

# FLOOD OF SEPTEMBER 16, 1975 AT UTUADO, PUERTO RICO

By  
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WATER RESOURCES INVESTIGATIONS OPEN-FILE REPORT 81-413

## INTRODUCTION

This report provides information on the floods of September 16, 1975 in the Utuado, Puerto Rico area. The report was prepared by the U.S. Geological Survey in cooperation with the Puerto Rico Department of Natural Resources. The study provides data and flood-plain information for planners and designers involved in the use of flood-plain land in the Utuado area. The study included the areas flooded by the Río Grande de Arecibo and Río Viví in urban Utuado.

SI (International System) units are used in this report. The SI units may be converted to inch-pound units by multiplying values given by the following factors:

Multiply SI units	By	To obtain inch-pounds unit
	Length	
meters (m)	3.2808	feet (ft)
millimeters (mm)	0.03937	inches (in)
kilometers (km)	0.6214	miles (mi)
	Area	
square kilometers (km <sup>2</sup> )	0.3861	square miles (mi <sup>2</sup> )
	Discharge	
cubic meters per second (m <sup>3</sup> /s)	35.31	cubic feet per second (ft <sup>3</sup> /s)
	Temperature	
degrees Celsius (°C)	1.8 °C + 32	degrees Fahrenheit (°F)

## DRAINAGE BASIN

Utuado is located in the west-central part of Puerto Rico, about 25.5 km southwest of San Juan and 66.4 km west of Arecibo (fig. 1). The rugged topography in the region, which consists of mountains with steep slopes and small, narrow valleys subject to flooding, restricts the expansion of the Utuado urban area.

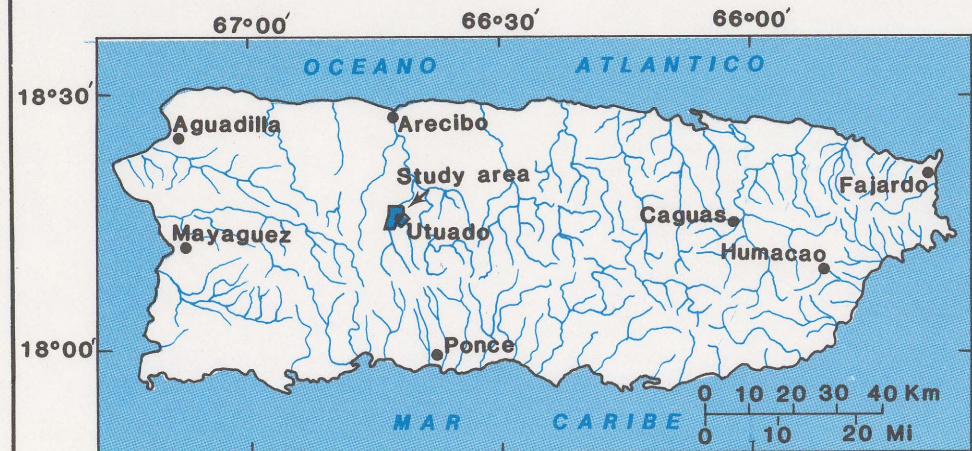


FIGURE 1.--Location of the study area.

The Río Grande de Arecibo drains a mountain basin located in the west-central part of the Cordillera Central. It flows in a northerly direction through a narrow valley near the town of Utuado, and empties into the Atlantic Ocean at Arecibo. The Río Grande de Arecibo is joined by Río Viví at the northwest corner of Utuado, and flows into Lago Dos Bocas about 1.9 km north of Utuado.

The drainage area of Río Viví at its mouth is 43 km<sup>2</sup>, and the drainage area of Río Grande de Arecibo at the lower limit of the study area is 173 km<sup>2</sup>.

The magnitude of floods in Utuado is not significantly affected by diversion tunnels interconnecting the reservoir system of Lagos Adjuntas, Pellejas, Viví, Jordan, and Caonillas with Lago Dos Bocas (fig. 2).

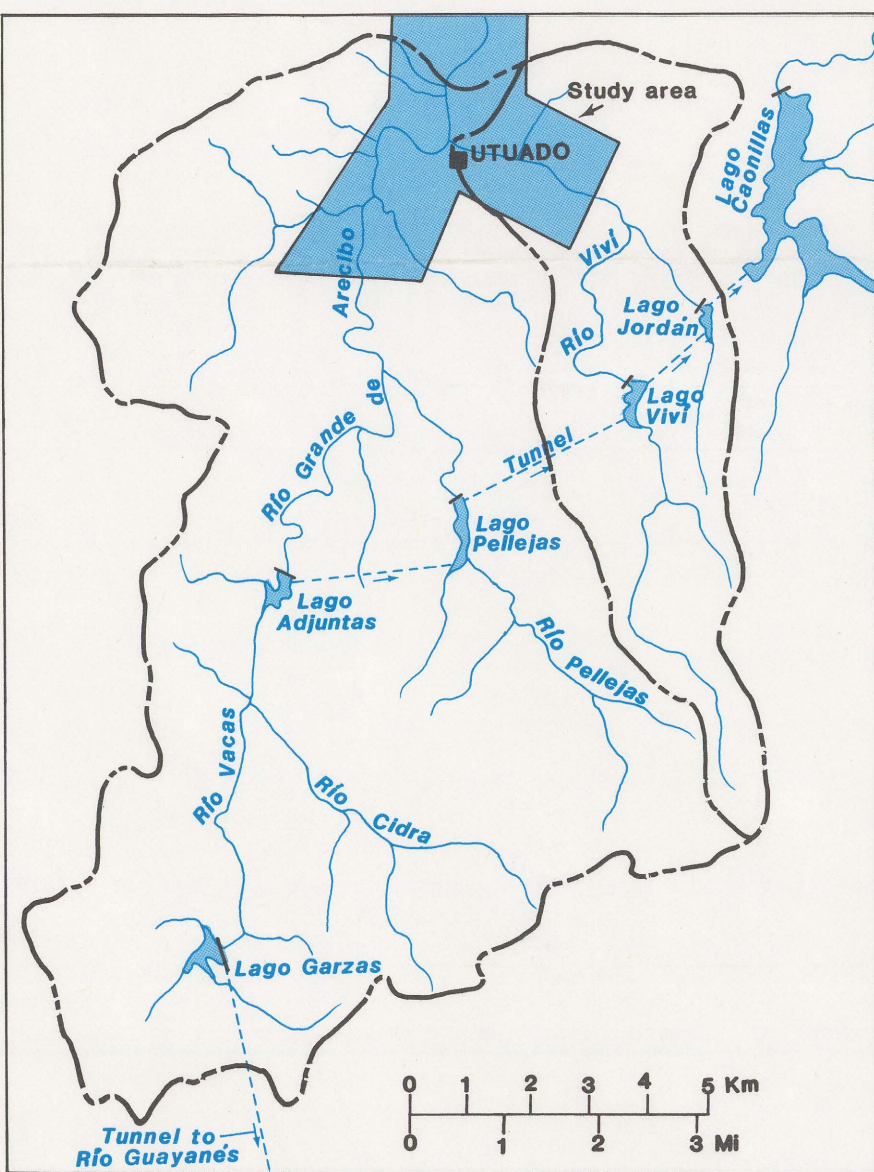
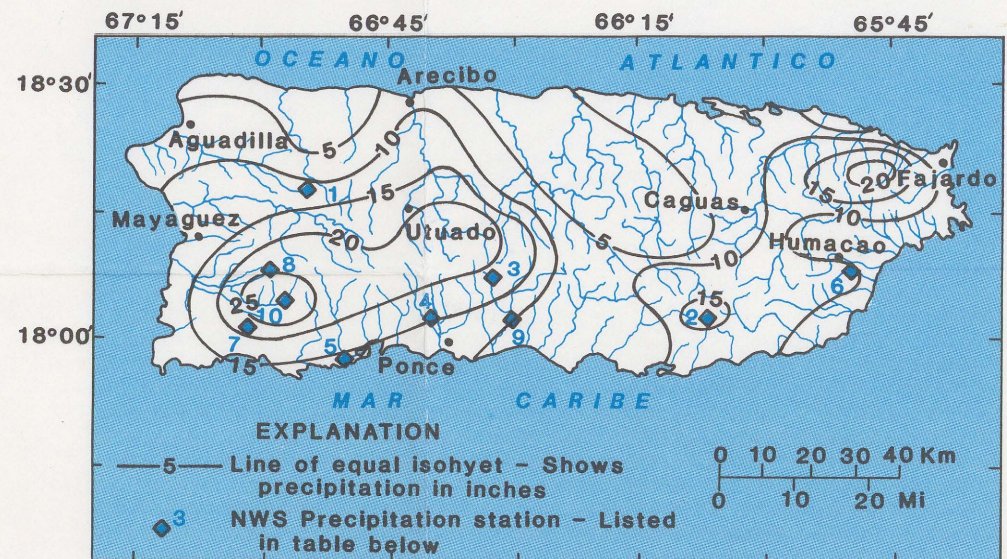


FIGURE 2.--Río Grande de Arecibo, Río Viví, and Río Pellejas drainage basins and study area.

The magnitude of floods does not appear to be affected by flow from the 16.2 km<sup>2</sup> of drainage area of Río Grande de Arecibo. This flow is diverted into Río Guayanés basin by a tunnel with an opening of about 2.1 m. The system of reservoirs and tunnels was designed for hydroelectric-power production and does not have the capability of lessening extraordinary flood peaks in the Utuado area because the reservoirs have small storage capacities.

## FLOOD HISTORY

The flood of September 16, 1975 was the most disastrous flood in the Utuado area in the last 100 years. Precipitation during the storm totaled as much as 20 inches in the upper Río Grande de Arecibo basin (fig. 3). Flood-marks surveyed by the U.S. Geological Survey shortly after the event, as well as interviews with residents in the Utuado area, confirm this fact. The September 16, 1975 flood was greater than the flood of August 8, 1899. Historical records show that the flood was the highest of record since 1886. A sizable flood of unknown magnitude occurred in 1886, and some reports indicate that it was higher than the 1975 event.



NUMBER ON MAP	LOCATION	PRECIPITATION, OF SEPTEMBER 15-17, 1975 IN INCHES			
		SEPT 15	SEPT 16	SEPT 17	TOTAL
1	ADJUNTAS SUBSTATION	0.15	11.99	4.87	17.01
2	CARITE PLANT NO. 1	0.05	10.05	6.85	16.95
3	CERRO MARAVILLA	0.46	16.00	2.37	18.83
4	CORRAL VIEJO	0.10	7.58	8.26	15.94
5	ENSENADA	0.05	5.41	10.30	15.76
6	HUMACAO	0.40	8.02	5.22	13.64
7	LAJAS SUBSTATION	0.29	3.10	12.26	15.65
8	MARICAO 2 SSW	2.32	6.05	14.10	22.47
9	PONCE 4E	0.00	2.90	7.78	10.68
10	SABANA GRANDE 2 ENE	1.20	14.00	11.50	26.70

FIGURE 3.--Map of Puerto Rico showing isohyets for September 15-17, 1975 and location of selected precipitation stations, and table showing the precipitation for the selected stations.

The most severe damage in the town of Utuado was caused by the Río Grande de Arecibo. The river backed up floodwaters for about 0.7 km into its main tributary, Río Viví, which flows through the town from east to west. The Río Viví peak flow was of lesser magnitude than the peak flow of Río Grande de Arecibo and consequently caused less damage. The photographs in figures 4 to 6 show the maximum height of the September 16, 1975, flood at selected sites in Utuado. Photographs are identified on the topographic map by a circular symbol with an identifying letter and an arrow showing the direction in which the photograph was taken.

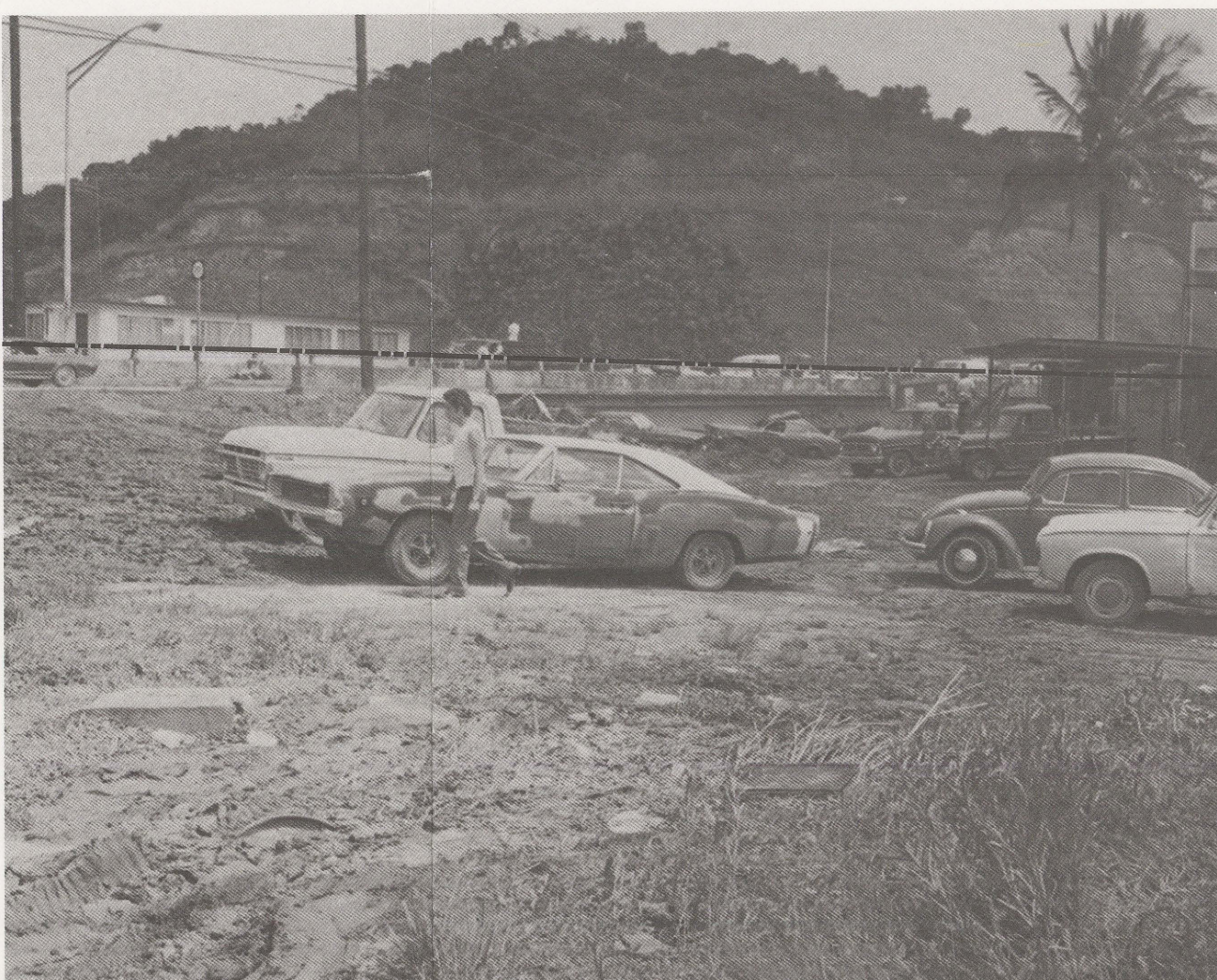


FIGURE 4.--Upstream side of Highway 111, facing bridge. Dashed line shows the approximate flood height reached, September 16, 1975 (Photograph A).



FIGURE 5.--Main street in Utuado looking northeast from the vicinity of Highway 10 bridge toward Highway 111. Dashed line shows approximate flood height reached, September 16, 1975 (Photograph B).



FIGURE 6.--House in front of the Utuado High School. Dashed line shows approximate flood height reached, September 16, 1975 (Photograph C).

## FLOOD PROFILES

The water-surface profiles for the September 16, 1975 floods of Río Grande de Arecibo and Río Viví, are shown in figures 7 and 8. Distances are referred to the arbitrary baseline shown on the flood map. The baseline, and therefore the profiles, are not confined to the configuration of the channel but follows a smoother path along the flood plain in the general direction of the flood-flow. The water-surface profiles of Río Grande de Arecibo and Río Viví are based on flood marks, identified and surveyed by field crews of the U.S. Geological Survey after the flood. Interviews with residents in the study area aided the identification of high-water marks. There are six bridges in the study area, three over Río Grande de Arecibo and three over Río Viví (Table 1).

TABLE 1.--Elevation of bridges in the Utuado area.

MAP SYMBOL	STATIONING ALONG BASELINE, IN KILOMETERS	BRIDGE LOCATION	ELEVATION, IN METERS (MSL)	
			TOP OF DECK	LOW BEAM
A	32.89	Río Grande de Arecibo, Hwy. 111	134.2	132.9
B	32.98	Río Grande de Arecibo, Hwy. 10	137.3	136.4
C	35.48	Río Grande de Arecibo, Hwy. 603	144.5	144.0
D	0.52	Río Viví, Urbanization acces road	134.8	134.6
E	0.82	Río Viví, Public Housing acces road	139.5	138.4
F	1.20	Río Viví, Hwy. 611	138.5	137.9

All elevations shown in the study area are referred to mean sea level datum. Reference marks were established at selected points throughout the area (Table 2) and are shown on the flood map.

TABLE 2.--Reference marks established by the U.S. Geological Survey in the Utuado study area.

Reference mark number (see map)	Elevation, mean sea level	Description of location
US-BM	134.91	442.62 Utuado, 0.8 km west of, 23 m of east end of bridge over Río Grande de Arecibo, at junction of road leading to Utuado on left upstream side of bridge, standard tablet stamped "36-Y-1934,"
RM-1	130.51	428.17 Utuado, 1.8 km northwest of, along Highway 10 at km 56.5, on right downstream side of culvert, chiseled square painted red.
RM-2	140.05	459.47 Utuado, 0.5 km west of Highways 10 and 111 intersection, at km 54.3, on upstream side of culvert, chiseled square painted red.
RM-3	146.69	481.26 Utuado, 2.0 km southwest of, along Highway 10 at intersection of Highway 603, on upstream head wall of culvert over Quebrada Arenas, chiseled square painted red.
RM-4	142.76	468.37 Utuado, in front of Plaza de Mercado opposite Col-mado "El Oasis," chiseled square painted red.

## WATER-SURFACE CONTOUR

Water-surface contours are based on the elevations of high-water marks surveyed after the September 16, 1975, flood. These contours represent equal elevations of the water surface and are normal to the direction of flow. Obstructions to the flow, such as changes in the ground surface and man-made obstacles, affect the shape of the contours. Future changes in the flood plain will alter the flow pattern.

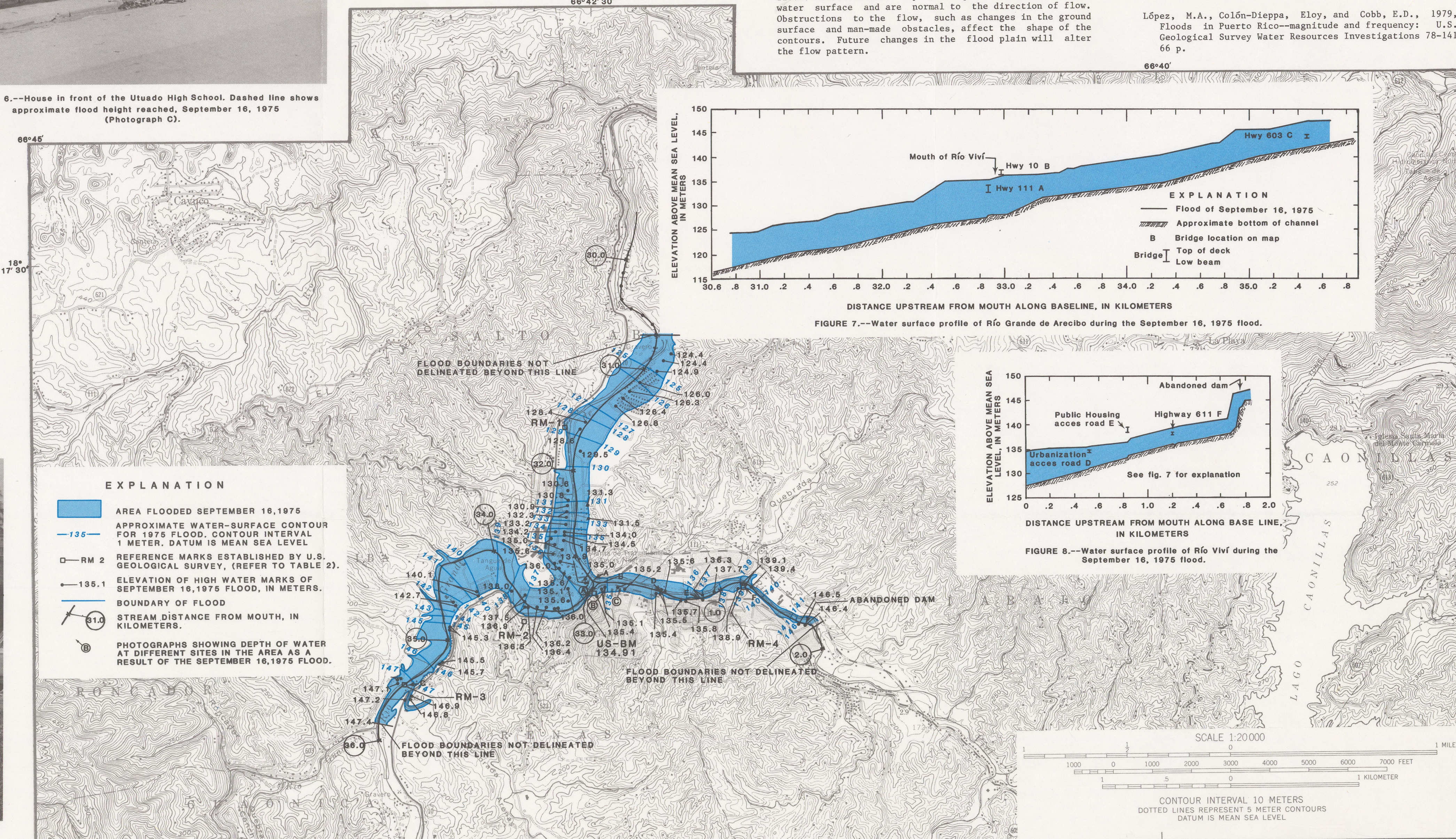


FIGURE 7.--Water surface profile of Río Grande de Arecibo during the September 16, 1975 flood.

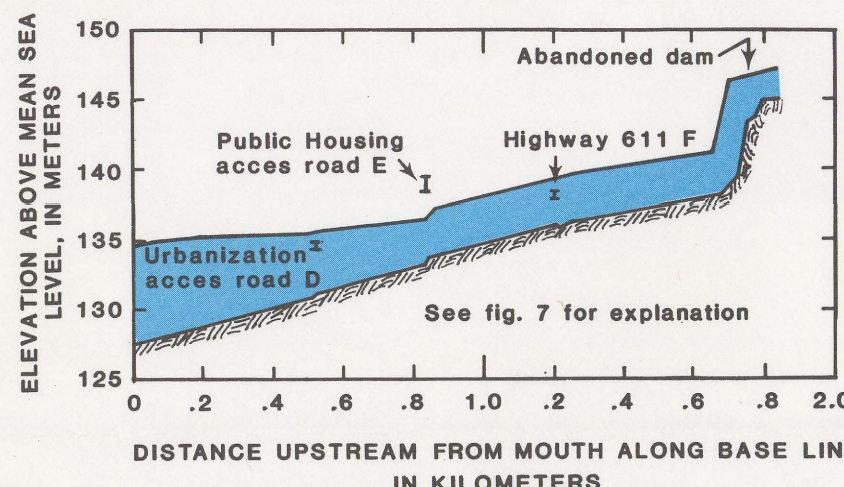


FIGURE 8.--Water surface profile of Río Viví during the September 16, 1975 flood.

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