FLOOD OF AUGUST 20, 1979, ON A TRIBUTARY OF CHICKAMAUGA CREEK, NEAR GALLIPOLIS, OHIO

U.S. Geological Survey

Open-File Report 81-414

Prepared in cooperation with

Ohio Department of Transportation

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

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CONVERSION FACTORS

For those readers who may prefer to use metric (SI) units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

To convert from	To	Multiply by
inch (in)	millimeter (mm)	25.4
foot (ft)	meter (m)	0.3048
mile (mi)	kilometer (km)	1.609
mile^2 (mi^2)	kilometer^2 (km^2)	2.590
foot^3 per second (ft^3/s)	meter^3 per second (m^3/s)	0.02832

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ABSTRACT

An intense summer rain estimated at 4 to 5 inches in 2.5 hours caused flooding on a Chickamauga Creek tributary 4.5 miles northwest of Gallipolis, Ohio. Computation of a peak discharge of 1,350 cubic feet per second from 3.03 square miles of drainage area (446 cubic feet per second per square mile) indicates a greater-than-100-year flood.

INTRODUCTION

An intense summer thunder storm in southeast Ohio during the early morning hours of August 20, 1979, caused severe flooding on several small streams near Gallipolis. Rainfall from this storm in the vicinity of the peak discharge measurement site, a culvert on State Route 160, 4.5 miles northwest of Gallipolis, was reported to be 4 to 5 inches in 2.5 hours. The resulting flood-peak discharge was computed as 1,350 ft^3/s from Chickamauga Creek tributary (drainage area 3.03 mi^2).

The flood was investigated by the U.S. Geological Survey as part of a cooperative program with the Ohio Department of Transportation. One of the objectives of the program is to collect data on high intensity, infrequent hydrologic events.

HYDRAULIC ANALYSIS

Peak discharge was determined to be 1,350 ft ^{3}/s using indirect methods at a 14-foot 3-inch by 8-foot 8-inch multiplate pipe arch culvert, #GAL 160-0149, which carries the flow of the tributary under State Route 160. The upstream (approach) water surface elevation was determined to be 588.9 feet, National Geodetic Vertical Datum of 1929 (NGVD of 1929), and the downstream (tailwater) elevation 580.8 feet (NGVD of 1929). Elevation of the low point in State Route 160 in the vicinity of the culvert is 589.9 feet (NGVD of 1929), indicating no flow over the road during this flood peak.

The measured peak discharge (1,350 ft ^{3}/s) was outflow from the culvert. Because of considerable storage above the highway embankment, the inflow discharge was larger.

A profile of the 100-year frequency flood for this site, published in a flood hazard report by the U.S. Soil Conservation Service (1979), shows a lower water surface elevation upstream from the culvert than that for the August 20, 1979 flood peak.

Flood peaks at nearby gaging stations; on Raccoon Creek at Adamsville, drainage area 585 miles^2, (discharge 3,780 ft ^{3}/s), 7 miles west of the measurement site; and Shade River near Chester, drainage area 156 miles^2, (discharge 1,610 ft ^{3}/s), 27 miles northeast of the site were less than the 2-year frequency floods.

HYDROLOGY

The tributary is ungaged, and there are no rainfall recorders in its basin. So, to indicate the severity of the storm and the height of the resulting flood peak, observed and statistical data are presented.

Precipitation

Precipitation recorded at National Weather Service (NWS) rain gages show that the storm was local. These data are as follows:

NWS Station	Time of reading	Rainfall, in inches Aug.19	Aug.20	Aug.21	Distance from site (in miles)	Direction from site
Gallipolis	6 p.m.	0.02	3.76	0.25	4	SE
Jackson	8 a.m.	1.51	0.03	0.81	24	NW
Athens	7 a.m.	0.75	---	1.00	33	N
Ironton	7 a.m.	0.20	0.64	1.02	33	SW

Measurements of rainfall were obtained from people living in or immediately adjacent to the basin (fig. 1). One resident reported that most of the rain fell in about 2.5 hours. Precipitation data from the local residents are as follows:

Map no. (Fig.1)	Person	Location	Type catch	Rain (inches)
1	Mrs. Darst	3.2 mi NE of site	swimming pool	5
2	Pearl Kemper	3.0 mi north of site	rain gage	5+
3	Kail Burleson	0.6 mi NW of site	test tube gage	3
4	Haskins	2.0 mi SE of site	do.	3.5
5	William Smith	0.6 mi north of site	do.	4
6	Arthur Isaacs	1.9 mi NW of site	in drum	4

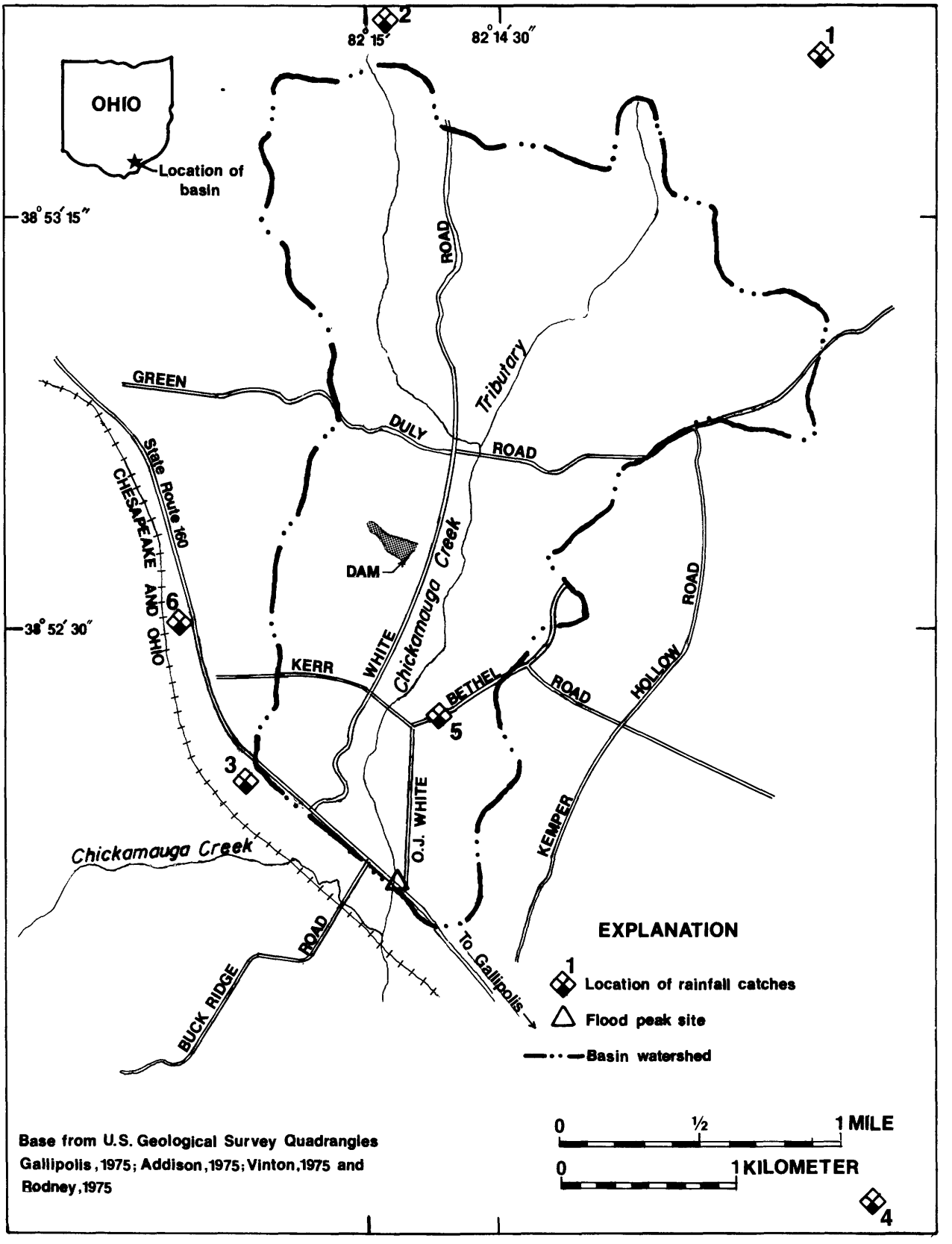

Figure 1.--Drainage basin, Chickamauga Creek tributary near Gallipolis, Ohio

Statistical data for rainfall rates for the United States are given in U.S. Weather Bureau Technical Paper no. 40 (1961). For southeast Ohio, the magnitudes and frequencies of rain, in inches, for a 3-hour period are as follows:

Frequency	Rainfall (inches)
10-year	2.5
50-year	3.2
100-year	3.5

Flood Frequency

The tributary basin includes 3.03 miles^2 and has a main channel slope of 34.9 ft/mi. Through the use of methods for determining discharge-frequency relations from basin characteristics, as described by Webber and Bartlett, (1977), the following peak discharges were computed:

Frequency	Discharge (ft^3/s)
10-year	582
50-year	1,010
100-year	1,230

The discharge-frequency curve is shown in fig. 2. The peak for the flood, 1,350 ft^3/s, is larger than the estimated 100-year flood-peak discharge.

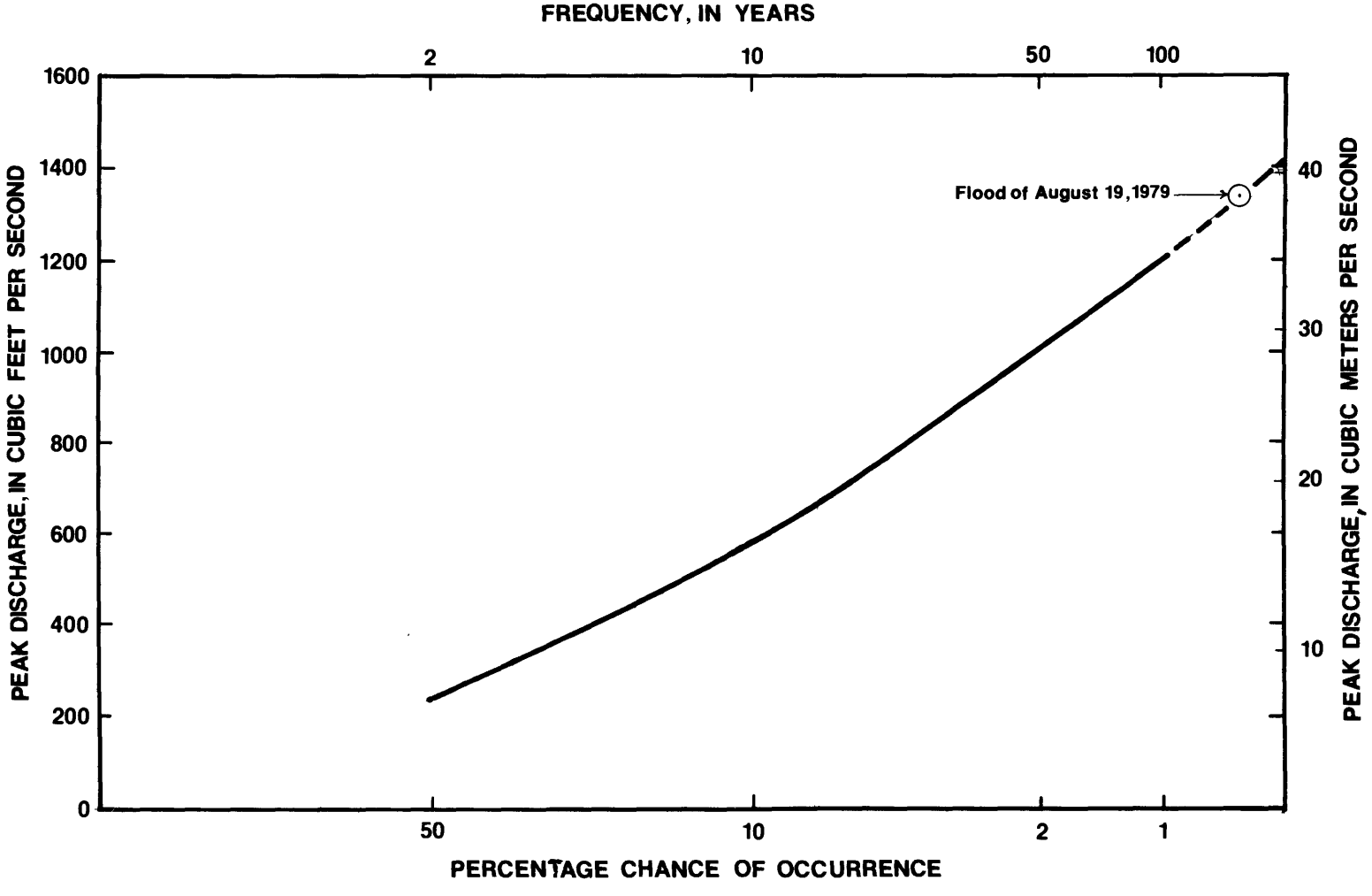

Figure 2.--Discharge-frequency curve, Chickamauga Creek tributary near Gallipolis, Ohio

SUMMARY

Four to five inches of rain fell on a tributary of Chickamauga Creek near Gallipolis, Ohio in a 2.5-hour period on August 20, 1979. This is greater than the 100-year frequency estimated for a rain of this intensity in southeast Ohio.

The resulting flood-peak discharge at the culvert, #GAL 160-0149, under State Route 160, of 1,350 ft^3/s, is larger than the estimated 100-year frequency discharge for this 3.03 $miles^2$ drainage basin, which has a main channel slope of 34.9 ft/mi. This peak discharge of 1,350 ft^3/s was smaller than the potential natural peak because some discharge was held in storage above State Route 160.

Maximum water-surface elevations were 588.9 feet (NGVD of 1929) upstream and 580.8 feet (NGVD of 1929) downstream from State Route 160.

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