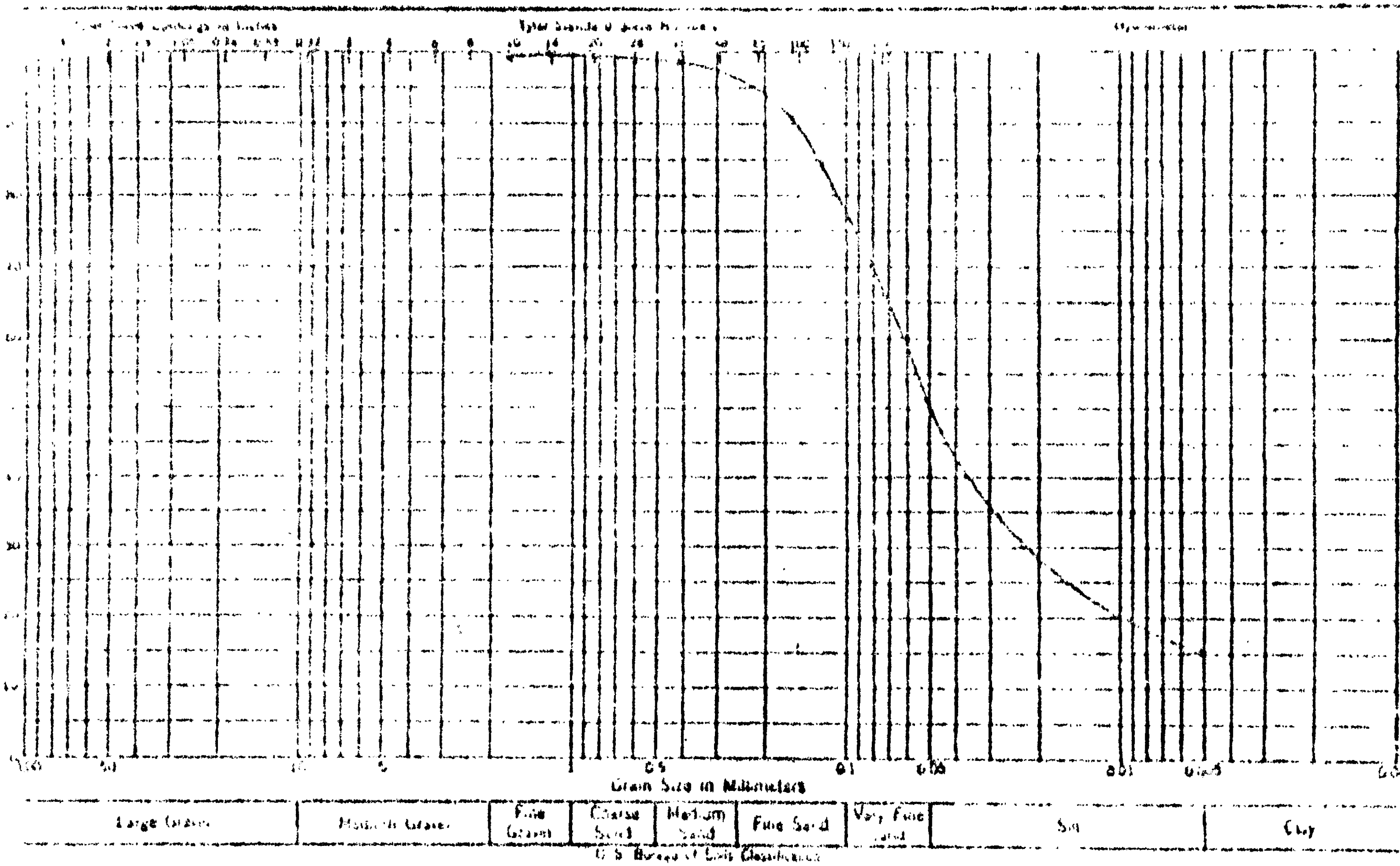
COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS STATE HIGHWAY LABORATORY



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Sample # S...11-3

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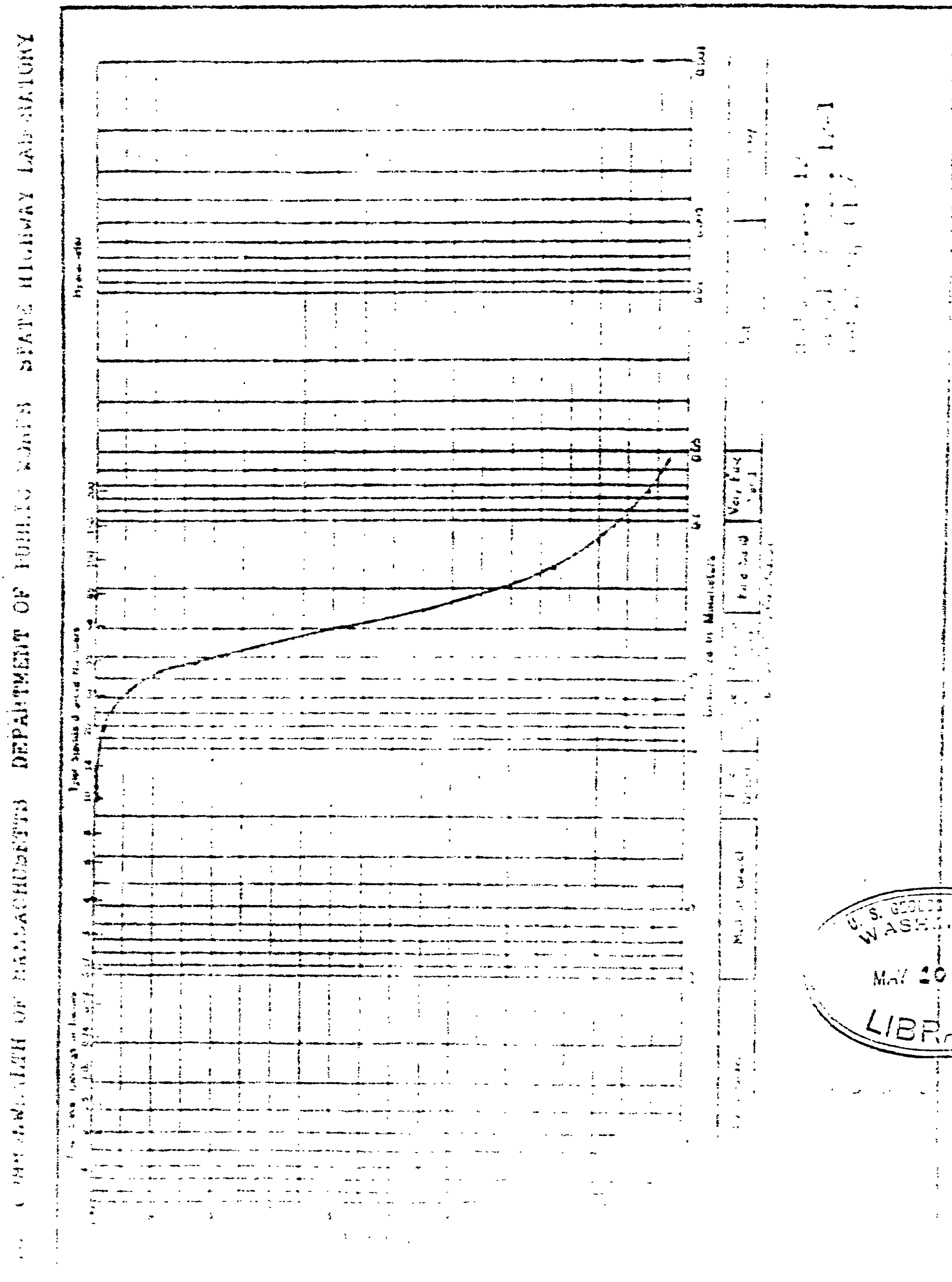
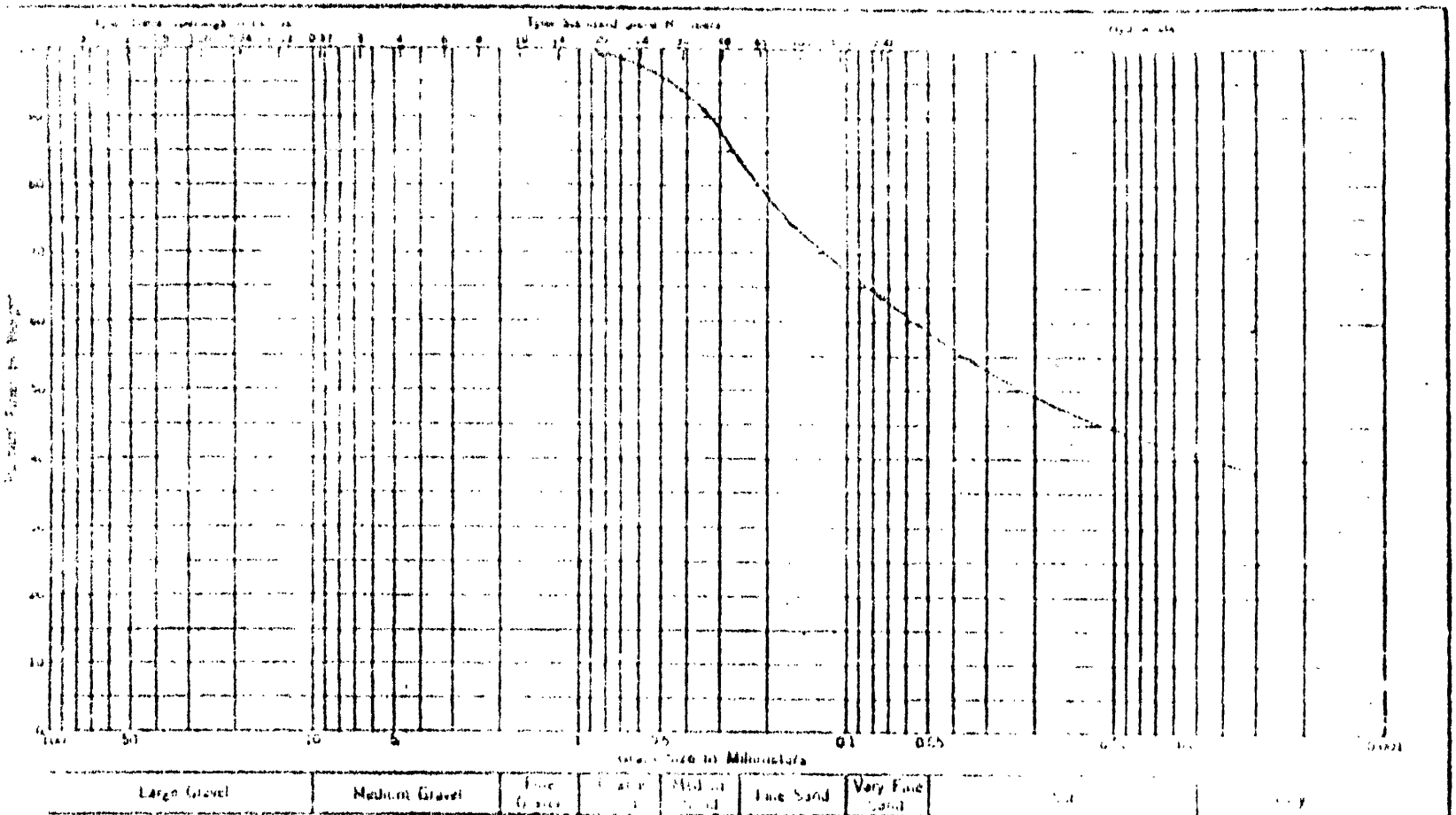
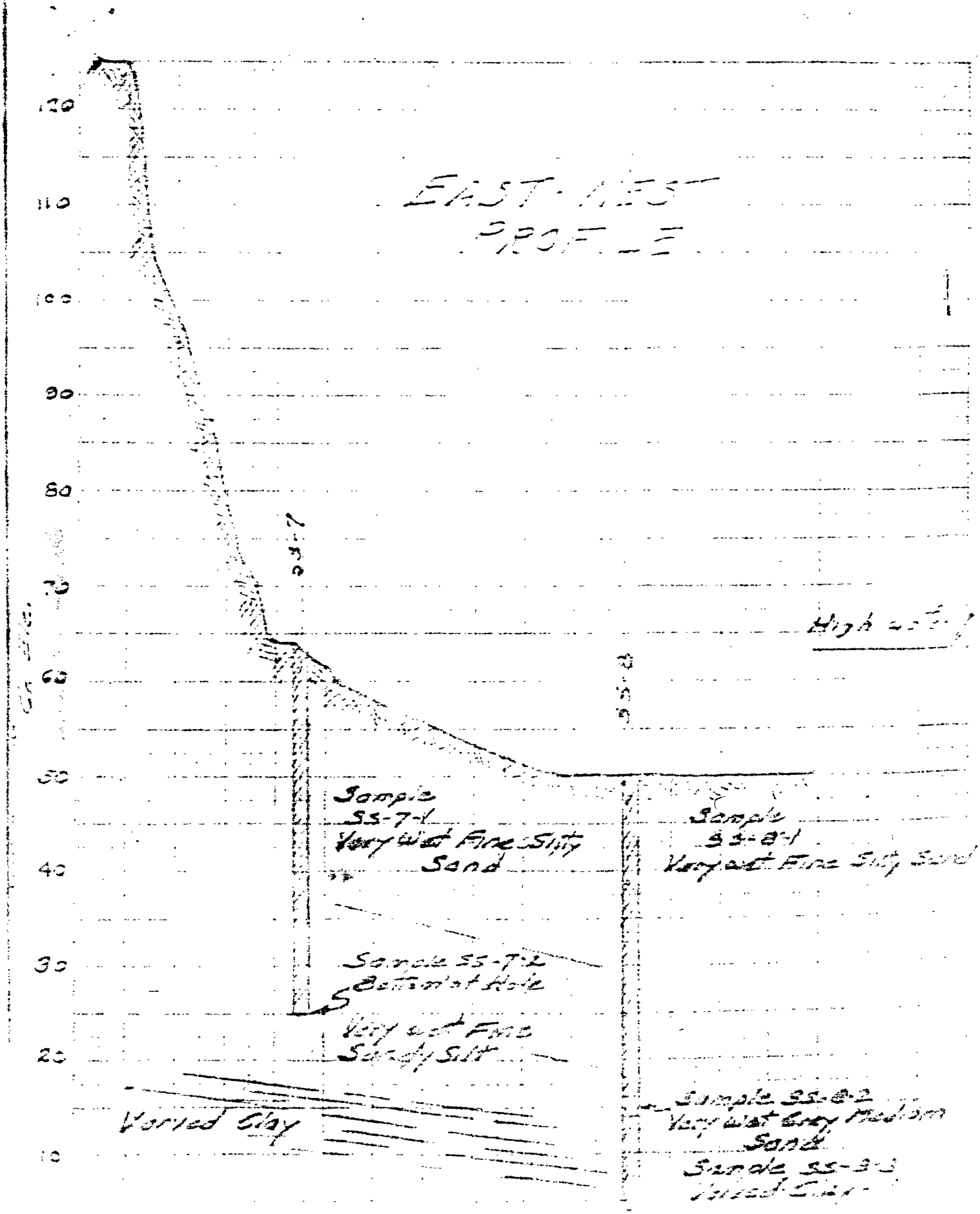
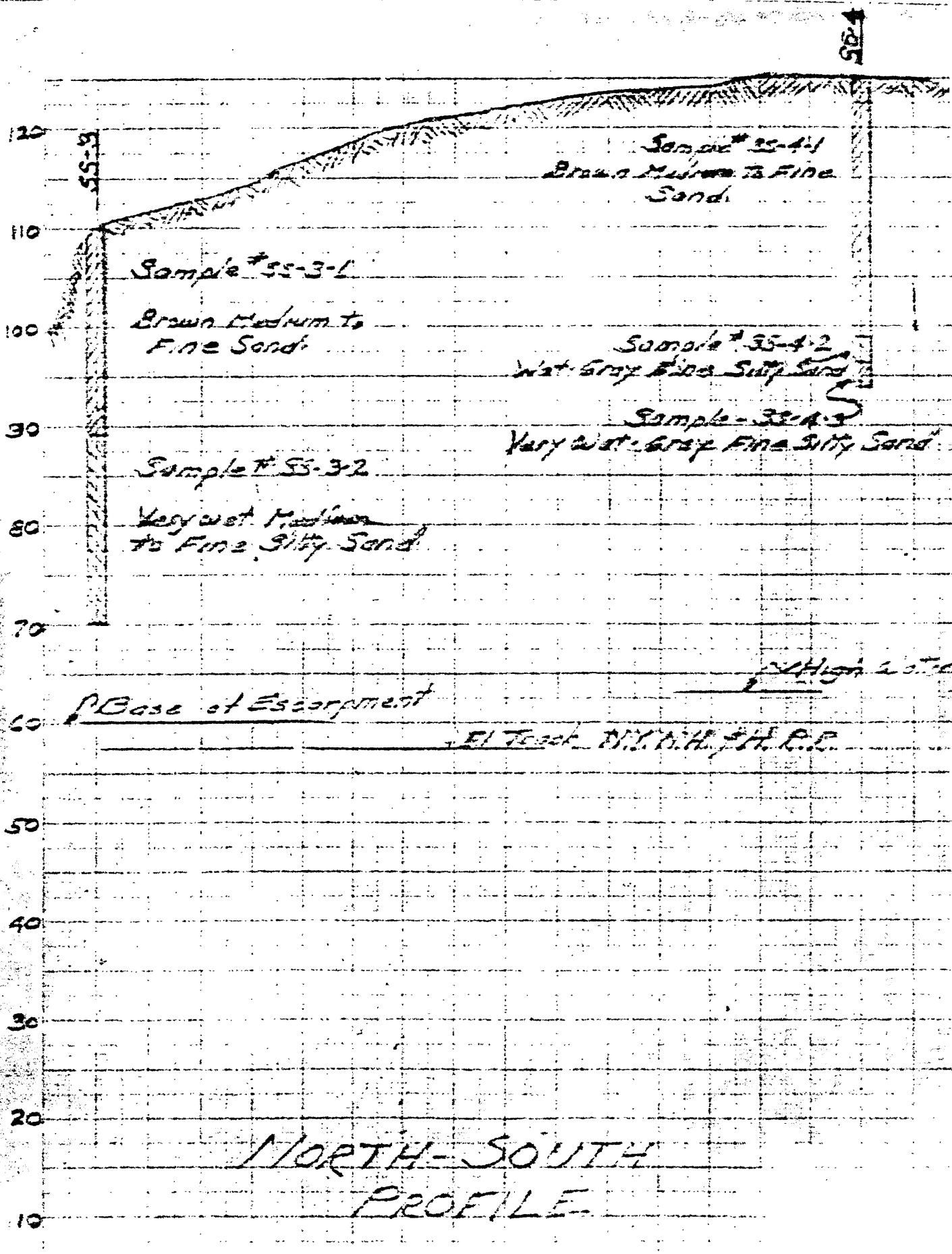
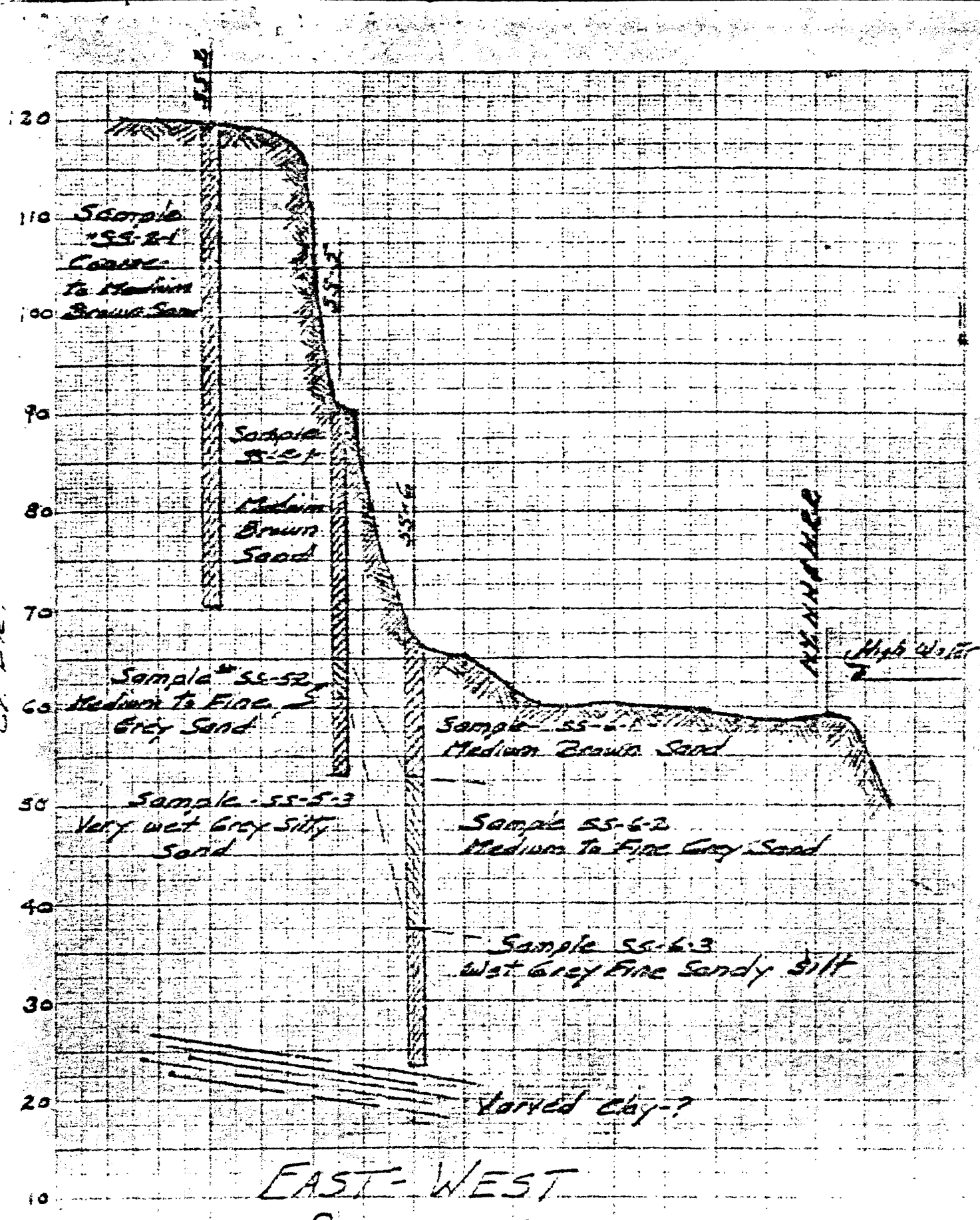
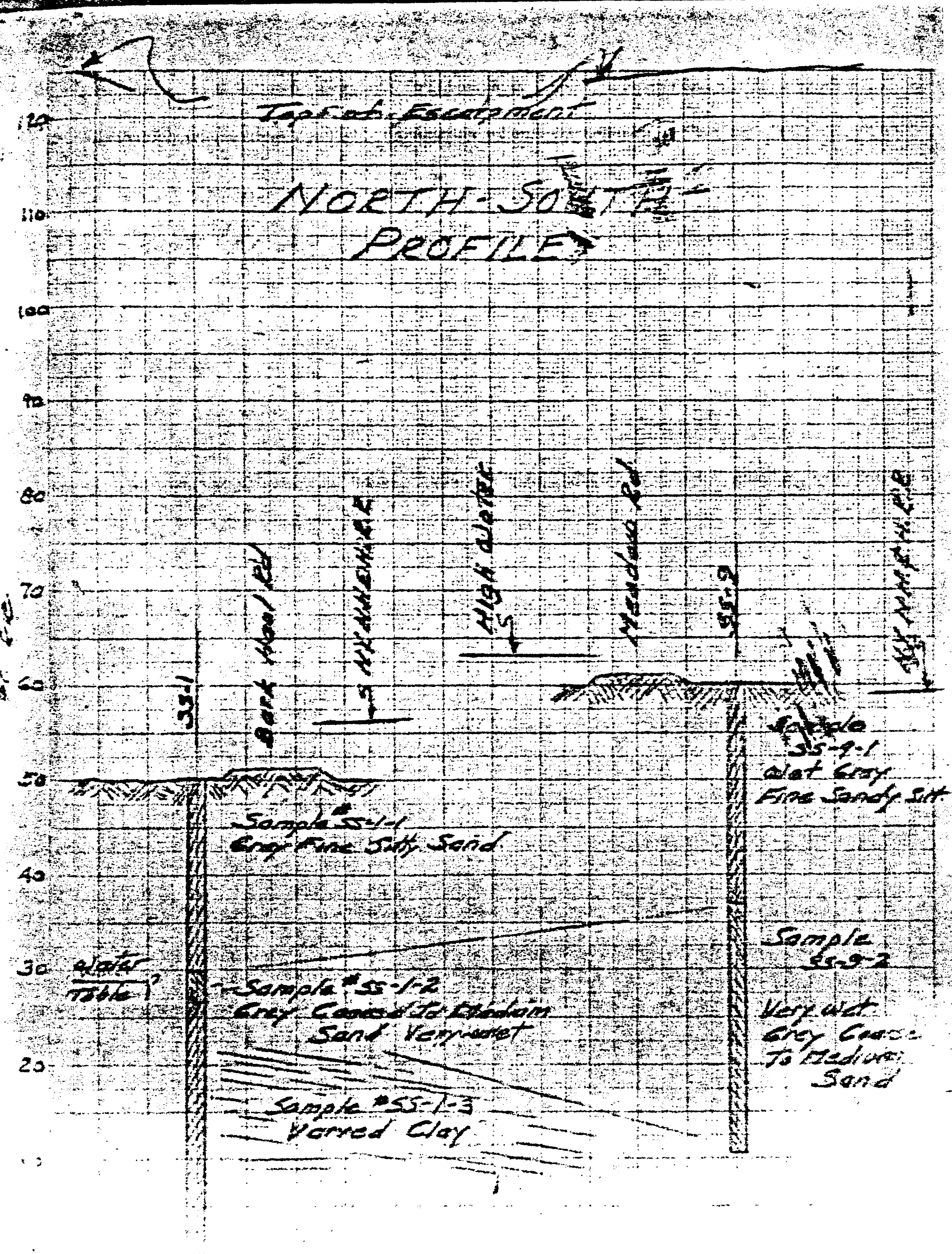


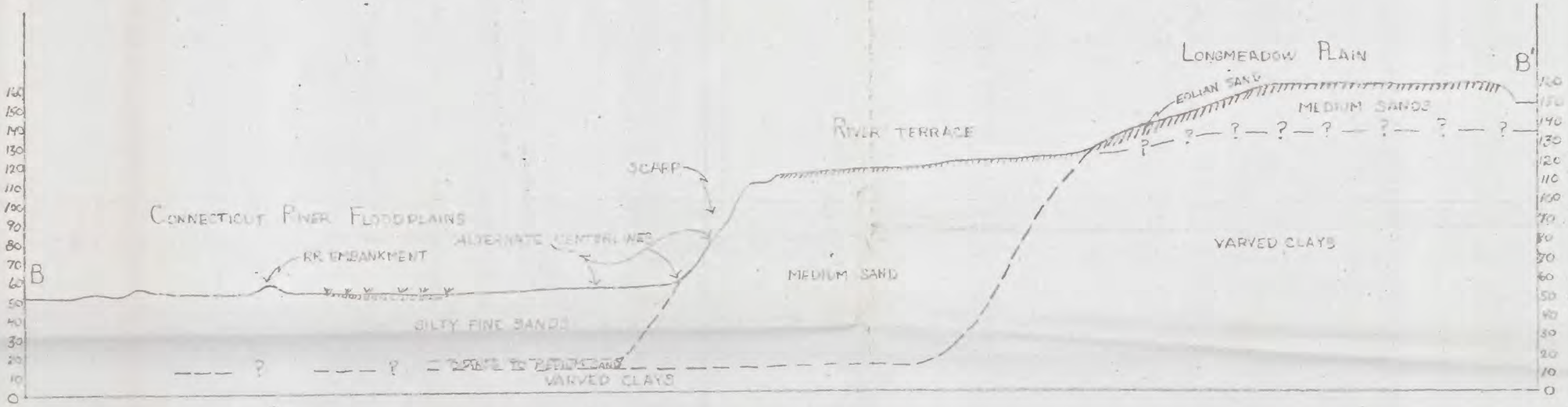


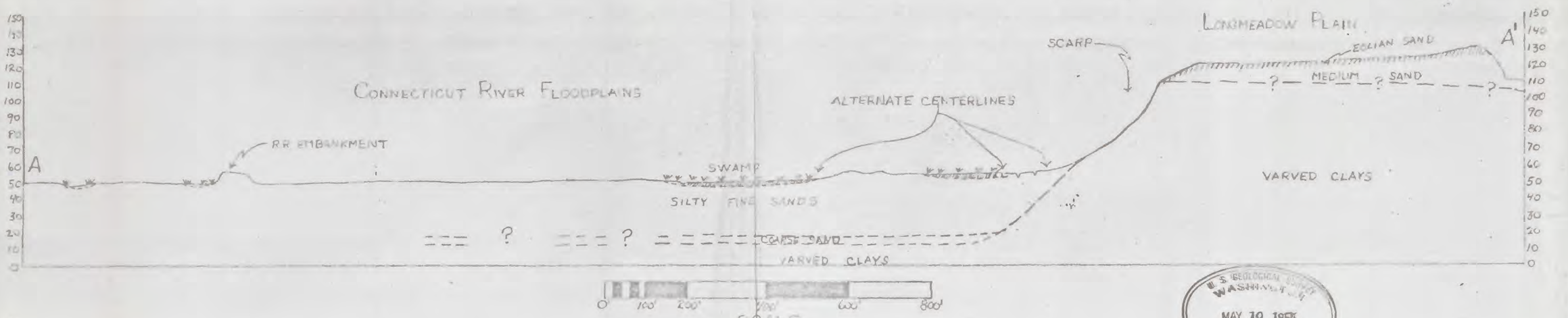

EAST - WEST
PROFILE
120
110
100
90
80
70
60
50
40
30
20
10
Sample
SS-7-1
Very Wet Fine Silty
Sand
Sample SS-7-2
Bottom of Hole
Very Wet Fine
Sandy Silt
Varved Clay
Sample
SS-8-1
Very Wet Fine Silty Sand
Sample SS-8-2
Very Wet Grey Medium
Sand
Sample SS-8-3
Varved Clay


SS-4
SS-3
120
110
100
90
80
70
60
50
40
30
20
10
Sample # SS-4-1
Brown Medium to Fine Sand
Sample # SS-3-1
Brown Medium to Fine Sand
Sample # SS-4-2
Wet Gray Fine Silty Sand
Sample - SS-4-3
Very Wet Gray Fine Silty Sand
Sample # SS-3-2
Very Wet Medium to Fine Silty Sand
High Water
Base of Escarpment
El Track N.Y.B.H. & H.R.R.
NORTH-SOUTH PROFILE


120
110
100
90
80
70
60
50
40
30
20
10
SS-1
SS-2
SS-3
SS-4
SS-5
SS-6
Sample "SS-1-1 Coarse to Medium Brown Sand
Sample SS-2-1 Medium Brown Sand
Sample SS-5-2 Medium to Fine Grey Sand
Sample - SS-5-3 Very wet Grey Silty Sand
Sample - SS-6-1 Medium Brown Sand
Sample SS-6-2 Medium to Fine Grey Sand
Sample SS-6-3 Wet Grey Fine Sandy Silt
Varved Clay-?
High Water
EAST - WEST PROFILE


Top of Escarpment
NORTH-SOUTH PROFILE
110
100
90
80
70
60
50
40
30
20
SS-1
High Water
SS-2
Sample #SS-1-1
Grey Fine Silty Sand
Water Table
Sample #SS-1-2
Sample #SS-1-3
Varved Clay
Sample SS-2-1
Fine Sandy Silt
Sample SS-2-2
Sand





Title ?

Figure 4
Figure 4

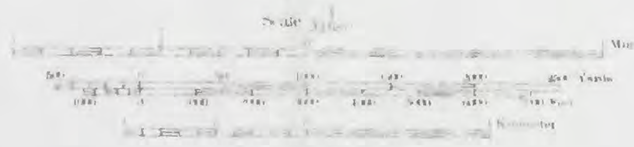
PLATE I

SURFICIAL GEOLOGIC MAP
OF
LONGMEADOW AND EAST LONGMEADOW, MASS.
AND
ADJACENT PARTS OF CONNECTICUT

SHOWING DISTRIBUTION OF SOIL MATERIALS AND SAND AND GRAVEL PITS

GEOLOGY BY JOSEPH H. HARTSHORN

SCALE



Contour interval 10 feet

EXPLANATION

Generally unsuitable as sources of granular material

PEAT, MUCK, AND ALLUVIAL AREAS

s – peat and silty to sandy peat and muck in swamps; underlain by clay, silt, sand, gravel, or till generally similar to surrounding area.

al – silty and sandy alluvium, chiefly recent flood deposits, restricted mostly to lowlands along the Connecticut River.

rt – mostly sand, some silt, in river terraces about 65' and 80' above the Connecticut River.

Chief areas of fine-grained granular material

AREAS IN WHICH SAND PREDOMINATES

sd – sand of uniform texture, deposited by wind action as elongate sand dunes, but in part as irregular forms (dotted overprint).

d – sand of variable texture, deposited as a delta in glacial Lake Hitchcock, now dissected by modern streams. Underlain by varved clays at depths of 15' to 50'+.

ow_1 – sand of variable texture, including subordinate pebble gravel, deposited as outwash plains by glacial meltwaters.

Chief areas of coarse granular material

AREAS IN WHICH GRAVEL PREDOMINATES

ow_2 – gravel and sand, deposited as outwash plains by glacial meltwaters; generally kettled.

kt – gravel and sand deposited as kame terraces (at Osborn Prison Farm, and west of Lee Street, East Longmeadow).

kd – gravel and sand in topset and foreset beds of a kame delta (east of North Thompsonville, Connecticut).

e – gravel and sand, extremely variable texture, including large boulders, in short esker segment (west of Kibbe Road, East Longmeadow).

Areas of granular material of variable texture

TILL AREAS

gm – till (ground moraine); a heterogeneous deposit of mixed boulder to clay sizes, known locally as "hardpan", red to reddish brown in color, generally covered by yellowish to buff colored wind-blown sand.

Artificial fill (af)

Approximate unit boundary

Edge of terrace
(hachures point upslope)

Sand and gravel pits
active and inactive

⊙3 .
Location of drill hole

S109
Location of sample

A ——— A'
Line of cross-section

This report has been prepared for open file [illegible] has not been edited for conformity [illegible] Geological Survey standards and [illegible]