

## 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
meters (m)	3.2808	feet (ft)
millimeters (mm)	0.03937	inches (in)
kilometers (km)	0.6214	miles (mi)
Area	0.3861	square miles ( $mi^2$ )
square kilometers ( $km^2$ )		
Discharge	35.31	cubic feet per second ( $ft^3/s$ )
cubic meters per second ( $m^3/s$ )		
Temperature	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.

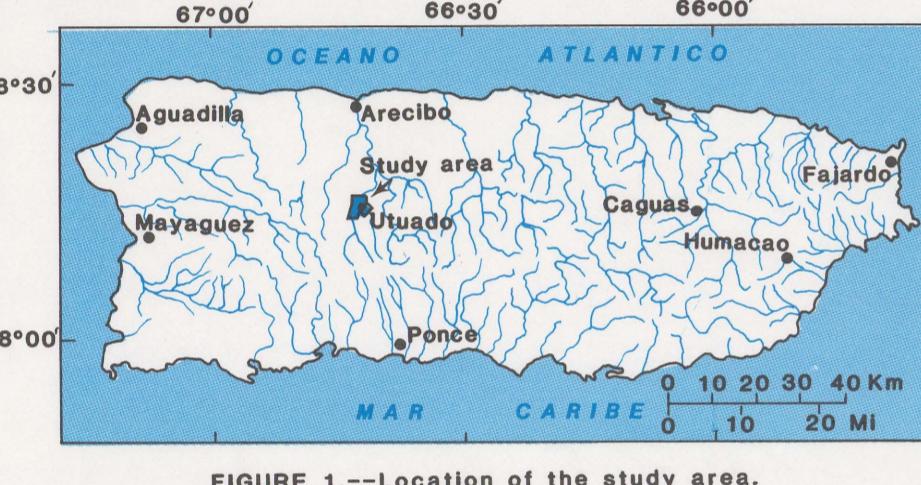


FIGURE 1.--Location of the study area.

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).

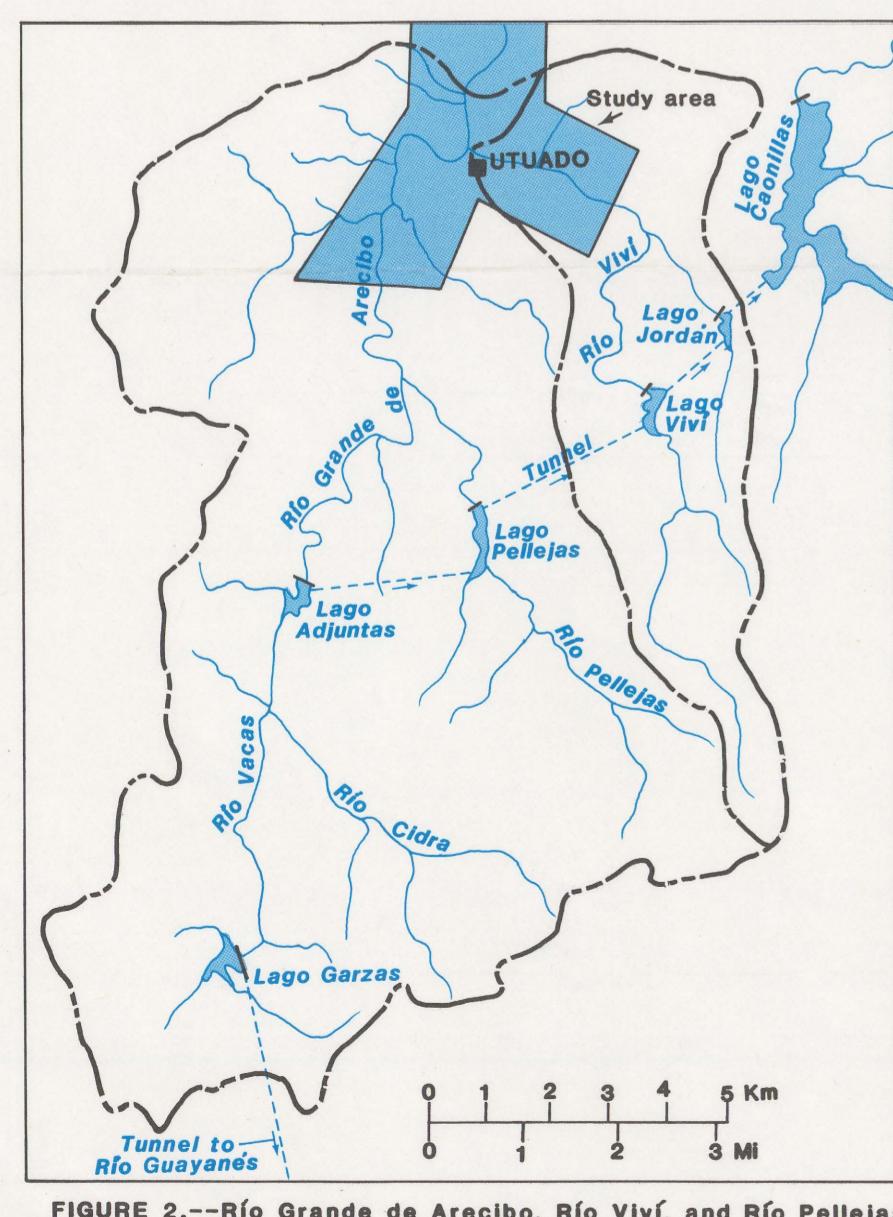


FIGURE 2.--Río Grande de Arecibo, Río Viví, and Río Pellejas drainage basins and study area.

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 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).

## 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	STATION-ING 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 Meters	Description of location
US-BM	134.91	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	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	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	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	Utuado, in front of Plaza de Mercado opposite Colmado "El Oasis," chiseled square painted red.

## DEPTH OF FLOODING

Depth of flooding during the September 16, 1975 flood at any point in the inundated area can be estimated by subtracting the ground elevation (ground contours) from the water-surface elevation shown on the map (water-surface contours). The ground elevations at any point on the topographic map can be found by interpolation between ground contours. The water-surface elevation at any point can be found by interpolation between water-surface contours.

## ADDITIONAL INFORMATION

Additional information relating to floods in the Río Grande de Arecibo at Utuado area, can be obtained from the U.S. Geological Survey, G.P.O. Box 4424, San Juan, Puerto Rico 00936, or from the Puerto Rico Department of Public Works, Floods Control Section - Operations, Minillas Bldg. Santurce, Puerto Rico 00940.

## COOPERATION AND ACKNOWLEDGMENT

This report was prepared as part of the cooperative water resources investigations program between the Department of Natural Resources, Commonwealth of Puerto Rico, and the U.S. Geological Survey, Water Resources Division. Historical flood information was provided by the Puerto Rico Department of Public Works and the General Archives of the Puerto Rican Institute of Culture, and from residents of the municipality of Utuado.

## SELECTED REFERENCES

Hickenlooper, I.J., 1968, Floods at Arecibo, Puerto Rico: U.S. Geological Survey Hydrologic Investigations Atlas HA 271.

López, M.A., Colón-Dieppa, Eloy, and Cobb, E.D., 1979, Floods in Puerto Rico—magnitude and frequency: U.S. Geological Survey Water Resources Investigations 78-141, 66 p.

## 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.

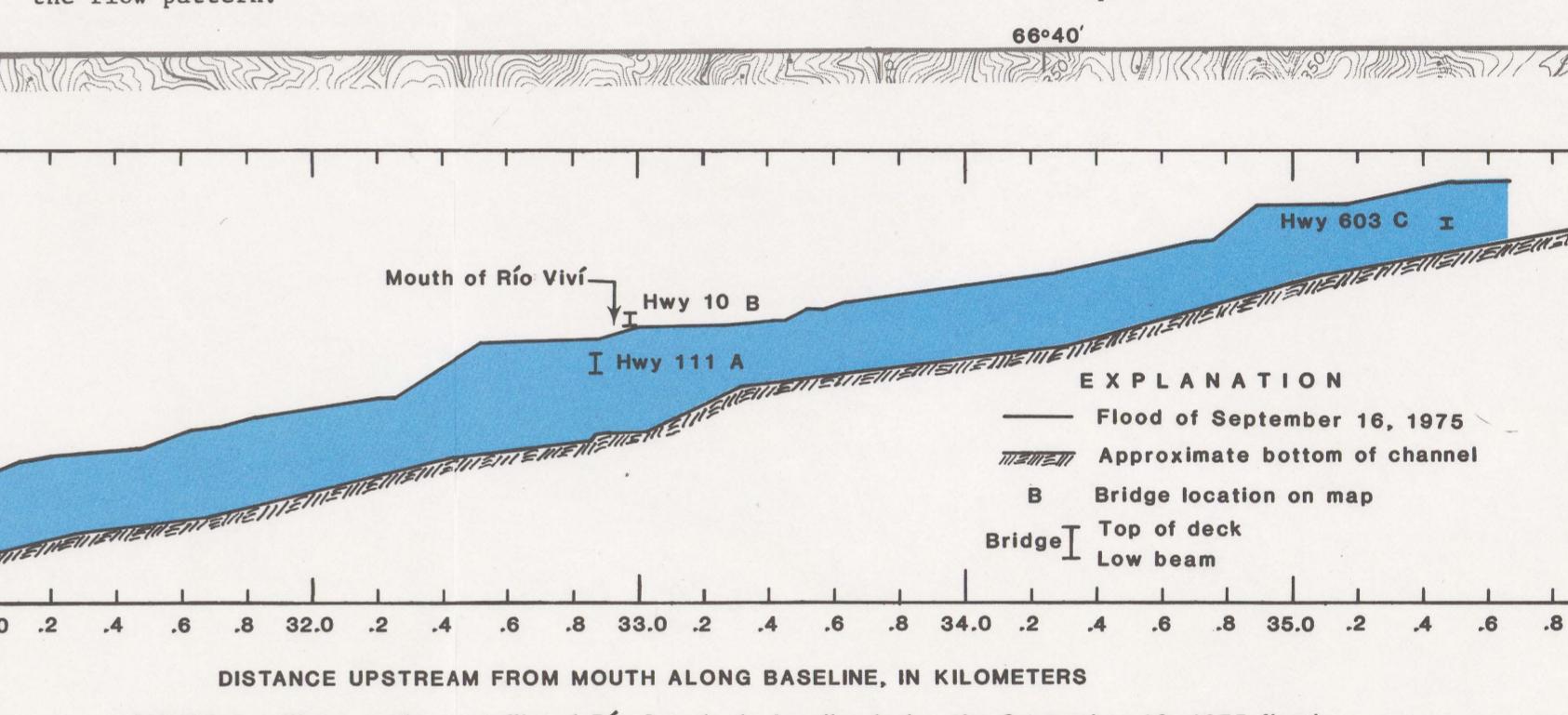


FIGURE 7.--Water surface profile of Río Grande de Arecibo during the September 16, 1975 flood.

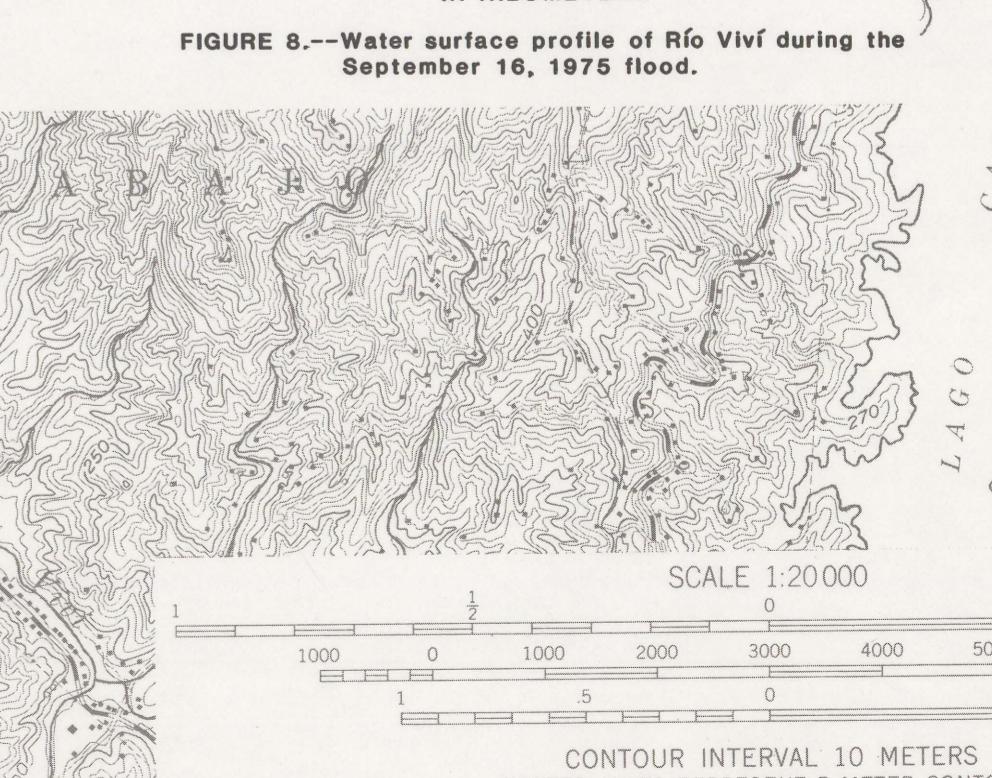
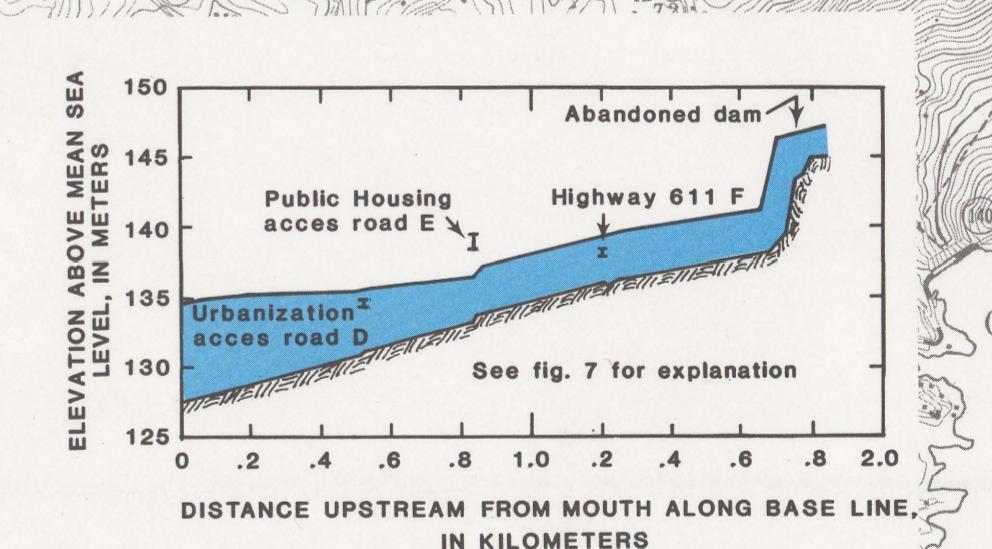
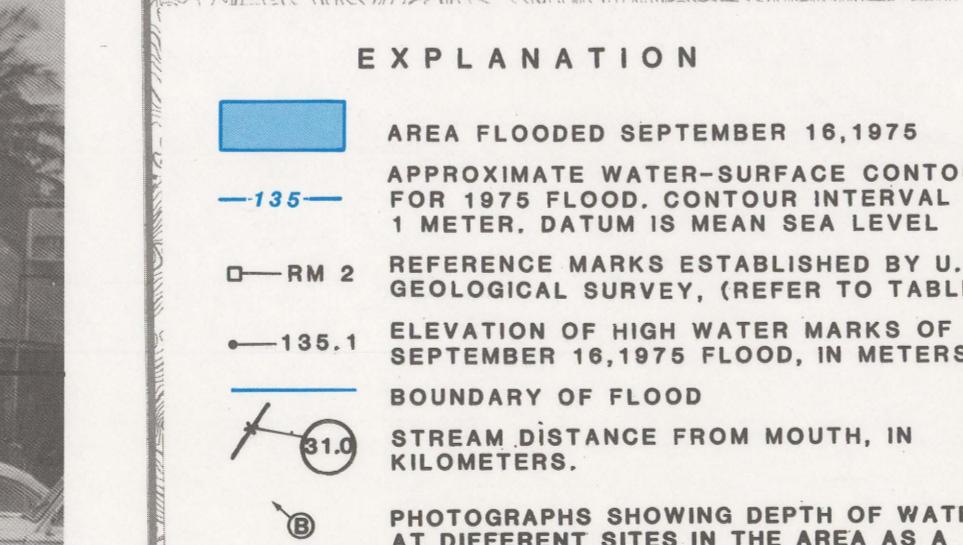


FIGURE 8.--Water surface profile of Río Viví during the September 16, 1975 flood.

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