



## FLOODS AT ARECIBO, PUERTO RICO

This report provides a record of the extent of inundation in the municipality of Arecibo, Puerto Rico, caused by two outstanding floods on Río Grande de Arecibo. The information can be used to reach more rational decisions related to land use in the flood-prone areas along the lower reaches of the river.

The approximate areas inundated by the floods of September 13, 1928, and October 13, 1954, are delineated on the topographic base map. The greatest flood known on Río Grande de Arecibo occurred on August 8, 1899, but the extent of inundation has not been determined. Since 1942 the regimen of the river has been altered by manmade structures in the river basin upstream from the study area. Garzas Dam, completed in 1943, diverts runoff from 6.25 square miles for use outside the basin. Dos Bocas and Caonillas dams, completed in 1942 and 1948, respectively, were designed for production of hydroelectric energy. The 1928 flood was the greatest from 1900 to 1942, before construction of the dams; and the 1954 flood was the greatest from 1942 to 1966, after construction of the dams. Although Lagos Caonillas and Dos Bocas can reduce the frequency of flooding in the lower reaches of the river, they cannot eliminate flooding as is evidenced by the extent of inundation during the 1954 flood. The areas inundated and the flood profiles shown in this report are for valley conditions that existed at the time of the floods.

**Drainage basin.**—Río Grande de Arecibo drains a basin on the northern slopes of the Cordillera Central and then flows northward through a belt of rugged limestone hills in a deep, narrow valley. Río Grande de Arecibo is joined by a major tributary, Río Tanamá, near the northern edge of the belt of rugged hill country about 5 kilometers south of the city of Arecibo. Río Tanamá drains a small basin and also flows through the belt of rugged hills partly in underground channels. From the mouth of Río Tanamá, Río Grande de Arecibo flows through widening coastal plain to the Atlantic Ocean. A map of the drainage basin and of the study area is shown in figure 1.

**Flood occurrence.**—From historical records and floodmarks, the 1899 flood was the greatest in the study area since at least 1886 when a flood of unknown height occurred. The 1928 flood was the second greatest from 1899 to 1966. The 1954 flood, adjusted for surcharge storage at Lagos Caonillas and Dos Bocas, was the greatest from 1929 to 1966. It is not known whether floods that occurred from 1900 to 1927 did or did not exceed the 1954 flood. A flood that occurred in 1932 was the second greatest from 1929 to 1966.

The peak discharge of the 1954 flood past Dos Bocas Dam was about 52,000 cubic feet per second. Had Dos Bocas and Caonillas dams not been in place it was estimated that the discharge would have been about 76,000 cubic feet per second.

**Recurrence interval.**—The frequency or recurrence interval, as applied to flood events, is the number of years on the average during which a flood of specific magnitude will be equaled or exceeded once. The 1928 flood was the second greatest during the 68 years from 1899 to 1966 and the recurrence interval is estimated to be 34 years. The 1954 flood, adjusted for storage, was the second greatest during the 39 years from 1928 to 1966 and it is estimated that inundation equal to or exceeding that caused by the 1954 flood can occur on the average once every 20 years. The recurrence intervals of floods that occurred before the construction of Dos Bocas and Caonillas dams have been increased downstream from Dos Bocas Dam but the amount of increase has not been determined. The estimated recurrence intervals for outstanding floods on Río Grande de Arecibo in the study area are tabulated below.

Date of flood	Recurrence interval (years)	
	Without dams	With dams
August 8, 1899	82	>82
September 13, 1928	34	>34
September 1932	13	>13
October 13, 1954	20	20

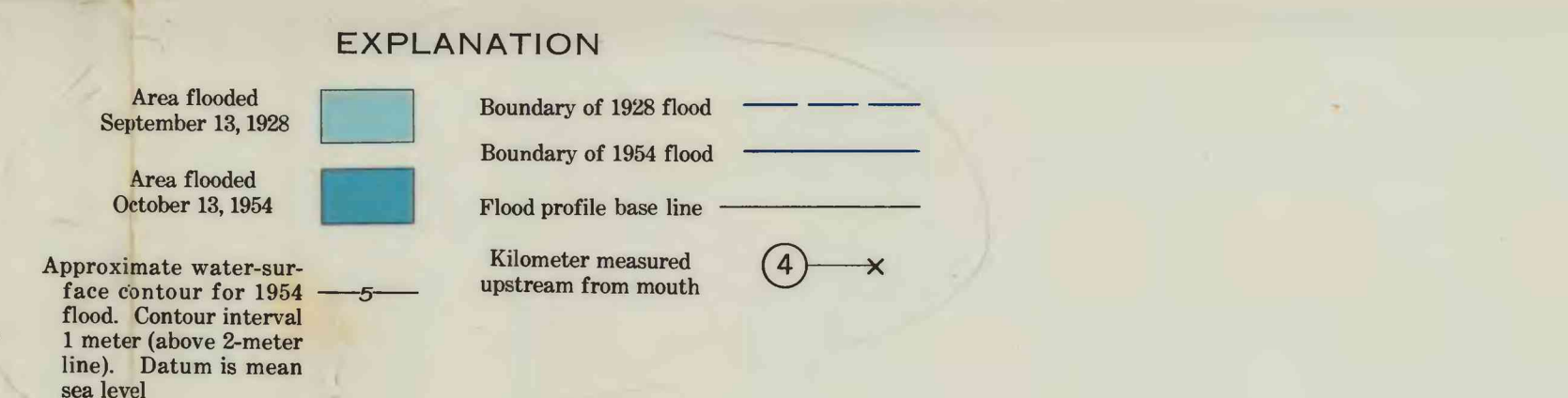
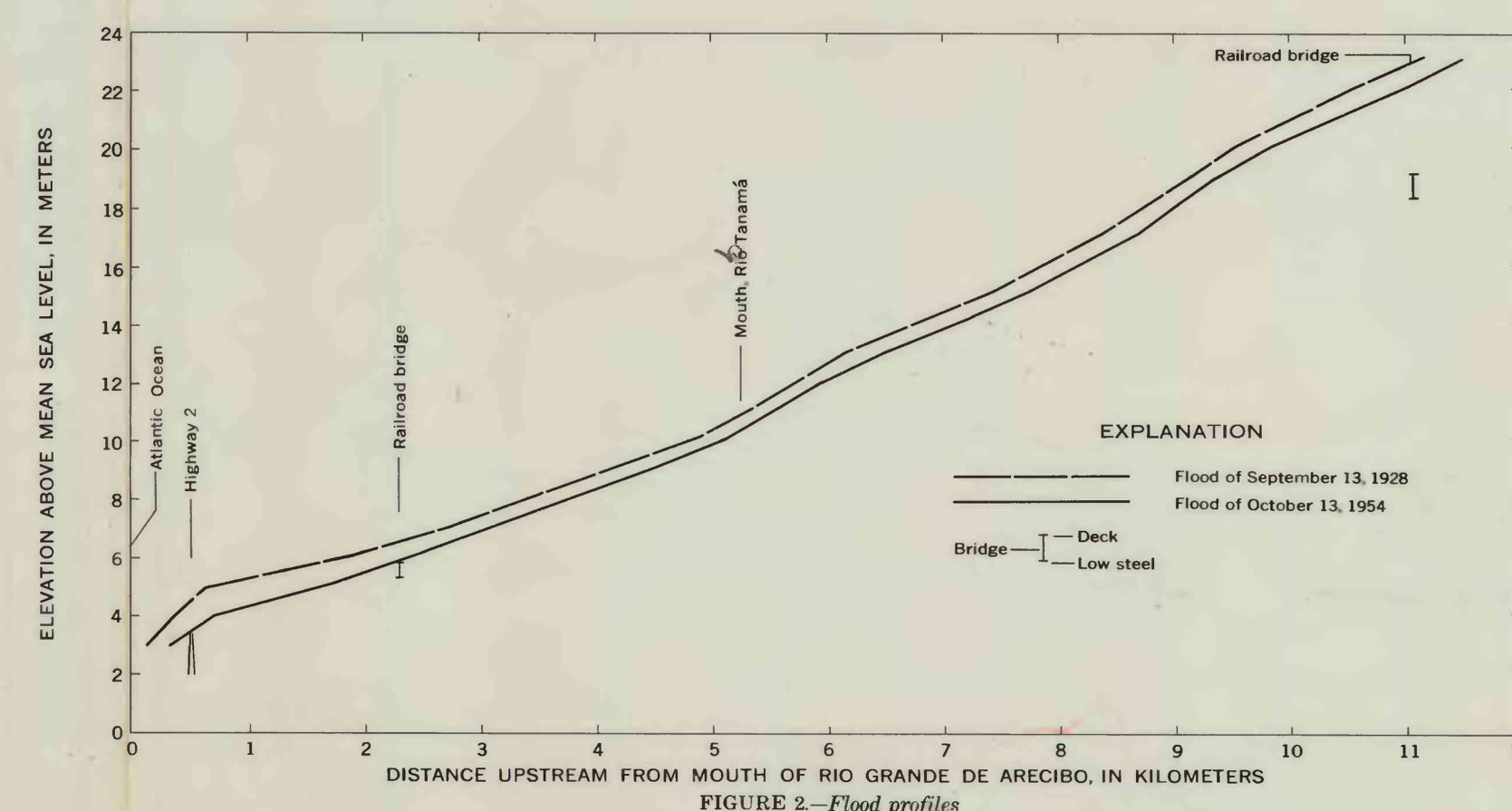
**Water surface.**—Approximate water-surface contours for the flood of October 13, 1954, based on floodmarks, are shown on the map. The water-surface profiles for the September 13, 1928, flood and the October 13, 1954, flood are shown in figure 2. The profiles, referenced to an arbitrarily chosen base line indicated on the map, show the difference in height reached by the two floods.

**Depth of flooding.**—Depth of flooding during the 1954 flood at any point in the inundated area can be estimated by subtracting the ground elevation, shown on the map by ground contours, from the water-surface elevation, shown by the water-surface contours. The ground elevation at a point can be found by interpolation between ground contours or by levels run from bench marks. The water-surface elevation at a point can be found by interpolation between water-surface contours.

**Additional information.**—Additional information relating to floods on Río Grande de Arecibo can be obtained from the U.S. Geological Survey, San Juan, Puerto Rico, or from the Sección de Control de Inundaciones, Negociado de Operaciones, Departamento de Obras Públicas, Parada 224, Avenida Ponce de León, Santurce, Puerto Rico.

**Cooperation and acknowledgment.**—This report was prepared as part of a flood-mapping project under a floods investigation program authorized by a cooperative agreement between the Department of Public Works, Commonwealth of Puerto Rico, and the U.S. Geological Survey. Much of the flood data were provided by the Puerto Rico Department of Public Works. Historical flood information was obtained from documents made available by the General Archives of the Institute of Puerto Rican Culture and from many residents of the Municipality of Arecibo.

Río Grande de Arecibo has a drainage area of about 170 square miles at Dos Bocas Dam. The contributory area between Dos Bocas Dam and the mouth at the Atlantic Ocean is indeterminate, as most of it is in cavernous limestone.



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