DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
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WATER RESOURCES INVESTIGATIONS 76-91
OPEN-FILE REPORT
PLATE 1 OF 3

FLOODS OF NOVEMBER 12, 1974 IN THE CHARLOTTE AMALIE AREA, ST. THOMAS, U.S. VIRGIN ISLANDS

ABSTRACT

The flood of November 12, 1974, was the largest recorded flood in the area from Fort Christian through Charlotte Amalie and Frenchtown to the end of Crown Bay. Records indicate this flood to have a recurrence interval of about 60 years.

With the exception of a few narrow beaches, very little flooding occurred outside of the Charlotte Amalie area.

The flood boundaries are controlled to a large extent by the prevailing channel and flood-plain conditions. Inundation from future floods may be affected by changes in channel conditions, alteration of waterway openings at roads, changes in runoff characteristics of the stream caused by increased urbanization, and other cultural developments.

INTRODUCTION

This is the second flood report covering the Charlotte Amalie area, St. Thomas; the first was by Haire and Johnson in 1973.

This report is intended for administrators, planners, engineers, and others concerned with development in areas subject to flooding on the south coast of St. Thomas. More specifically, this information should be useful to those responsible for formulating flood-plain regulations that could minimize flood damage.

This report is based on data collected from field investigations conducted by the U.S. Geological Survey immediately after the flood of November 12, 1974. U.S. Geological Survey bench marks used for this survey, and their descriptions, locations and elevations above mean sea level are provided in table 1. All elevations given are in feet above mean sea level.

For those readers who may prefer metric units rather than English units, the conversion factors are listed below:

Multiply English unit	By	To obtain metric unit
feet (ft)	0.3048	meters (m)
inches (in)	25.40	millimeters (mm)
miles (mi)	1.609	kilometers (km)
square miles (mi^2)	2.590	square kilometers (km^2)

The U.S. Virgin Islands consists of more than 40 islands and cays located about 1,100 mi east-southeast of Miami, Florida and about 50 mi east of Puerto Rico (fig. 1). The islands form part of the Antilles Island Arc, which separates the Atlantic Ocean from the Caribbean Sea. St. Thomas is the second largest of the group with a land area of 32 mi^2; it ranges from 1 to 3 mi wide and is about 14 mi long.

St. Thomas is characterized by rugged terrain and all streams head in the volcanic uplands that form a central ridge the length of the island. The ridge ranges from about 500 to 1,500 ft above mean sea level and the steep slopes cause rapid runoff and high stream velocities. In the uplands, streambeds are composed of rocks that range in size from small cobbles to large boulders. On the coastal plains, stream gradients are mild, the valleys broad, few boulders are found, and deposits of sand and gravel are common. With the exception of a few narrow beaches, most of the land subject to flooding is in the area of Charlotte Amalie (fig. 2).

Most of the streamflow on St. Thomas results from direct runoff; therefore, the streams usually cease flowing several hours to a day or two after rainfall stops. Floodwaters also recede rapidly and inundation usually lasts less than a day.

The mean range of ocean tides is only 0.8 ft and generally the effects of tide on the extent of flooding in the shore area is negligible. However, flooding of shore areas can occur during hurricanes.

OCCURRENCE OF FLOODS

Historical information (Bowden, 1974 and Haire and Johnson, 1973) shows that at least five severe floods have occurred since 1867, when a tidal wave reportedly caused a major disaster along the south coast of St. Thomas. Floods occurred on October 9, 1916, May 8, 1960, March 1, 1969, October 7, 1970, and November 12, 1974, and these are described briefly below (in order of magnitude). Data were not available to determine stream discharge from each flood, so the order of magnitude was determined from evidence on depth of inundation. No information is available for major floods prior to 1916. Information provided here is for those areas most subject to overland flooding in the Charlotte Amalie area of St. Thomas (fig. 2).

The largest recorded flood was that of November 12, 1974. The data indicated that the 1974 flood was about 1 ft higher than the 1960 flood in the Charlotte Amalie-Frenchtown area. Flooding in 1974 in the vicinity of Harry S. Truman Airport was nearly the same as that mapped after the March 1, 1969, flood (Haire and Johnson, 1973) and is not shown in this report. Intense rainfall of over 6 in in 3 to 4 hours fell on saturated soil and resulted in extremely heavy runoff and severe flooding in the densely populated area along the south coast of St. Thomas. Harry S. Truman Airport, not in the study area, had from 12 to 18 in of water inside the terminal and on the runways and was closed for about 30 hours. Falling trees and power poles and a vast accumulation of rocks, mud, and debris blocked roads and knocked out electrical power. Schools, businesses, government offices, banks and Post Offices were closed. Inundated areas extended from Fort Christian through Charlotte Amalie and Frenchtown to the end of the Crown Bay area. Property damages as estimated by the Government of the Virgin Islands were in excess of $3 million. The island of St. Thomas was declared a major disaster area.

The second largest recorded flood was that of May 8, 1960, and is commonly known by residents as the "Great Mother's Day Flood." Intense rain fell on the entire island and the National Oceanic and Atmospheric Administration recorded a 2-day total of 13.25 in at Charlotte Amalie. Roads and trails were washed out in many places over the island; damage to public property was estimated by the Government of the Virgin Islands to be $700,000. No estimate for damage to private property is available but many homes and businesses in the Charlotte Amalie area were flooded with considerable losses resulting. The Frenchtown area and much of Harry S. Truman Airport were also inundated.

The third largest flood, estimated on the basis of 24-hour rainfall data, occurred on October 9, 1916, and was caused by rainfall during a hurricane, the center of which passed over the U.S. Virgin Islands. A small amount of data was obtained from residents concerning high-water marks of this flood. However, sufficient data were not recovered to define the boundaries of the flood, but the areas reportedly hardest hit were Charlotte Amalie, Frenchtown, and the present airport area.

The flood of March 1, 1969 (4th largest flood), resulted from 6.30 in of rain that fell in 24 hours; most of the rain, however, fell in a much shorter time. Boulders and debris carried by floodwaters blocked culverts and roads over much of the island. Debris and silt left by the flood contributed considerably to the damage. Many areas in Charlotte Amalie and Frenchtown were inundated, and water on the runway necessitated closing the airport for a short period.

The fifth largest flood occurred on October 7, 1970, and was about the same magnitude as the 1969 flood. In 4 days, 10.53 in of rain from a slow-moving tropical depression fell at Charlotte Amalie. The heaviest rain occurred on the afternoon and night of October 7; the National Oceanic and Atmospheric Administration recorded 6.70 in for the 24 hours ending at 0800 on October 8. Severe flooding occurred during the evening of October 7. Heavy runoff caused landslides and severe damage to roads and buildings. Once again, floods damaged Charlotte Amalie and Frenchtown and the airport was forced to close for a short time.

FLOOD FREQUENCY

The occurrence of a flood of a given magnitude cannot be predicted, but the probable number of such floods during a long period of time can be estimated with reasonable accuracy. The frequency of occurrence (recurrence interval) is the average interval of time within which a given flood will be exceeded once. For example, a 50-year flood has 1 chance in 50, or a 2 percent chance of being exceeded in any 1 year.

The record of floods in St. Thomas is fragmentary and not enough data are available to determine either a stage-frequency or a discharge-frequency relationship. Marks from floods prior to 1960 were not found; however, historical records and information from local residents indicated that major flooding has occurred five times during the 59-year period, from 1916 to 1974. Listed below is the year of occurrence, rank, and the estimated recurrence interval for each flood. (Rank is the order of magnitude of the flood; the largest flood has rank 1, the second largest has 2, and so forth.)

Date	Rank	Estimated recurrence interval (years)
1974	1	60
1960	2	30
1916	3	20
1969	4	15
1970	5	12

The three areas most subject to flooding on St. Thomas (Harry S. Truman Airport, Charlotte Amalie, and Frenchtown) probably can be expected to be inundated to an extent greater than that of the 1970 flood about once in 12 years, on the average.

FLOOD PROFILES

The maximum elevations of the water surface, along the south coast of St. Thomas during the flood of November 12, 1974, are shown in figures 3 through 6; the locations of the base lines are shown on plates 2 and 3. The base lines, used to determine the distance upstream from the mouth, follow a smooth path along the valleys and conform to the general direction of flow during floods. The stream channels for which base lines are drawn have been assigned arbitrary names of Gut No. 1, Gut No. 2, Gut No. 3, and Gut No. 4 for identification purposes in this report. Abrupt changes in the profiles indicate the difference in water-surface elevations at the upstream and downstream sides of channel constrictions. The drop in water surface through constrictions, during other floods, may be different from that shown.

INUNDATED AREAS

The areas inundated by the 1974 flood are shown on plates 2 and 3; U.S. Geological Survey personnel identified floodmarks in these areas shortly after the flood. Floodmarks are noted on plates 2 and 3 by dots. The flood boundaries were delineated using profiles based on elevations of these floodmarks. The boundaries were also checked in the field and defined by plotting flood-profile elevations on the map and interpolating between the contours, where necessary.

The flood boundaries shown are controlled to a large extent by prevailing channel and flood-plain conditions during the flood. Inundation from other floods may be affected by changes in channel conditions, alteration of waterway openings at highways, changes in runoff characteristics of the stream caused by increased urbanization, and other cultural developments. Protective works built after the flood shown may reduce the frequency and depth of flooding in an area, but will not necessarily eliminate future flooding.

Water-surface contours based on elevations of floodmarks are imaginary lines representing equal elevations of water surface; these are shown on plates 2 and 3. Generally, they are at right angles to the direction of flow. Obstructions to flow, either natural or man made, and the variations in valley widths cause irregularities in the contours.

The approximate depth of flooding in any area for the 1974 flood can be determined by subtracting the ground elevation from the flood elevation indicated by the profile or by the water-surface contour line. The approximate ground elevation can be determined from ground (topographic) contours shown in the plates. Elevation of the ground and of the water surface at any point can be interpolated between respective contour lines. More accurate elevations can be obtained by field surveying to one of the reference marks shown on plates 2 and 3 and described in table 1.

ACKNOWLEDGMENTS

Selection of the sites for this investigation was made in collaboration with the Government of the U.S. Virgin Islands. Historical flood data were made available by many residents of St. Thomas.

ADDITIONAL INFORMATION

Supporting data and computations relating to this report are in the files of the U.S. Geological Survey, P.O. Box 34168, Building 652; Ft. Buchanan, Puerto Rico 00934.

SELECTED REFERENCES

Bowden, Martyn J., 1974, Hurricane in paradise: perception and reality of the hurricane hazard in the Virgin Islands: Island Resources Foundation, St. Thomas, V.I., 115 p.

Haire, W.J., and Johnson, K.G., 1973, Floods in and near the Charlotte Amalie area, St. Thomas, U.S. Virgin Islands: U.S. Geol. Survey, Puerto Rico Hydrol. Inv. Map Series no. 3.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, 1974, Climatological data: v. 20, nos. 10 and 11.

Table 1.--Reference marks established by the U.S. Geological Survey in St. Thomas, U.S. Virgin Islands

Reference-mark number (see plates 2 & 3)	Elevation above mean sea level (ft)	Description
1	3.58	At waterfront on Veterans Drive and in front of intersection of Gutters Gade and Veterans Drive on top of bulkhead over drain outlet, seaward of gutter. A brass disk stamped "U.S. Geological Survey" and set in concrete.
2	5.66	At retaining wall on Veterans Drive and 5 ft west of entrance to Demerrara Elementary School. A brass disk stamped "U.S. Geological Survey" and set in concrete.
3	19.70	At intersection of Harwood Highway and Harry S. Truman Airport Road on south side of sidewalk. A brass disk stamped "U.S. Geological Survey" and set in concrete.
4	18.74	At intersection of Harwood Highway and road in front of basketball court and on manhole on west corner of road. A brass disk stamped "U.S. Geological Survey" and set in concrete.
5	6.90	On southeast corner of Harry S. Truman Airport terminal. A brass disk stamped "U.S. Geological Survey" and set in concrete on base of tower.

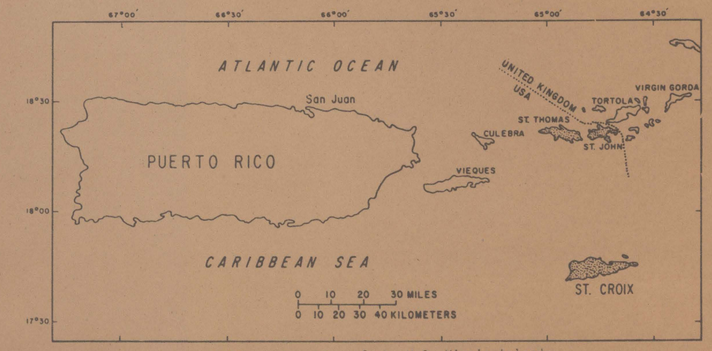

FIGURE 1.--Location of the U.S. Virgin Islands.

FLOODS OF NOVEMBER 12, 1974 IN THE CHARLOTTE AMALIE AREA, ST. THOMAS, U.S. VIRGIN ISLANDS

by
W.J. Haire and K.G. Johnson

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