DRAFT

THE REPUBLIC OF THE PHILIPPINES

PLANNING REPORT ON THE PASIG-POTRERO RIVER FLOOD CONTROL AND SABO PROJECT

APPENDIX III

RIVER CONDION AND IMPROVEMENT PLAN, SURVEY

SFPTEMBER 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

THE REPUBLIC OF THE PHILIPPINES

PLANNING REPORT ON THE PASIG-POTRERO RIVER FLOOD CONTROL AND SABO PROJECT

APPENDIX III

RIVER CONDION AND IMPROVEMENT PLAN, SURVEY

SFPTEMBER 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

PLANNING REPORT
ON
THE PASIG-POTRERO RIVER FLOOD CONTROL AND SABO PROJECT

APPENDIX III

CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

Page

RIVER CONDITION AND IMPROVEMENT PLAN

I. General

This report contains the results of study based on the surveys which have been carried out in a rainy season, from August 22 to September 20 in 1977, and a dry season from,December 12 in 1977 to March 31 in 1978, for the Pasig-Potrero Flood Control and Sabo Project in the Republic of the Phillipines.

The Pasig-Potrero River has a total length of 35km and a catchment area of $125km^2$. The up-stream running in the mountainous area of $25km^2$ goes down on a steep slope and flows down along the ridge into the fan-delta area. This Project consists of Sabo plan in the mountainous area and river improvement plan in the stretch from the fan-head to the confluence with Gua-Gua River. In this report, the latter stretch is studied.

Therefore, besides the study of a river channel and a water flow, surplys sediment discharged from the mountainous area is taken into consideration. The improvement plan is set up to enable the river channel to flow down the design discharge and sediment safely and effectively.

Based on the results of cross-sectional survey at a pitch of 1km, the following items have been studied.

i) Soil test of river bed materials
ii) Improvement plan based on the design discharge
iii) Design of sand arresting basin
iv) Study of flow capacity and river bed stability
v) Improvement of drainage system for the down stream land area.
vi) Survey

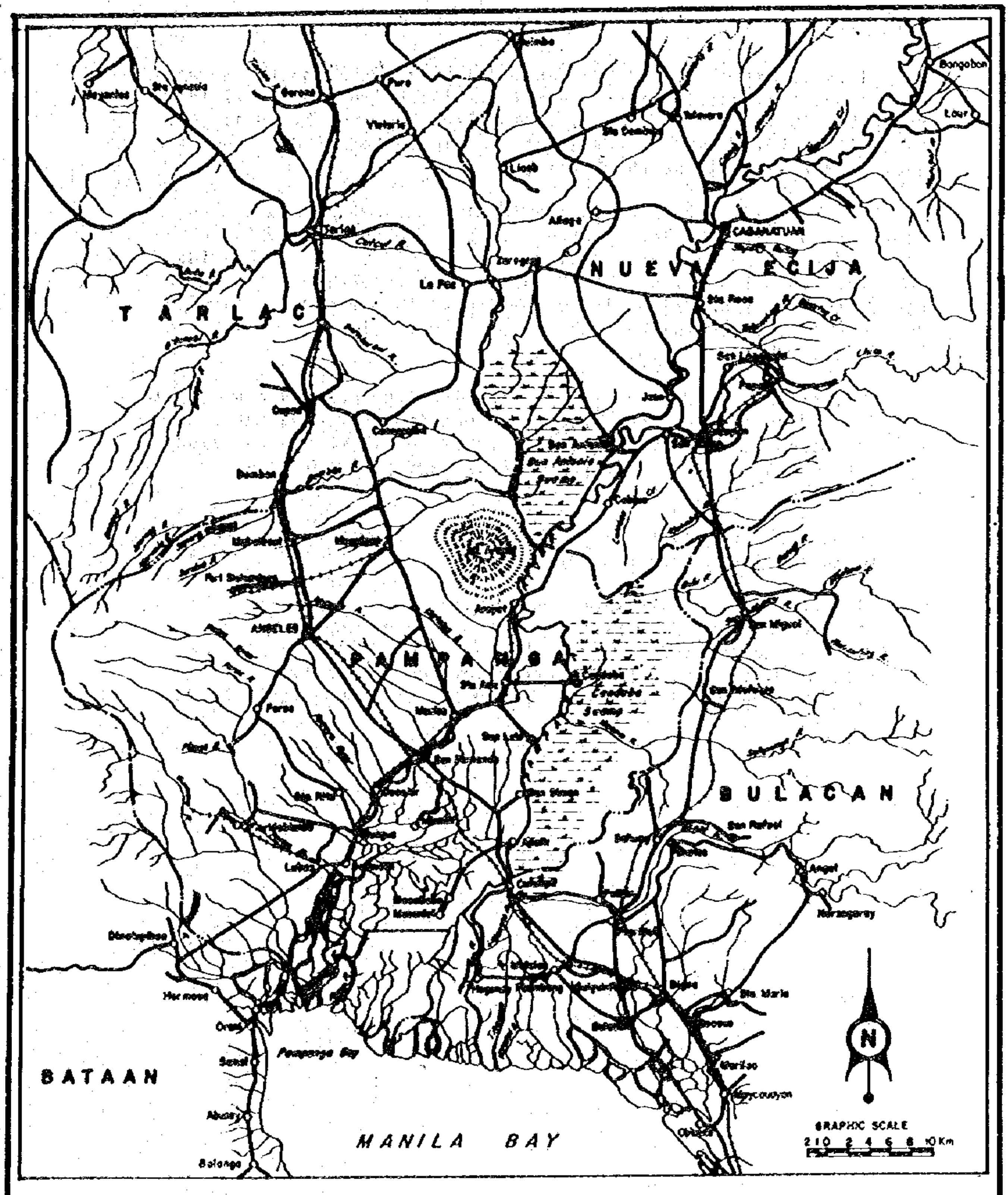


FIGURE - III - 1 LOCATION MAP OF PASIG-POTRERO RIVER

II PRESENT RIVER CONDITION

2-1 River Course and Sedimentation

The Pasig-Petrero River has its headspring near the east slope of the Cabusilan Mountains which are located on the western boundary of the Pampanga Province in the central part of Ruzon; the Pasig-Potrero, after being confluenced by the Yongca River, the Bucbucu River and the Timbu River, changes its river course to south-east direction at the fan head that is formed of the sediment by the Pasig-Potrero itself; it flows through Mancatian and Bacolor, and then confluences into the Gua-Gua River at the Pampanga delta. The Pasig-Potrero River is a midium-size river with its length 35 km and its drainage area 125 km^2. The Gua-Gua River empties into the Manila Bay after passing through low swampy area where rivers confluence and diverse like a mesh.

The Pasig-Potrero River disappears its river course at down stream and because it forms a fan delta of sand and gravel at the outlet of the mountainous area. It outflows so much amount of sediment from its upper stream in flood, and overflows it at the mid-stream, thus course so many damages every year.

A levee is built at the right bank of the upper stream of the Mancatian Bridge as long as 3.7 km, and also at both banks of the lower stream of the bridge upto near the convluence with the Gua-Gua River. The former is built to prevent damages by avoiding flood of the river and runoff of the sediment over the Town Porac, while the latter is built and is still progressing the embankment works, i.e., excavation and construction of banks since 1974, on the proposal of the River Improvement Plan by BPW following the reports of ECAFE in 1964.

The present state of the river will be described hereunder in 3 parts:

a) Upper Stream; from the apex of the fan head to the intake of the sand arresting basin. (STA.27 - STA.23)

b) Middle Stream; from the sand arresting basin to the end of the fan head stretch (the just upper end of the embankment of the river) (STA.23 - STA.16)

c) Lower Stream from the embankment to the confluence with the Gua-Gua River

The upper stream is a very important part which influences the following stream in the fan delta and the river bed. The upper stream is 100 to 250 m wide and have its bed slope 1/60 to 1/70 with a few steps. At present the re-transition of sediment is actively progressing, thus giving the production sources of sand and soil. Besides, the side errosion on both banks also give the production sources of them. In the past the river bed was higher

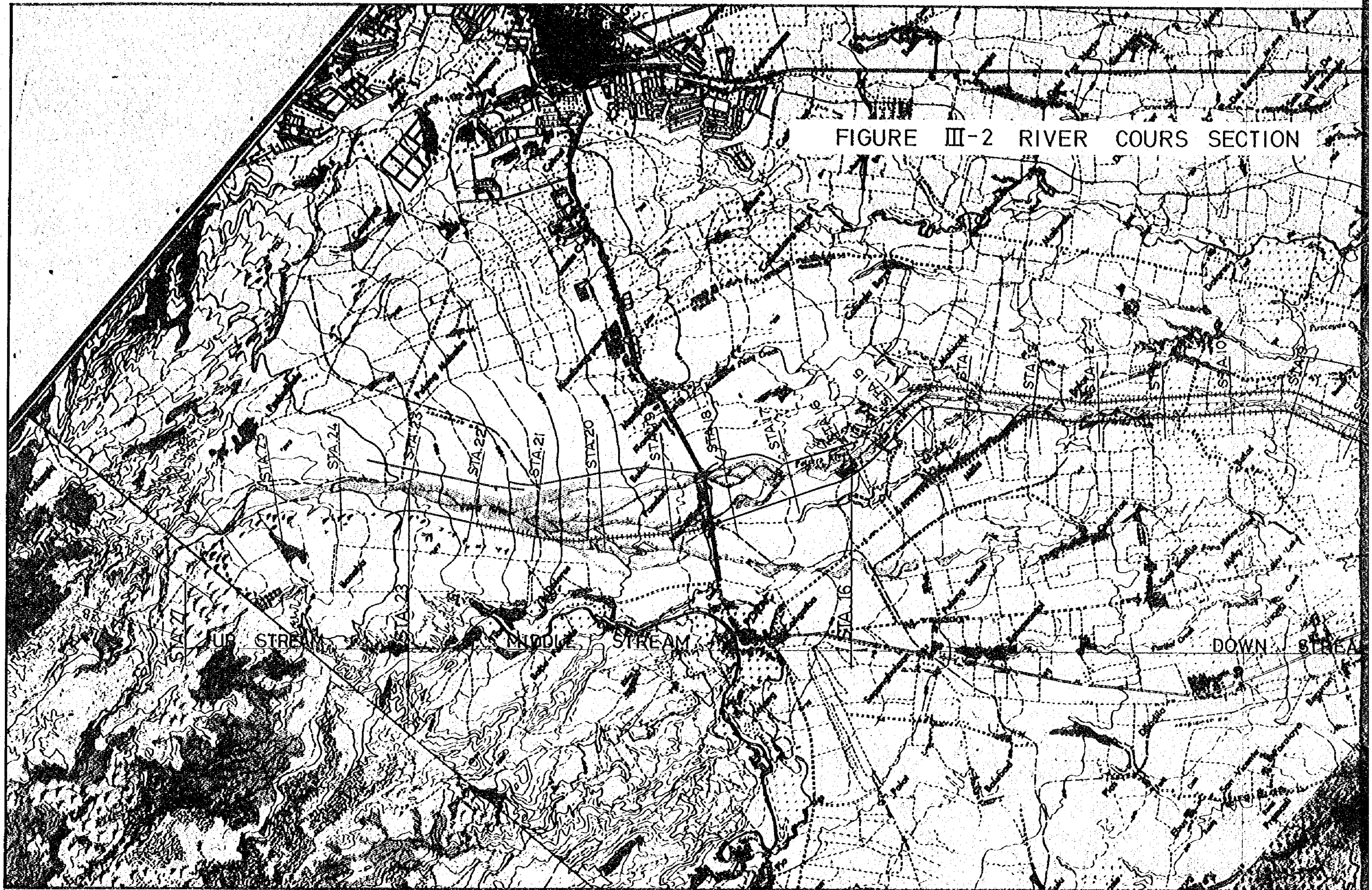
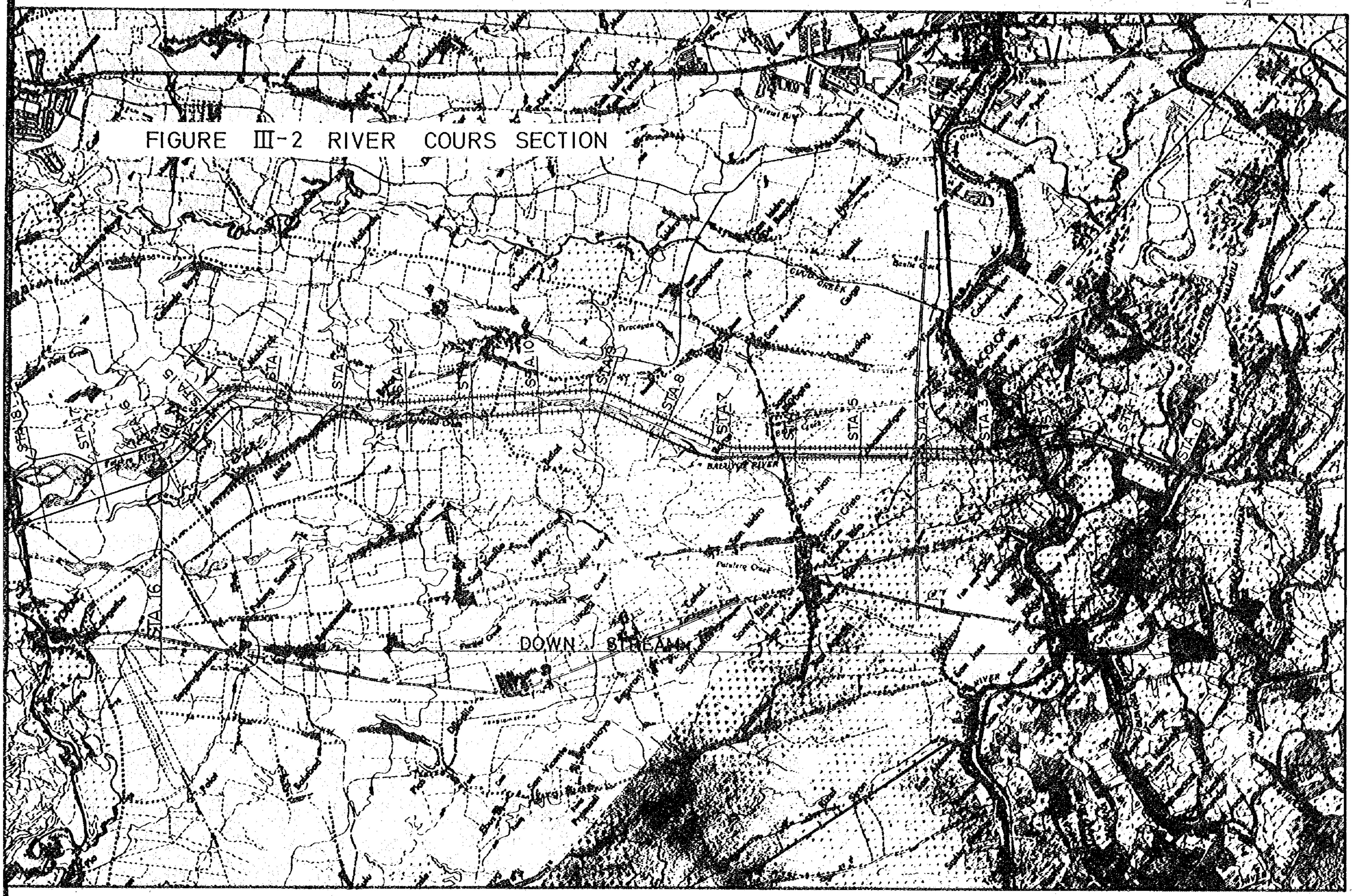


FIGURE Ⅲ-2 RIVER COURS SECTION

FIGURE III-2 RIVER COURS SECTION



than it is now, and during flooding the river flow goes down out of the river channel, though the river bed is now lower than before. However, it is possible as in the past that the flow goes down out of the river channel during flooding depending upon the runoff sediment in the past flooding. Gravels of more than 10 cm in diameter can be observed among the runoff sediment from the mountains, which cause severe impact on the banks during flooding.

The middle stream, upto the existing embankment, is 300 to 800 m wide and have its bed slope 1/70 to 1/100, and presently functions as a sand arresting basin. A turbulent flow or a biassed flow is more likely to occur because the river bed is wide and the sediment is usually measured to be 10 to 20 cm thick. At present aggregate for construction work is obtained in this area. In 1977, the turnouts of aggregate amounted to 846,000 cubic meter.

The lower stream with embankment has some surplus within the river course, thus it causes a biassed flow. The part of levee where the levee crosses the old river course after completion of its construction, is a weak point of the river to be easily broken as a result of the co-influence with the errosion by the inner water. The stream lower than the bridge that is now under construction at the lower most part of the Bacolor has no Levee and is now planning to construct a levee. The river breadth of the overstream of STA.7 is 350 m and it flows with 200 m width, but the river breadth decreases along the flow, thus it is naturally imagined that the stream transport the sediment to the lower stream. The bed slope is 1/100 to 1/1500. The revetment of the Levee at right bank has been completed upto STA.4+300 to STA.13+50 and at left levee upto STA.4+300 to STA.14+500. On the curved river course a groyne of 5 m is constructed at some distance apart.

Sediment of about 835,000 cubic meter is reported to be flowed down from the mountainous area of the upper stream and sedimented near the Macatian Bridge during flooding in 1973.

2-2 River Bed Materials

The cross-section survey of the river has been executed every 1 km along it. Various soil tests of the materials collected from the river bed at points of the high water channel and the low water channel on a survey line are executed in the laboratory of B.P.W. The results will be shown on TABLE III-1 and on FIGURE III-3-1.

1. Collection of Specimen

A square of 1 m by 1 m is decided to be the area where the specimen is to be collected. The top layer of 30 cm of the area will be removed, and then soil of 50 cm depth below the top layer was dug out and was collected 60 kg of soil as the specimen according to quartation method. The specimen was kept in a bag and transported to the laboratory of B.P.W. in Manila, thus keeping the moisture content of the specimen unchanged.

2. Articles of Test

i) Analysis of Grain: All specimens (66 specimens)

ii) Specific Gravity: All specimens (66 specimens)

iii) Moisture Content: 2 specimens every even number of kilo meters along the river (32 specimens)

iv) Bulk Specific Gravity: 5 specimens (10K(L), 19K(L), 21K(H), 21K(L), 32K(L))

v) Moisture Content, Specific Gravity, Bulk Specific Gravity for every grain of soil: 3 specimens (2KL, 23KL, 31KL)

3. Method of Tests

i) Analysis of Grain

Most part of specimens are analysed with the shieve analysis alone, but specimens which contain fairly amount of silt and/or clay were analysed with the Hydrometer Analysis.

ii) Specific Gravity

The Specific Gravity was calculated according to the following formula.

$$\rho = \frac{dw\ (Ws - Wa)}{(Ww + Ws - Wa - Wsw)}$$

where

ρ = Specific Gravity

W = Specific Gravity of water (0.995646)

Wa = Weight of flask filled with air

Ww = Weight of flask filled with water

Ws = Weight of falsk partially filled with soil

Wsw = Weight of flask when completely filled with soil and water

iii) Moisture Content

The moisture content was calculated according to the following formula.

$$M(\%) = \frac{Ww - Wd}{Wa} \times 100$$

where

Ww = Weight of soil

Wd = Weight of dried soil

iv) Bulk Specific Gravity

The Bulk Specific Gravity was particularly measured, because some sorts of gravel looked porus.

$$Gb = \frac{dW\ (Wods)}{Wsa - Wsw}$$

where

Gb = Bulk Specific Gravity

dW = Density of water (0.995646)

Wods = Oven dry weight of soil

Wsw = Net weight of soil in water

The Bulk Specific Gravity was measured for the specimens of the grain of 3 cm, 2 cm, 1 cm and 0.05 cm respectively.

v) Measurement of Moisture Content, Specific Gravity and Bulk Specific Gravity for every grain

The Moisture Content, Specific Gravity and Bulk Specific Gravity were measured for every size of grain of 19.05 mm, 9.53 mm, 4.75 mm, 2.50 mm, 2.38 mm, 1.19 mm, 0.69 mm, 0.297 mm, 0.149 mm and 0.074 mm.

4. Test Resuts

The test results will be shown on FIGURE III-3 to FIGURE III-9.

i) Grain Size

As is shown on FIGURE III-3, the grain size in the high water channel is composed of as follows;

0 - 4 km	Clayey silt
5 - 18 km	Midium grained sand

19 - 27 km	midium to coarse grained sand
28 - 32 km	gravel & sand

And the grain size in low water channel is composed of as follows;

0 - 4 km	Clayey silt
5 - 13 km	midium sand
14 - 26 km	midium sand or coarse sand
27 - 32 km	gravel

As is shown above, the distribution of grain in high water channel and low water channel are almost the same. However, the coarse sand is distributed upto lower stream in low water channel than high water channel.

ii) Specific Gravity

It is possible to measure only the Bulk Specific Gravity with the abovementioned method for the soil that contains gravel. However, it is possible to measure the True Specific Gravity with the some method for the soil that is composed of midium sand, since the grain in this specimen becomes as small as the composition unit of a rock. The Specific Gravity of the specimen has a little less value than the True Specific Gravity as it contains some gravel. The results obtained are shown on FIGURE III-4 and on FIGURE III-5.

FIGURE III-4 shows the frequency distribution of the Specific Gravity. The greatest frequency is 2.62 and 2.64. The minimum is 2.15 and the maximum is 2.83. The mean value is 2.57 which is less than the normal mean value, that is, 2.65, because in the specimen there is contained some gravel, out of which some are pumiceous and quite porus.

The test results of the Bulk Specific Gravity of the gravel will be shown on the following page. The measured value of the Bulk Specific Gravity at the cross-section survey points taken every 1 km measured from the confluence with the Gua-Gua River will be shown on FIGURE III-5. Some different tendency between specimens taken at points of 15 km and 17 km can be seen from the FIGURE III-5; sedimentation at both points seem to be caused during different flooding. Between points of 32 km and 16.5 km from the confluence, the Specific Gravity of the sediments becomes greater along the flow of the river. This can be explained that on the upper stream the admixed ratio of the gravel is greater than the lower stream and the Specific Gravity is rather far from the True Specific Gravity but near to the Bulk Specific Gravity.

Between points of 16.5 km and 5 km from the confluence, the Specific Gravity of the sediments becomes greater along the flow of the river, but it becomes less on the lower stream lower than 5 km. This can be explained that the increase of the Specific Gravity of sediment along the flow of the river between 16.5 km and 5 km can be derived of the same reason as aforementioned. However, the decrease of the Specific Gravity of the sediment of the lower stream lower than 5 km can be explained that the sediment contains the more silt and clay, which have less Specific Gravity, where the flow of the river becomes the lower.

From the explanation mentioned above, it is understood that the sediments of the upper stream and that of the lower stream of the 16.5 km point are transported during different floodings with different tractive forces.

iii) Bulk Specific Gravity

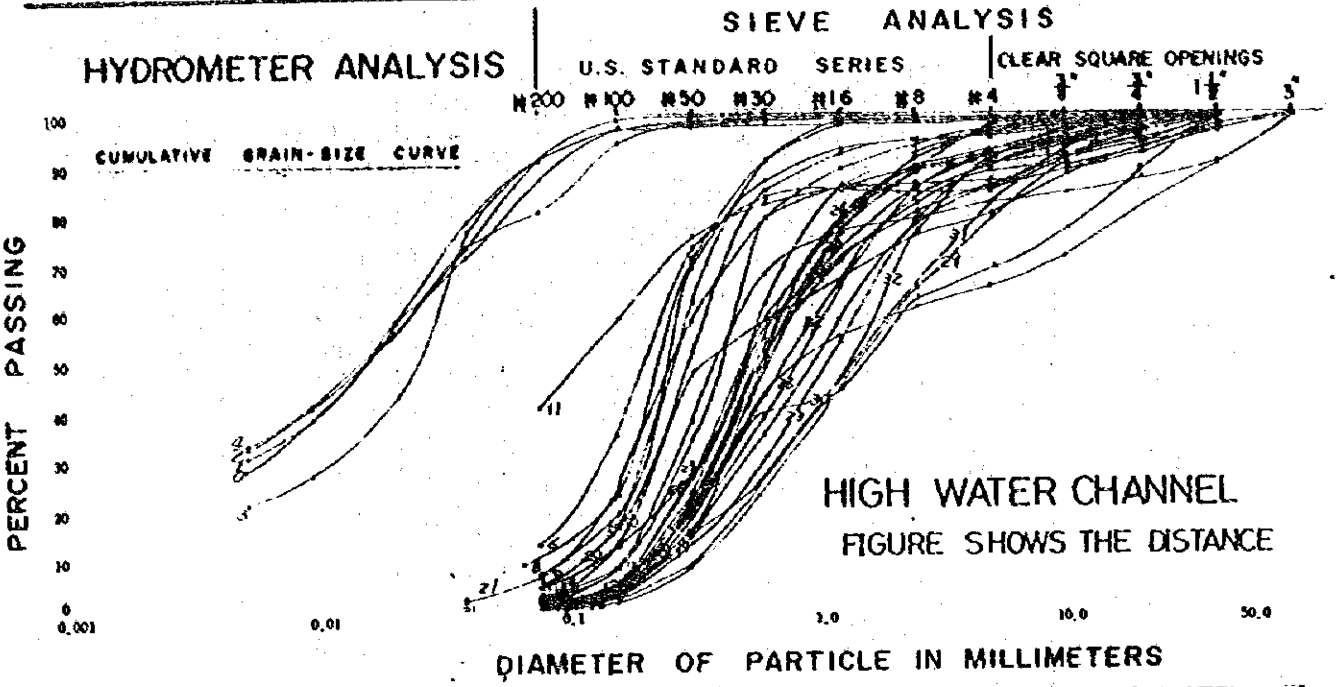
The results of the tests for each grain will be shown on FIGURE III-9 . The grain of 0.05 cm is thought to be midium grain and to III-9 the True Specific Gravity. Therefore, the grain of 3 cm, 2 cm and 1 cm was examined; the results show that the minimum is 1.46, the maximum is 2.58 and the mean value is 2.19. It is believed that the great difference between the maximum and the minimum value is derived from the different species of gravel; the sediment with the maximum Specific Cravity is mostly composed of usual andesite and that with the minimum is composed of Porus dacites or pumice.

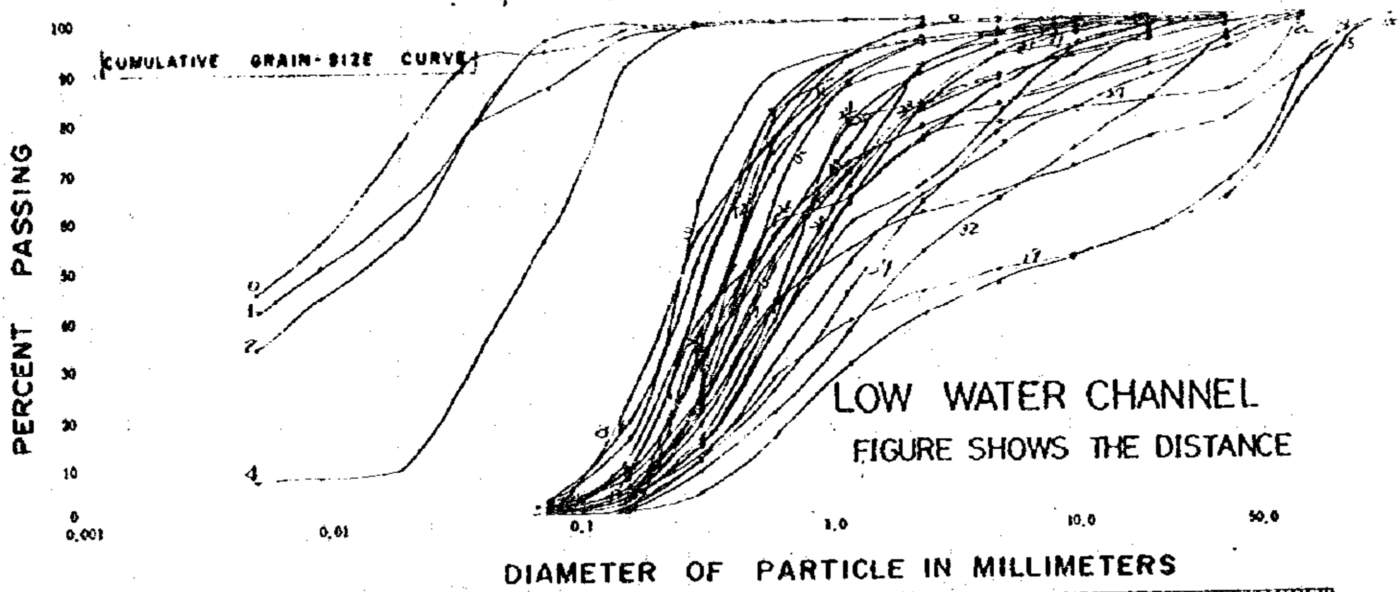
Table III-1 PASIG POTRERO EROSION FLOOD CONTROL PROJECT
LIST OF RIVER BED MATERIAL SAMPLES

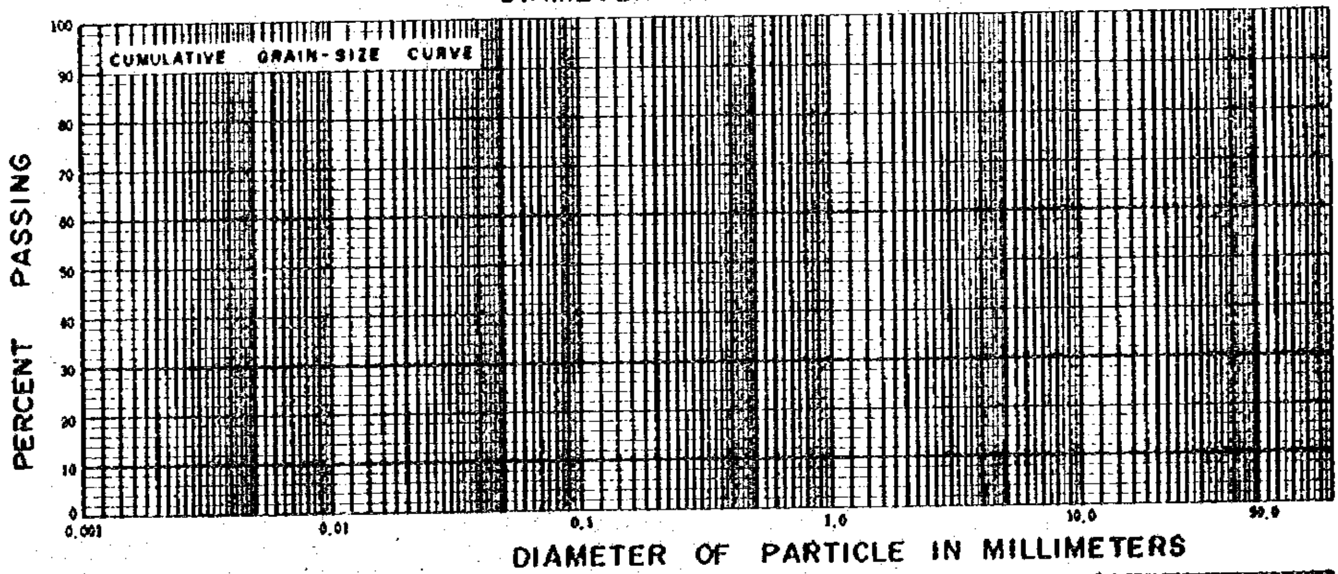
BM No.	Sample No.	Sample Site
BM-000	S-26	High water channel 13m from left bank
"	S-27	Low water channel
BM-1+000	S-42	High water channel 5m from left bank
"	S-29	Low water channel 4m from right bank
BM-2+000	S-28	High water channel 5m from left bank
"	S-25	Low water channel 5m from right bank
BM-3	S-50	High water channel 60m from left bank
"	S-32	Low water channel 20m from right bank
BM-4	S-51	High water channel 65m from right bank
"	S-33	Low water channel 45m from left bank
BM-5	S-40	High water channel 70m from right bank
"	S-48	Low water channel 24m from left bank
BM-6	S-37	High water channel 47m from left bank
"	S-39	Low water channel 18m from left bank
BM-7	S-62	High water channel 50m from right bank
"	S-35	Low water channel 24m from left bank
BM-8	S-41	High water channel 100m from right bank
"	S-31	Low water channel 38m from left bank
BM-9	S-43	High water channel 52m from left bank
"	S-36	Low water channel 18m from left bank
BM-10	S-49	High water channel 89m from right bank
"	S-21	Low water channel 148m from right bank
BM-11	S-23	High water channel 113m from left bank
"	S-64	Low water channel 39m from left bank
BM-12	S-38	High water channel 205m from left bank
"	S-65	Low water channel 145m from left bank
BM-13	S-56	High water channel 173m from left bank
"	S-46	Low water channel 126m from left bank
BM-14	S-34	High water channel 82m from left bank
"	S-57	Low water channel 18m from left bank
BM-15	S-66	High water channel 72m from left bank
"	S-63	Low water channel 50m from left bank
BM-16	S-58	High water channel 69m from left bank
"	S-30	Low water channel 46m from left bank
BM-17	S-53	High water channel 55m from left bank
"	S-47	Low water channel 13m from left bank
BM-18	S-15	High water channel 103m from left bank
"	S-11	Low water channel 43m from left bank
BM-19	S-13	High water channel 193m from left bank
"	S-19	Low water channel 124m from left bank
BM-20	S-18	High water channel 175m from right bank
"	S- 9	Low water channel 199m from right bank
BM-21	S-17	High water channel 283m from right bank
"	S-10	Low water channel 198m from right bank
BM-22	S-20	High water channel 217m from right bank
"	S-16	Low water channel 176m from right bank
BM-23	S-52	High water channel 195m from left bank
"	S-44	Low water channel 200m from left bank
BM-24	S-59	High water channel 225m from left bank
"	S-54	Low water channel 95m from left bank
BM-25	S-24	High water channel 171m from left bank
"	S-60	Low water channel 84m from left bank
BM-26	S-61	High water channel 107m from left bank

BM No.	Sample No.	Sample Site
BM-26	S-55	Low water channel 42m from left bank
BM-27	S- 6	High water channel 60m from left bank
"	S-12	Low water channel 29m from left bank
BM-28	S-14	High water channel 76m from left bank
"	S- 8	Low water channel 35m from left bank
BM-29	S- 3	High water channel 4m from left bank
"	S- 5	Low water channel 4m from right bank
BM-30	S- 4	High water channel 2m from left bank
"	S- 7	Low water channel 5m from right bank
BM-31	S- 2	High water channel 10m from left bank
"	S- 1	Low water channel 23m from left bank
BM-32	S-45	High water channel 23m from left bank
"	S-22	Low water channel 4m from right bank

FIGURE III-3-1 GRAIN SIZE DISTRIBUTION



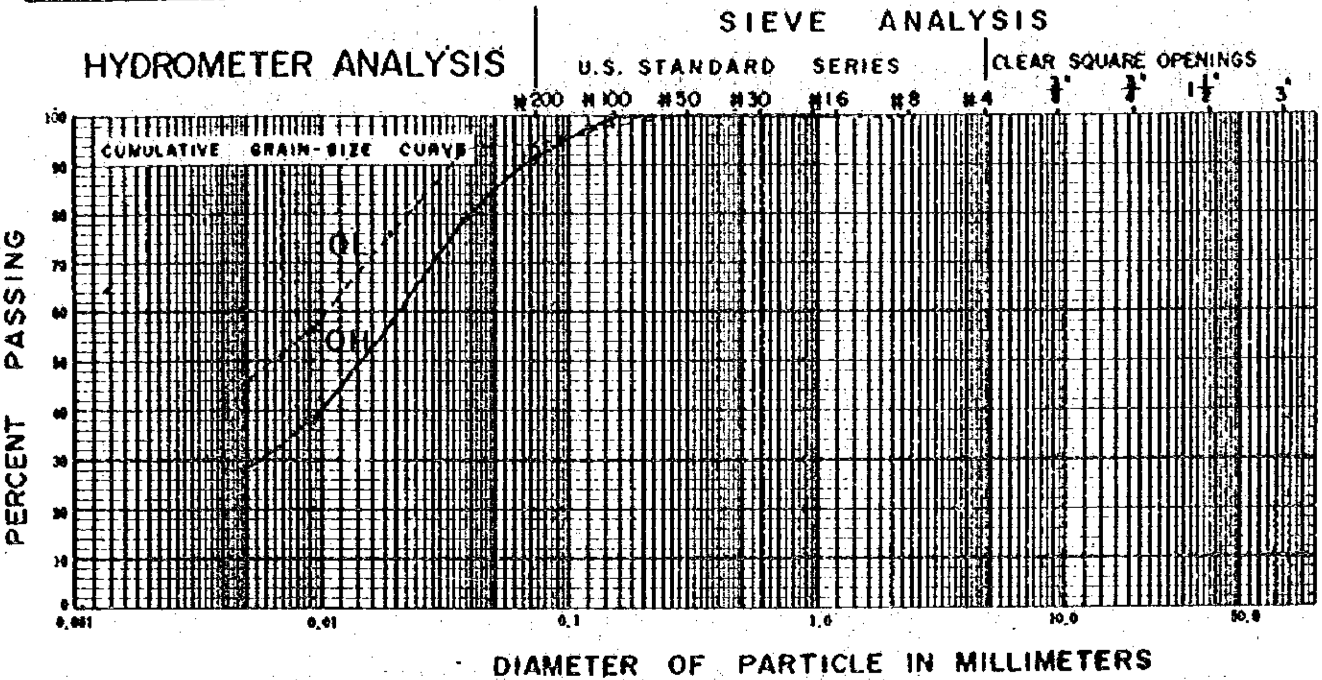


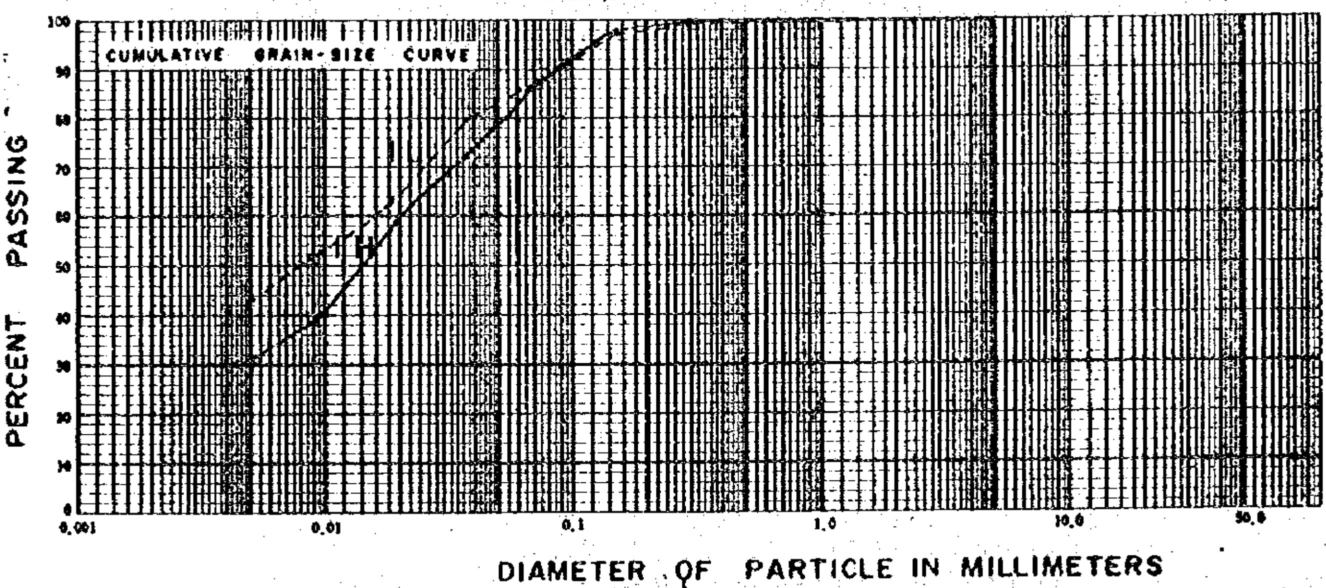


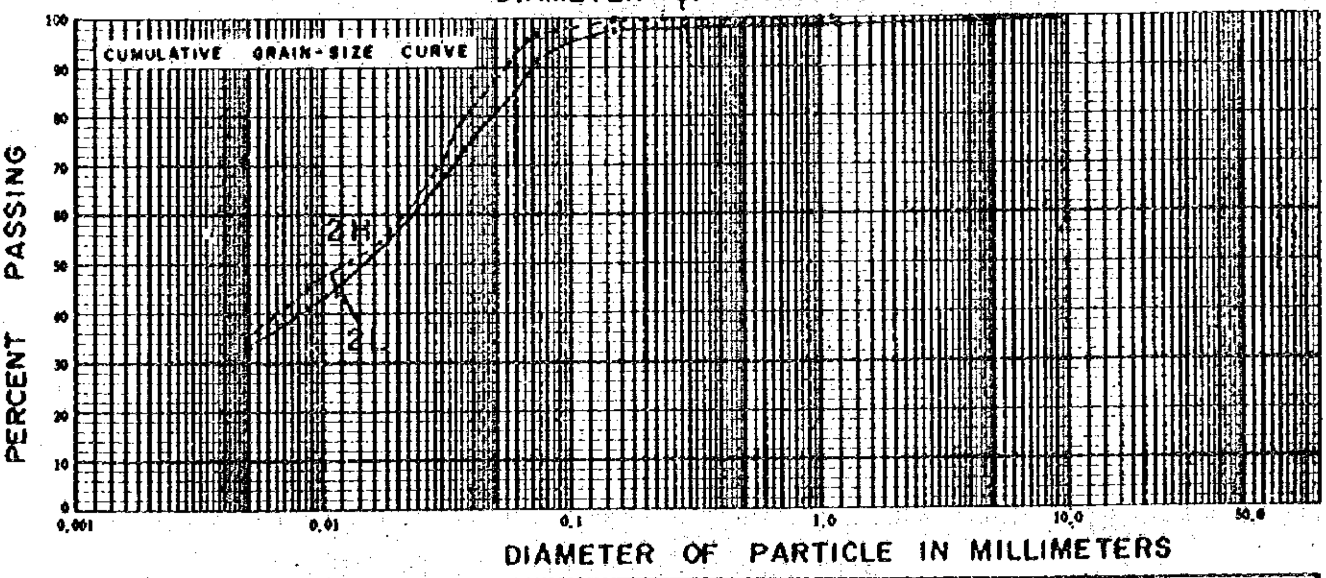
CLAY & SILT		SAND			GRAVEL		
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

FIGURE

III -3-2 GRAIN SIZE DISTRIBUTION



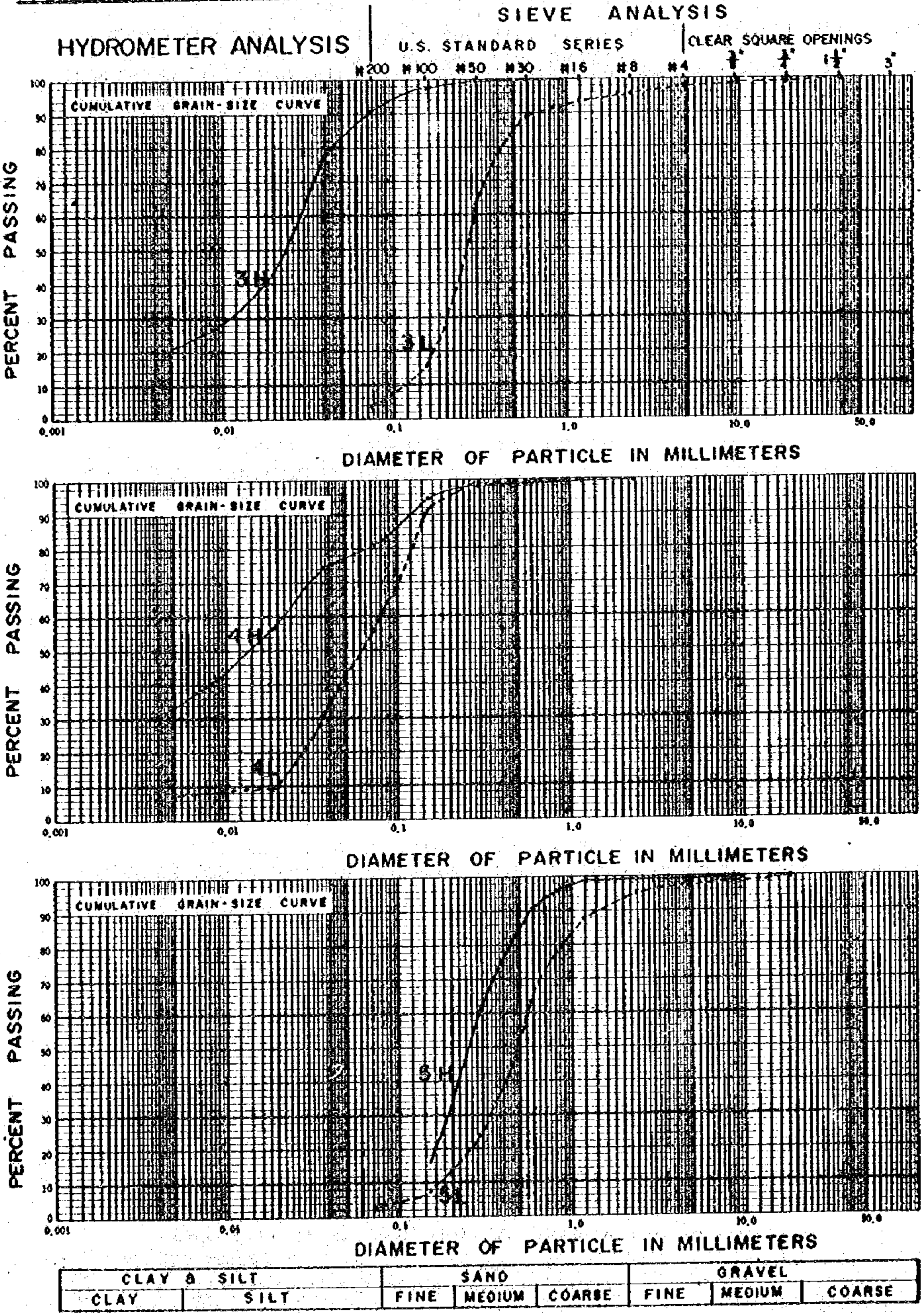




CLAY & SILT		SAND			GRAVEL		
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

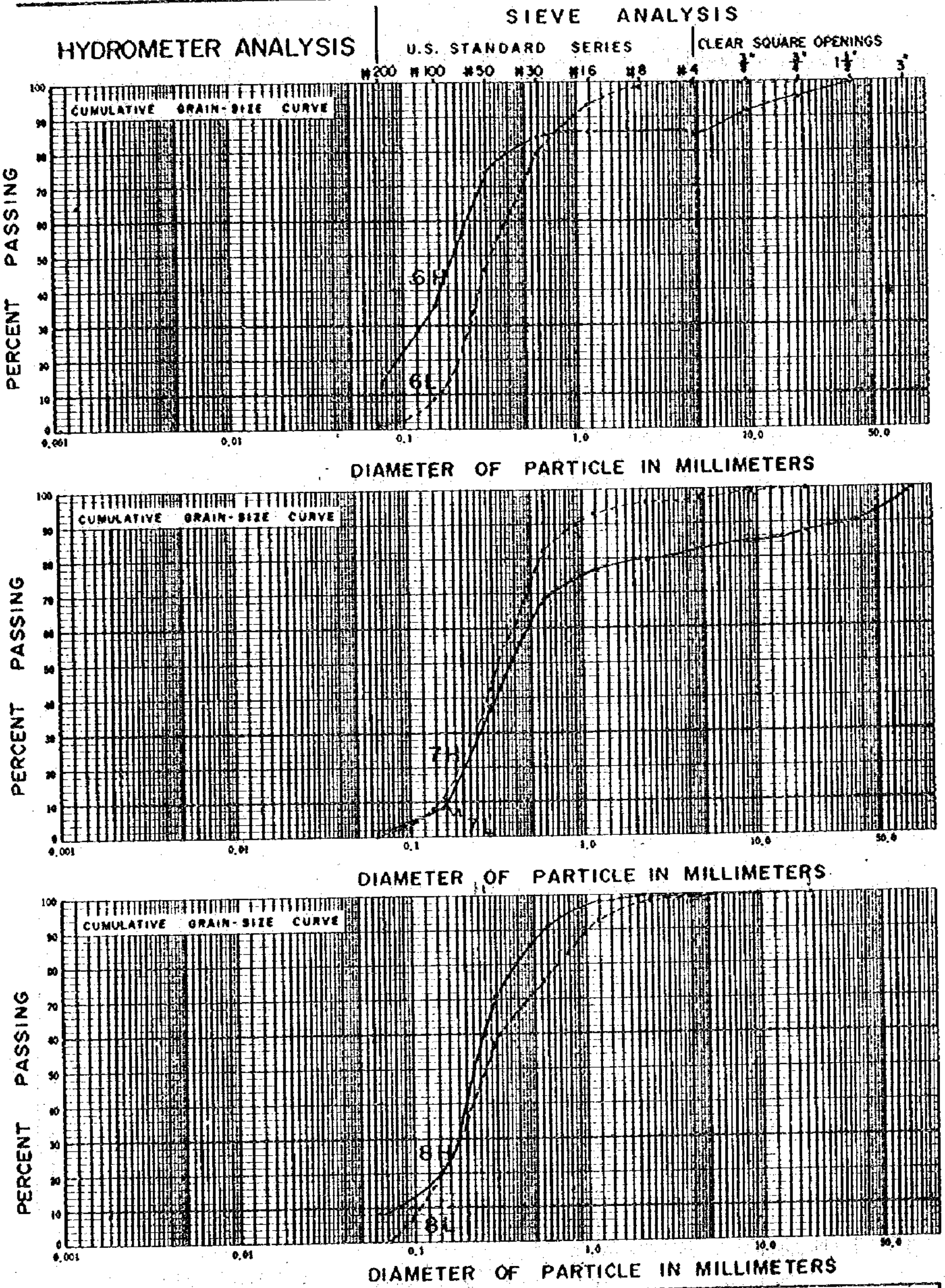
FIGURE

III -3-3 GRAIN SIZE DISTRIBUTION



FIGURE

III-3-4 GRAIN SIZE DISTRIBUTION



CLAY & SILT		SAND			GRAVEL		
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

FIGURE

III-3-5 GRAIN SIZE DISTRIBUTION

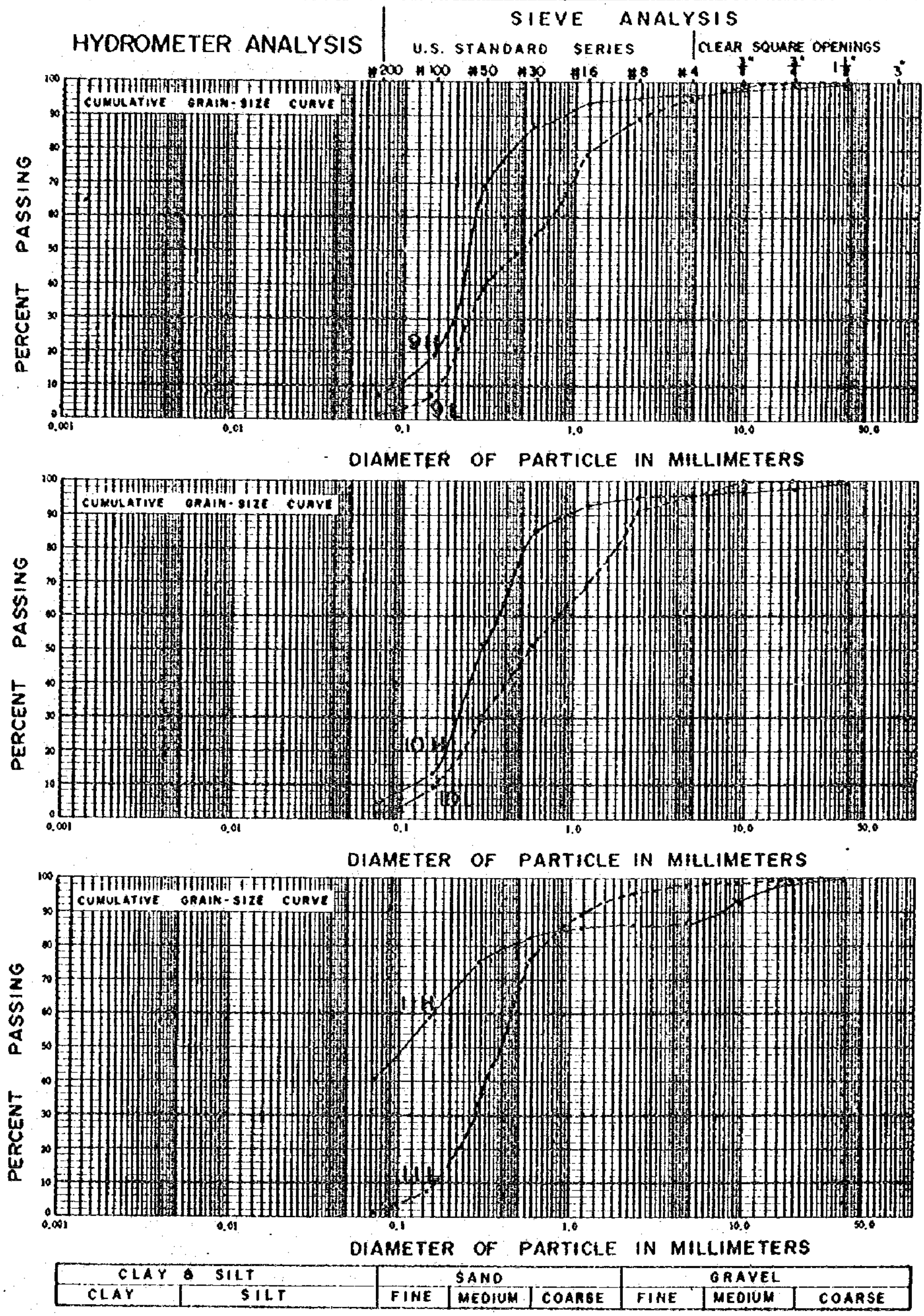
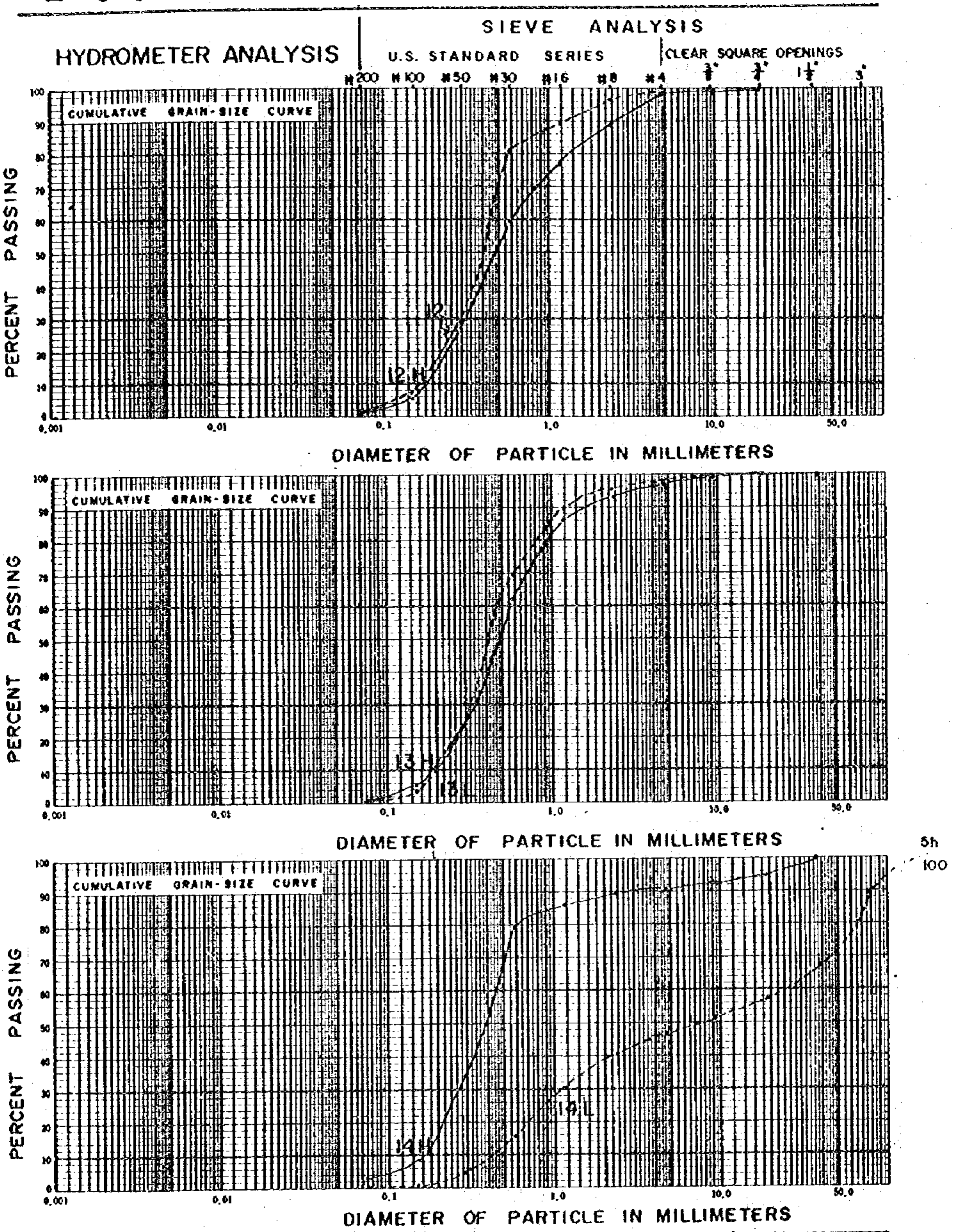


FIGURE III -3-6 GRAIN SIZE DISTRIBUTION



CLAY & SILT		SAND			GRAVEL		
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

FIGURE
III -3-7 GRAIN SIZE DISTRIBUTION

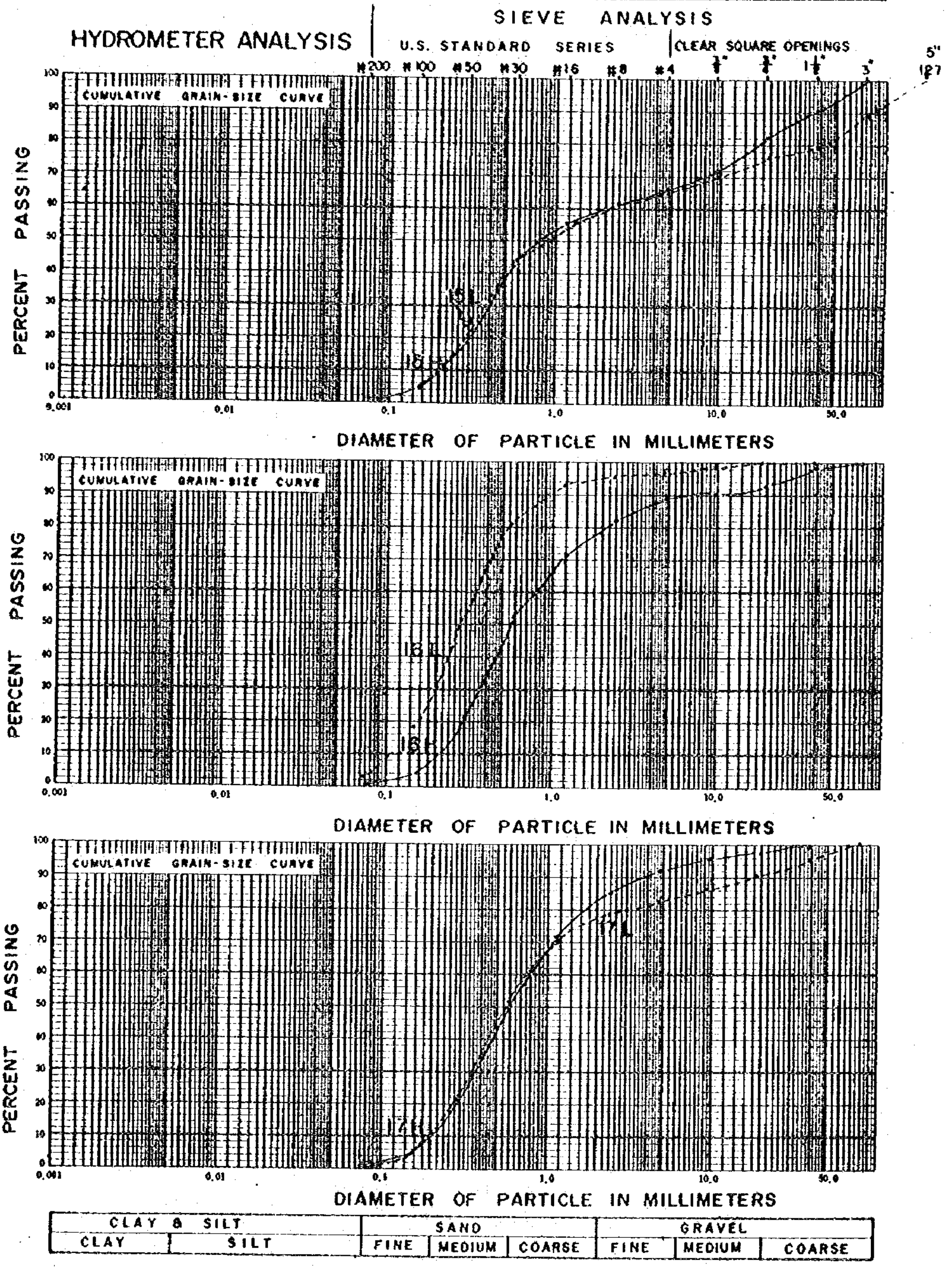


FIGURE II -3-8 GRAIN SIZE DISTRIBUTION

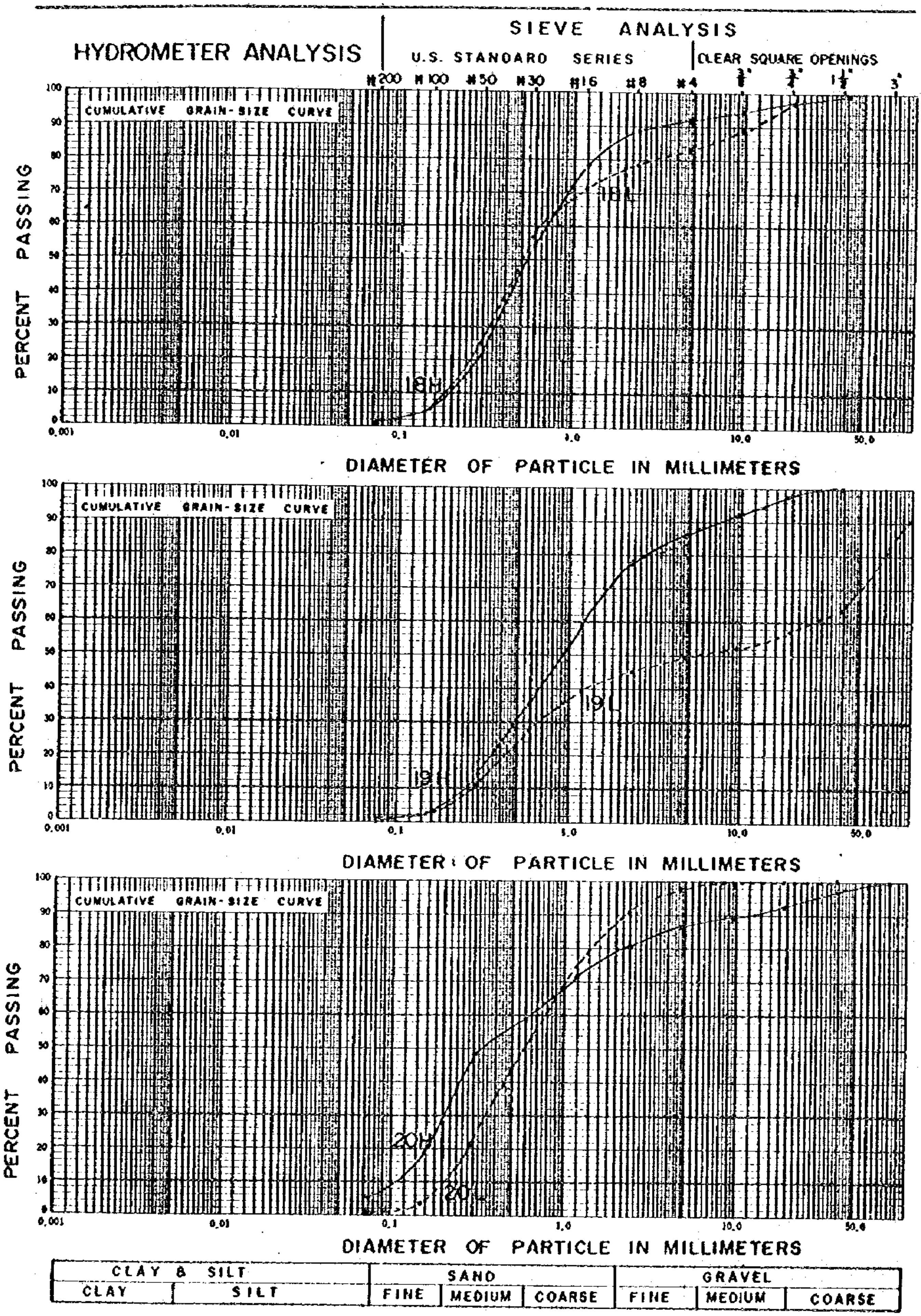


FIGURE
III-3-9 GRAIN SIZE DISTRIBUTION

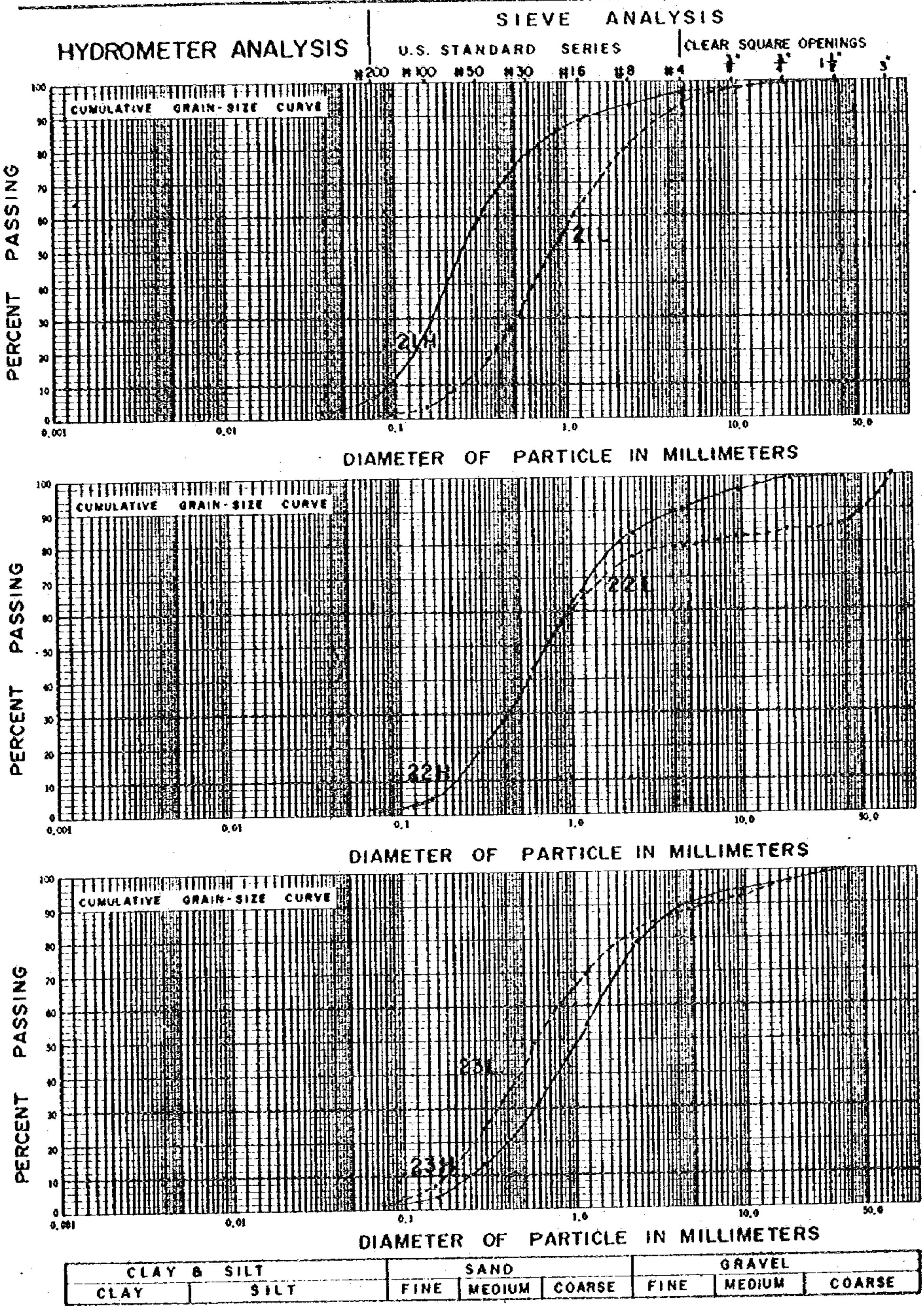


FIGURE
III-3-10 GRAIN SIZE DISTRIBUTION

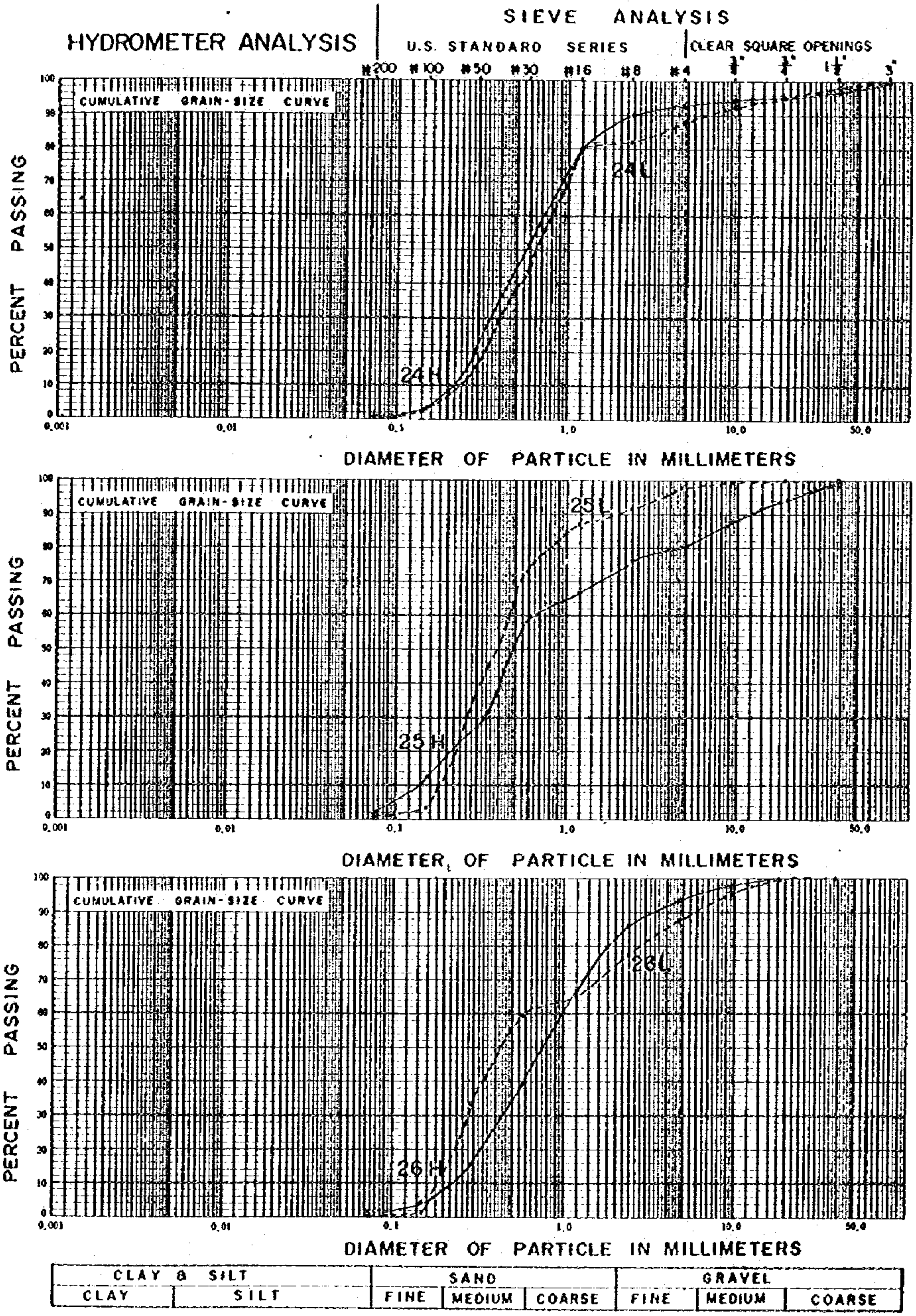


FIGURE
Ⅲ-3-11 GRAIN SIZE DISTRIBUTION

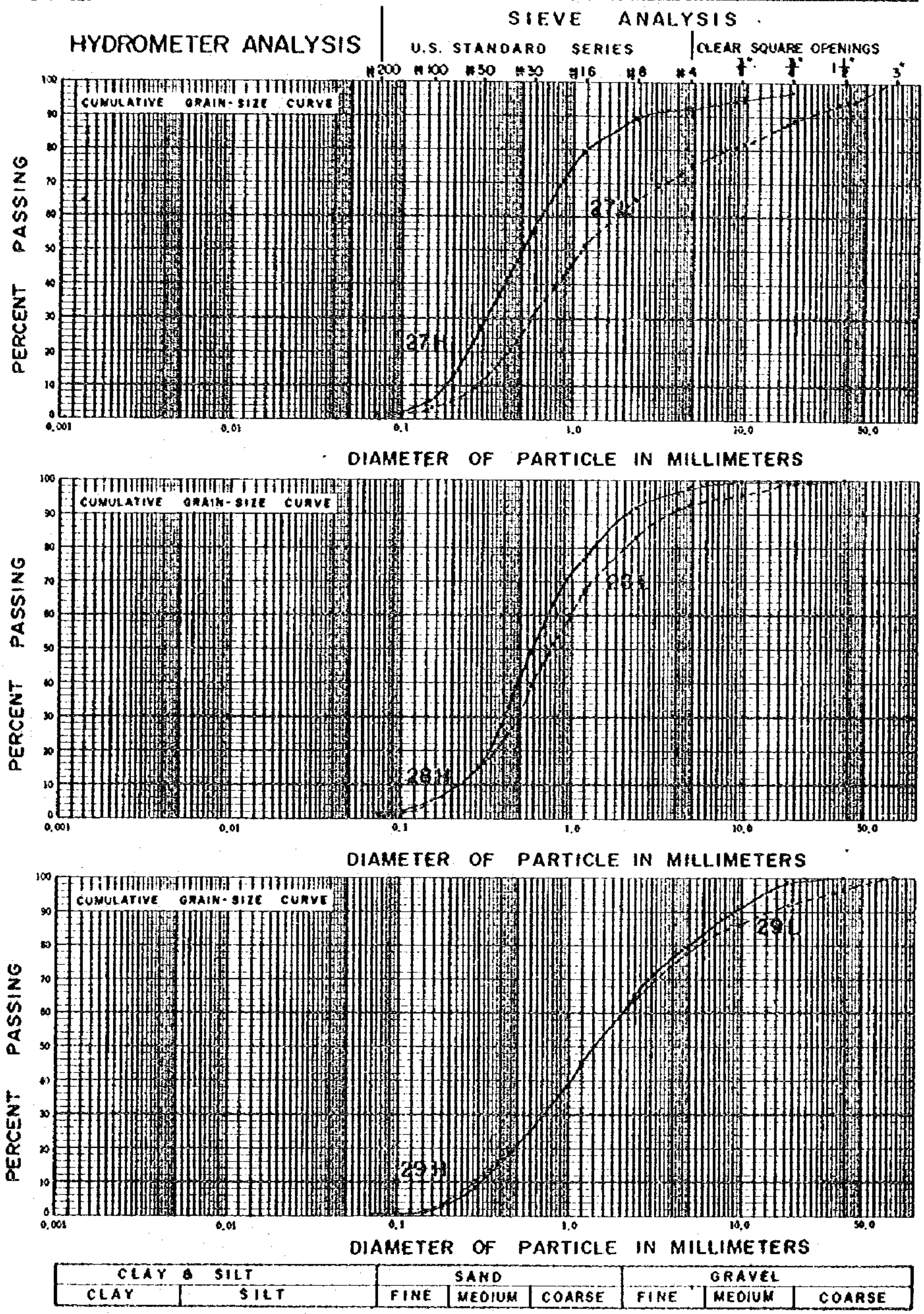


FIGURE
III -3-12 GRAIN SIZE DISTRIBUTION

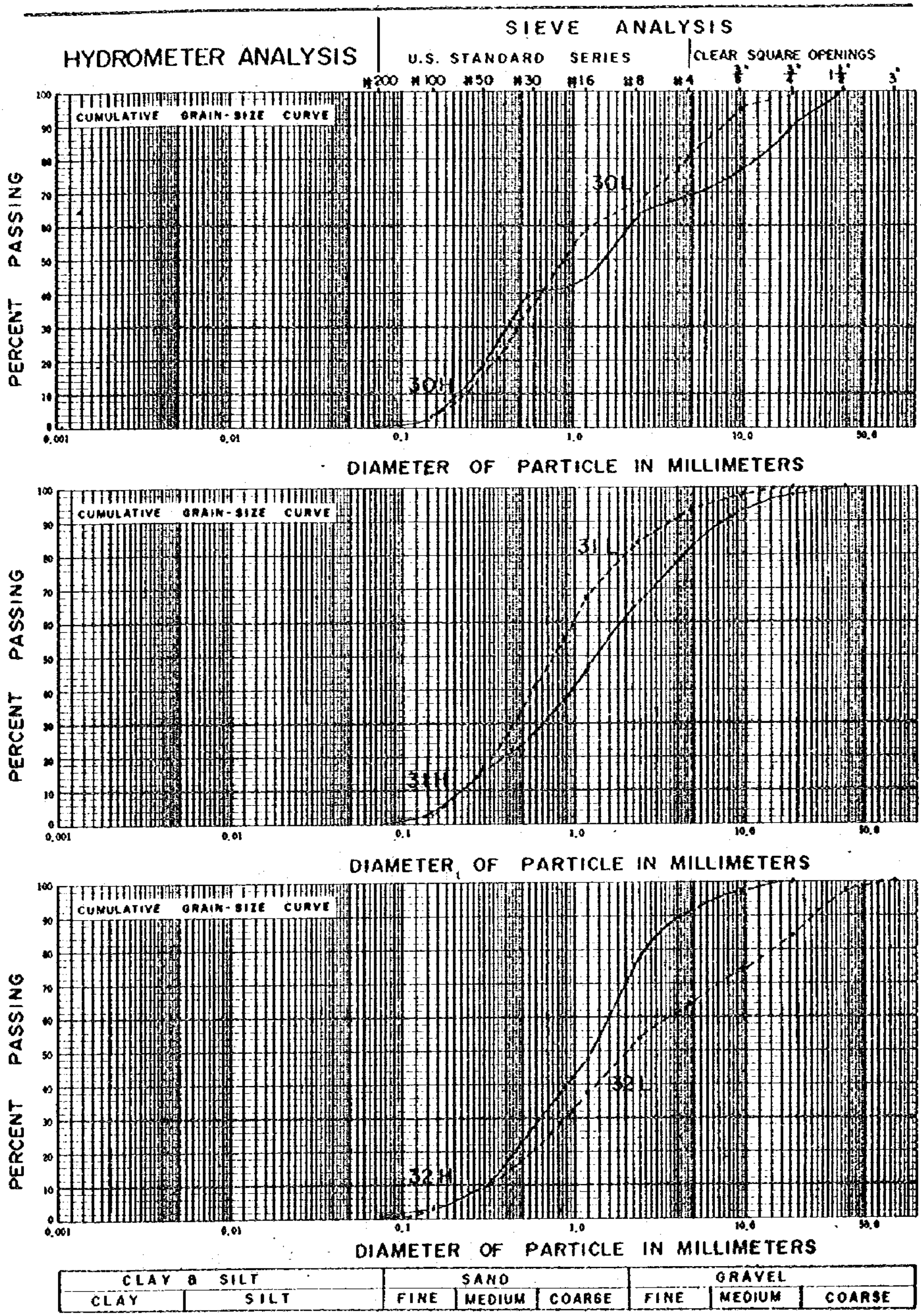


FIGURE Ⅲ-4 SPECIFIC GRAVITY (FREQENCY)

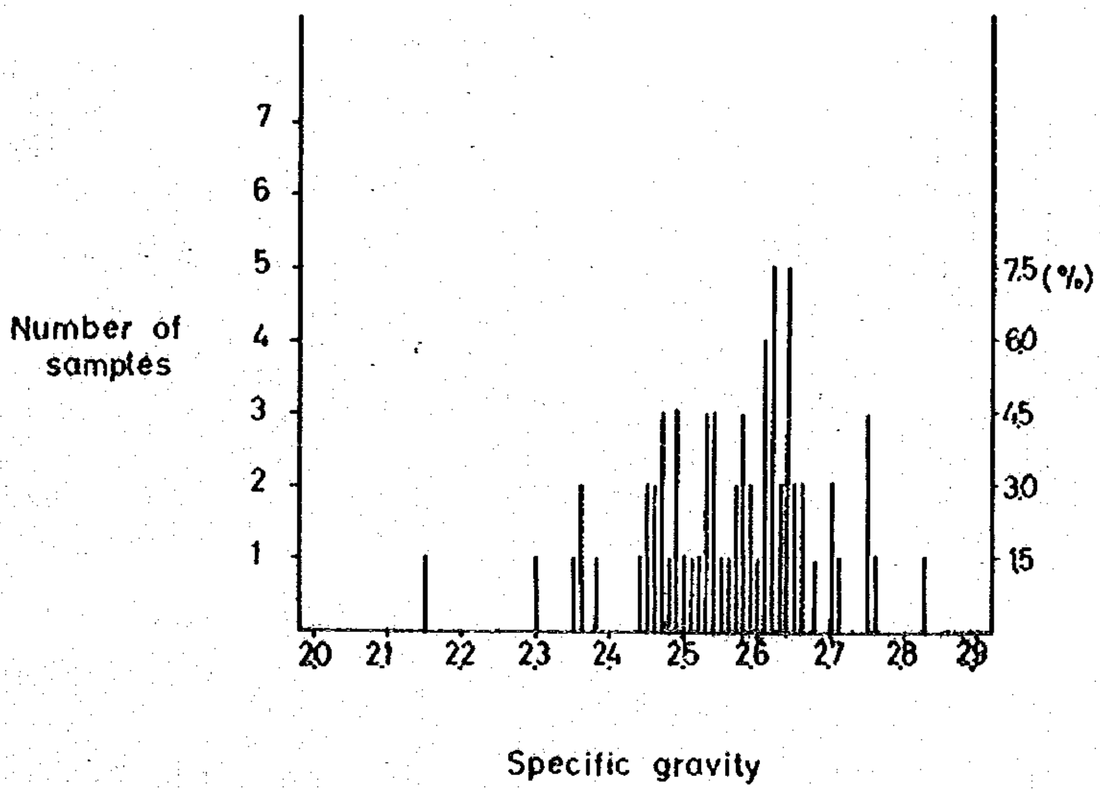


FIGURE Ⅲ-5 SPECIFIC GRAVITY (LONGITUDINAL DISTRIBUTION)

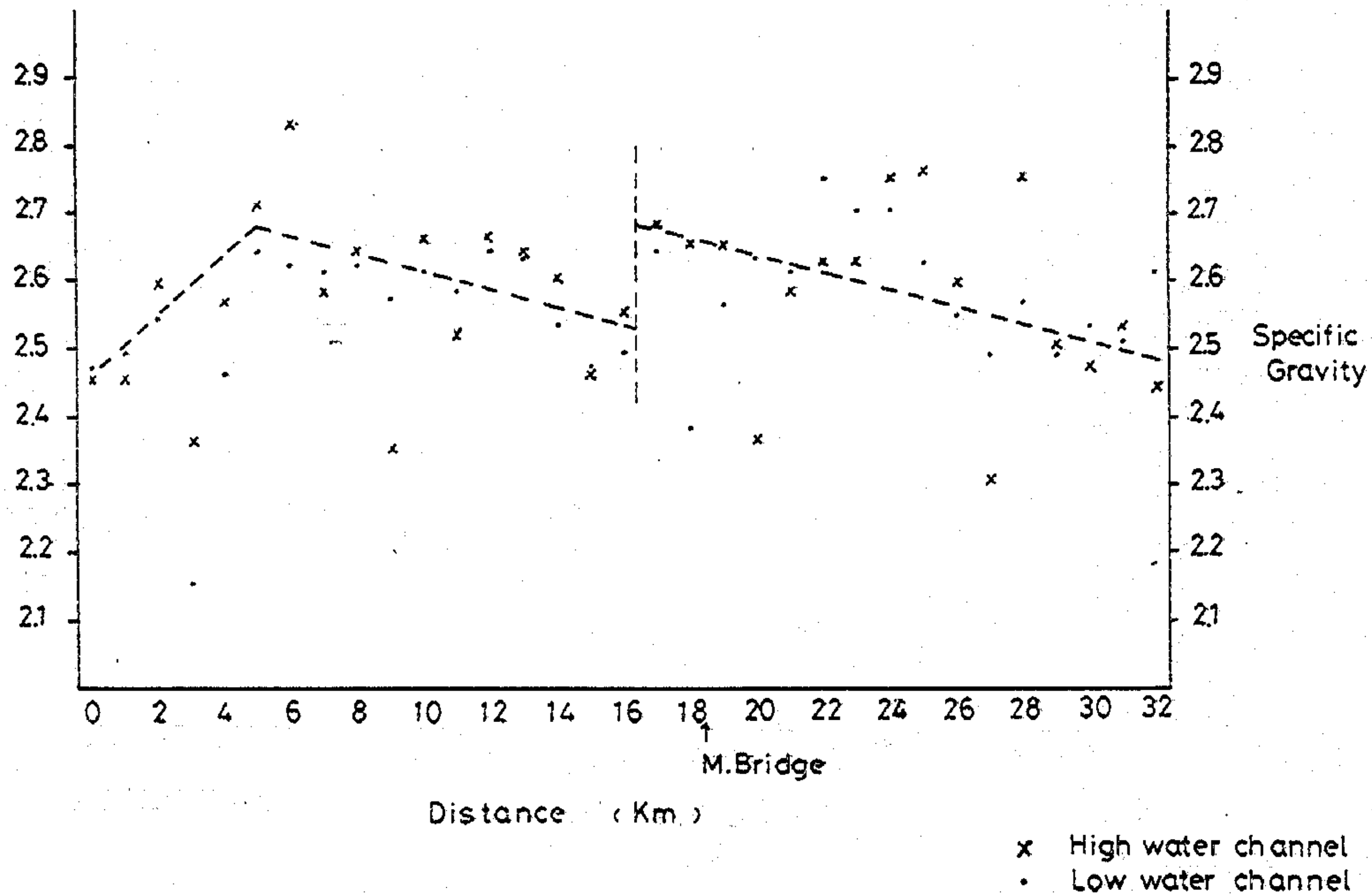


FIGURE Ⅲ - 6 MOISTURE CONTENT

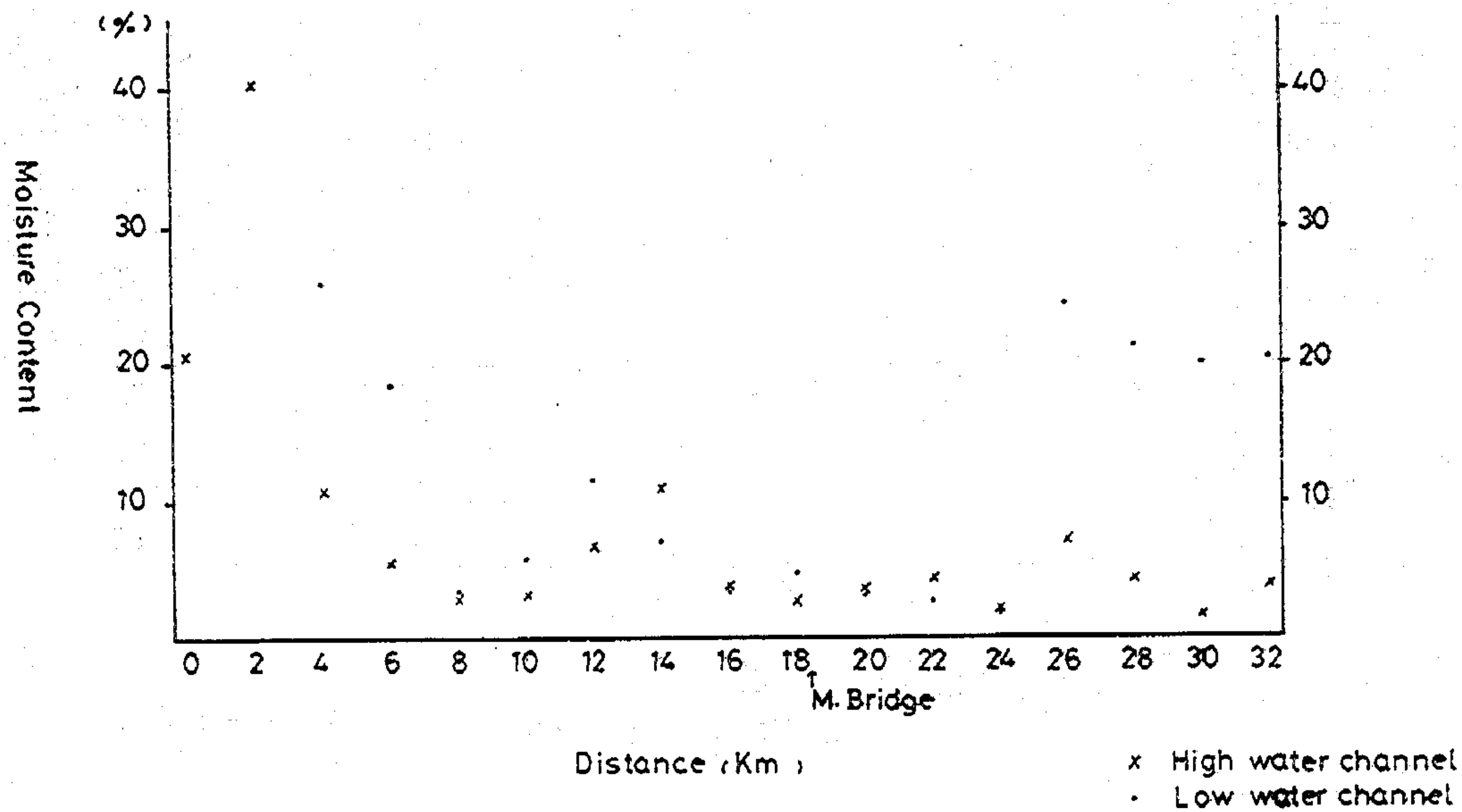


FIGURE III-7 COEFFICIENT OF UNIFORMITY

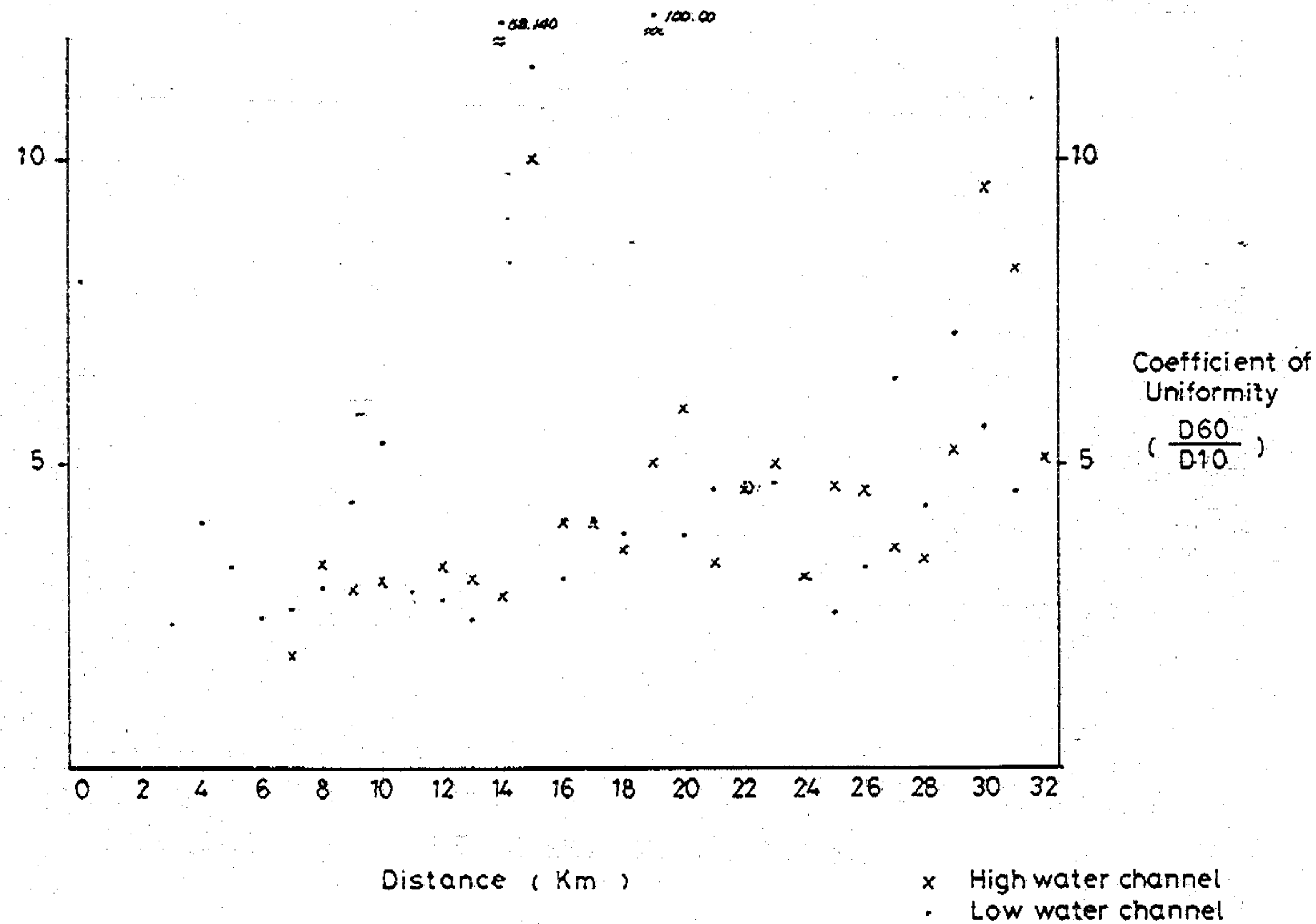


FIGURE Ⅲ-8 COEFFICIENT OF CURUETURE

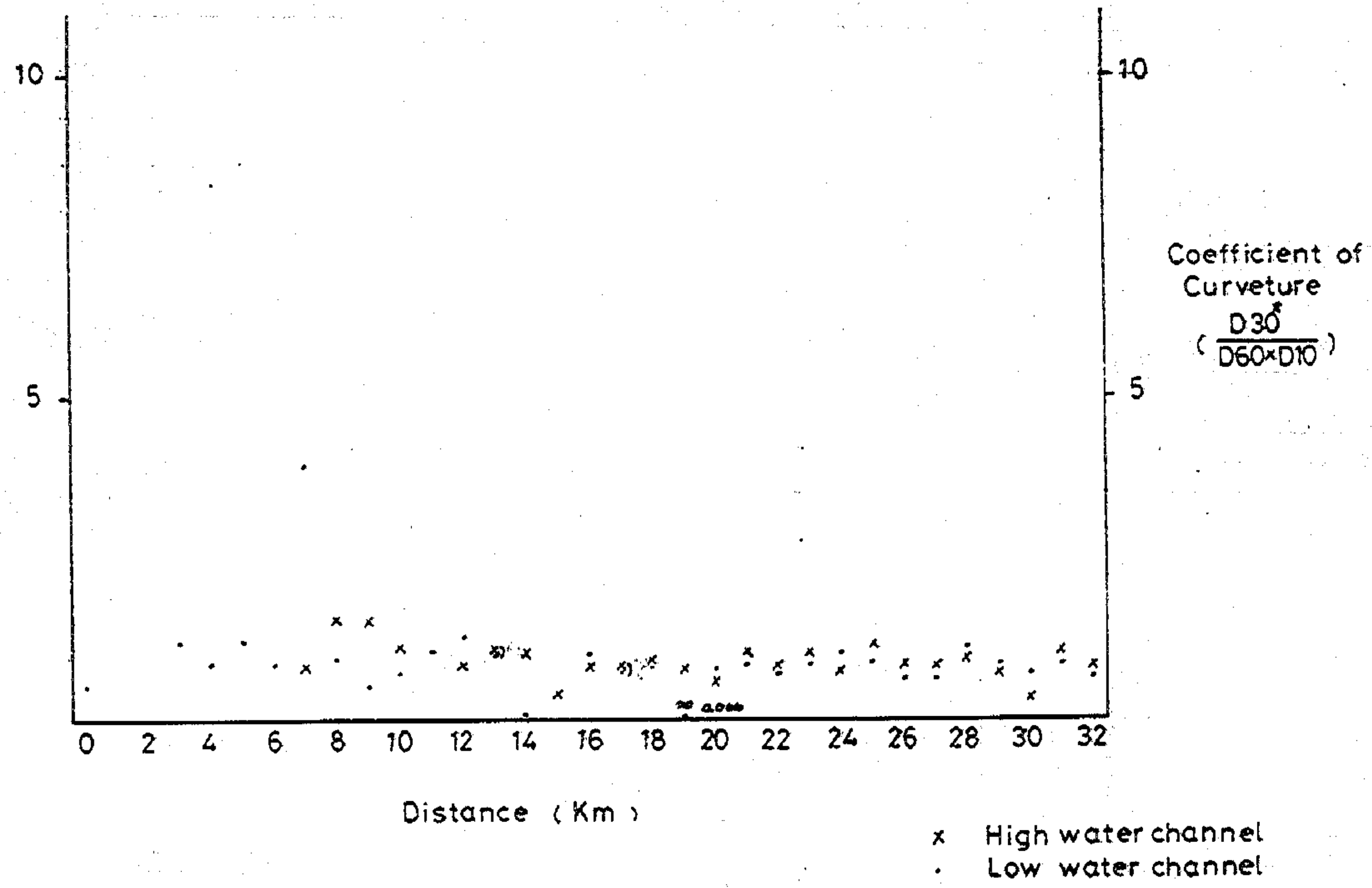
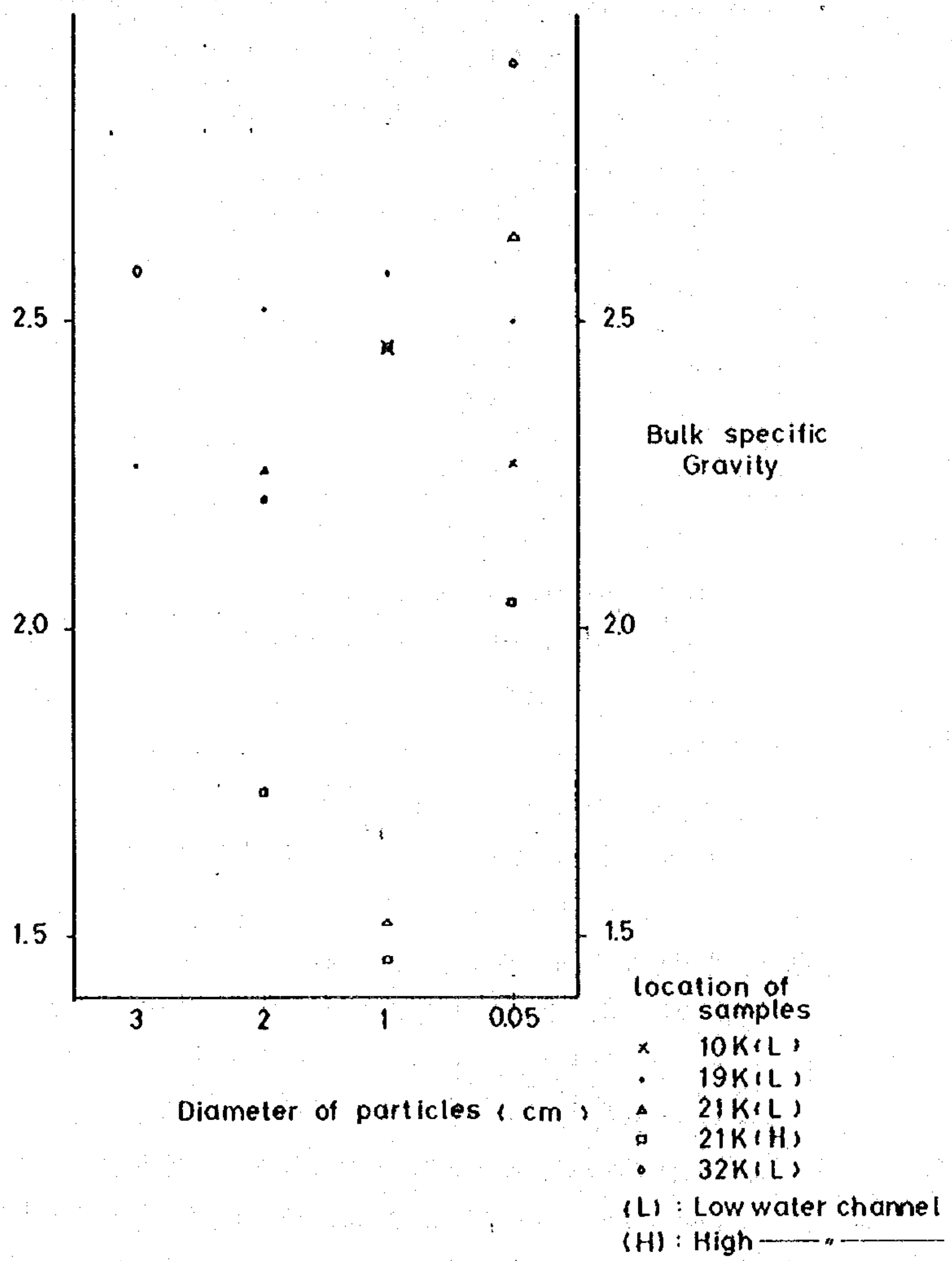


FIGURE Ⅲ-9 BULK SPECIFIC GRAVITY



2-3 Utilization of river and river water

River and river water will be utilized as follows.

(i) Mining of river sediment

River sediment will be mined for use as construction material, material for site preparation and raw material of glass. The total consumption recorded in 1977 is 846×10^3 m^3/year.

History of annual output of sediment

	Entire state	The Potrero
1973	88.220 m^3/year	
1974	585,440 "	
1975	976,820 "	
1976	1,172,380 "	
1977	1,180,330 "	845,550 m^3/year

(ii) Utilization as drainage river

Drainage and creek at river surrounding district flow into the Pasing-Potrero.

(iii) Watering place of livestock

Spring water and river water in the midstream and downstream areas are being used as watering places for livestocks, but in few cases.

(iv) Utilization as road

As there has been little current flowing in the river courses during the dry season they have been utilized as roads in such season. Even after construction of levees which changed them into riverbeds, they are still used by pedestrians and vehicles for traffic between Milta-Balas and San Juan-Santa Barbara except when there is water flow.