WATER RESOURCES REPORT 19

FLOODS OF JUNE 17th and 18th, 1964 IN JEFFERSON, STE. GENEVIEVE, AND ST. FRANCOIS COUNTIES, MISSOURI

by M. S. PETERSEN

MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES

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REPORT 19

Floods of June 17-18, 1964 in Jefferson, Ste. Genevieve and St. Francois Counties, Missouri

by

M. S. Petersen

Water Resources Division, U.S.G.S.

Prepared in cooperation

with

MISSOURI GEOLOGICAL SURVEY
AND WATER RESOURCES

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Surface Water Branch:	Anthony Homyk, District Engineer
Ground-Water Branch:	Edward J. Harvey, District Geologist

*Certified Professional Geologist by the American Institute of Professional Geologists.

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By M. S. Petersen

ABSTRACT

The flash floods of June 17-18, 1964 in southern Jefferson County, and northern St. Francois and Ste. Genevieve counties in Missouri were of a magnitude to merit documentation of details and special study.

Flood damage to farm lands and buildings amounted to many thousands of dollars but was considerably less than that caused by most high-frequency floods owing to the rural nature of the drainage basins. No lives were lost, although several were threatened.

Intense storms deposited 5-7 inches of rain during a 4-hour period. Rainfall was most intense between 10 p.m. and 12 p.m. The area of high-intensity rainfall in Missouri was approximately 200 square miles.

Flooding caused by the intense rainfall produced the highest stages in the memory of local residents, identifying the flood as the highest in at least 80 years. Flood-frequency curves established by a regional analysis indicate a flood frequency well in excess of 100 years. Creeks in the area of the most intense rainfall produced discharges with a Myers rating in excess of 60 percent, which exceeds all previous documented experience in the State of Missouri.

INTRODUCTION

The floods of June 17-18, 1964, on several small creeks in Jefferson, Ste. Genevieve, and St. Francois counties in Missouri were among the most outstanding floods ever recorded in Missouri. The area within the storm boundary was small, but the intensity of rainfall and the magnitude of peak discharges were outstanding. Rainfall amounts ranging up to 7.3 inches were recorded for a 4-hour period, and isolated unofficial reports exceeded this amount. The purpose of this report is to document this unusual flood and to publicize the rarity of the event. The study is part of a continuing program to supply answers to basic questions on the hydrology of small drainage areas in the State of Missouri.

Evaluation of the flood was made by surveying high-water marks and channel features. This data was used in the computation of discharge and the definition of stream profiles. Data on rainfall amounts and intensity were obtained from many residents and compared with records from U.S. Weather Bureau rain gages in the vicinity to determine and verify the rainfall pattern.

This report gives a history of floods in the area; details of the June 1964 storm and flood; a typical discharge hydrograph; frequency curves for estimating recurrence interval; general statements of damage; previously known floods for comparison; flood profiles; stage and discharge at the gaging station in the immediate area; and peak stage and discharge at selected locations.

ACKNOWLEDGEMENTS

The collection, preparation and analysis of data for this report were made by personnel of the Rolla district of the U.S. Geological Survey under the direction of Anthony Homyk, District Engineer. This report was prepared in cooperation with the Missouri Geological Survey and Water Resources, Dr. William C. Hayes, State Geologist and Director. The Jefferson County Planning Commission furnished newspaper reports of the flood and reports of damage to county roads.

DESCRIPTION OF THE AREA

The area covered by this report is approximately 40 to 50 miles south of St. Louis in Jefferson, St. Francois, and Ste. Genevieve Counties, and comprises about 200 square miles. The creeks in Missouri affected by the floods lie immediately west of the Mississippi River and all drain into it. This area is in the eastern part of the Ozark Plateau Province.

Topography of the terrain varies but is generally classed as rolling hills. The steep slopes of the upland areas are heavily wooded. Cropland dominates the flood plains. The steam bed profile, typical of this type of terrain, is very steep in the headwater reaches, becomes less steep as the headwater tributaries come together to form a main channel, and then flattens considerably on reaching the Mississippi River alluvium.

The lower reaches of each of the basins blend into the Mississippi River alluvium and are therefore subject to flooding by the Mississippi River.

The areas affected by the flood are almost exclusively rural and are less susceptible to large damage from floods than the more industrialized areas. Damage from floods in these basins is confined largely to crops and agricultural activities associated with cattle raising, dairy farming, and poultry raising.

DETAILS OF THE STORM

June 17, 1964, was a pleasant day with temperatures reaching into the 90's. Thunderhead clouds began to accumulate during late afternoon and intensified as the evening progressed. The rain began about 8 p.m. (c.s.t.) falling as short, small bursts for the first 2 hours. At 10 p.m. (c.s.t.) the rain began to fall much faster and soon built up into unusual intensity. The precipitation was decreasing rapidly by midnight and stopped soon thereafter.

Residents of the area reported most of the rain fell during a 2-hour time interval. Intensities of up to 3 inches in 1 hour were reported. Maximum rainfall amounts reported and verified were in excess of 7 inches. Rumors of 12-inch rainfalls could not be confirmed. Results of a bucket survey are given in table 1, page 19.

An isohyetal map of the area (fig. 1) shows the rainfall amounts as well as the lateral distribution and extent of coverage.

Rainfall amounts recorded were greatest east of the Mississippi River where the U.S. Weather Bureau rain gage at Prairie du Rocher, Illinois (two miles east of the Mississippi River) recorded 7.30 inches. Figure 2 shows hourly precipitation amounts recorded by this gage. Rainfall was intense on the Isle du Bois Creek basin, on Kinsey Creek basin (headwaters of Establishment Creek) and on the headwaters of Plattin Creek. As is noted on figure 1, intensive rainfall was limited to a relatively small area in Missouri with the amount of precipitation and resultant runoff decreasing rapidly toward the outside fringe.

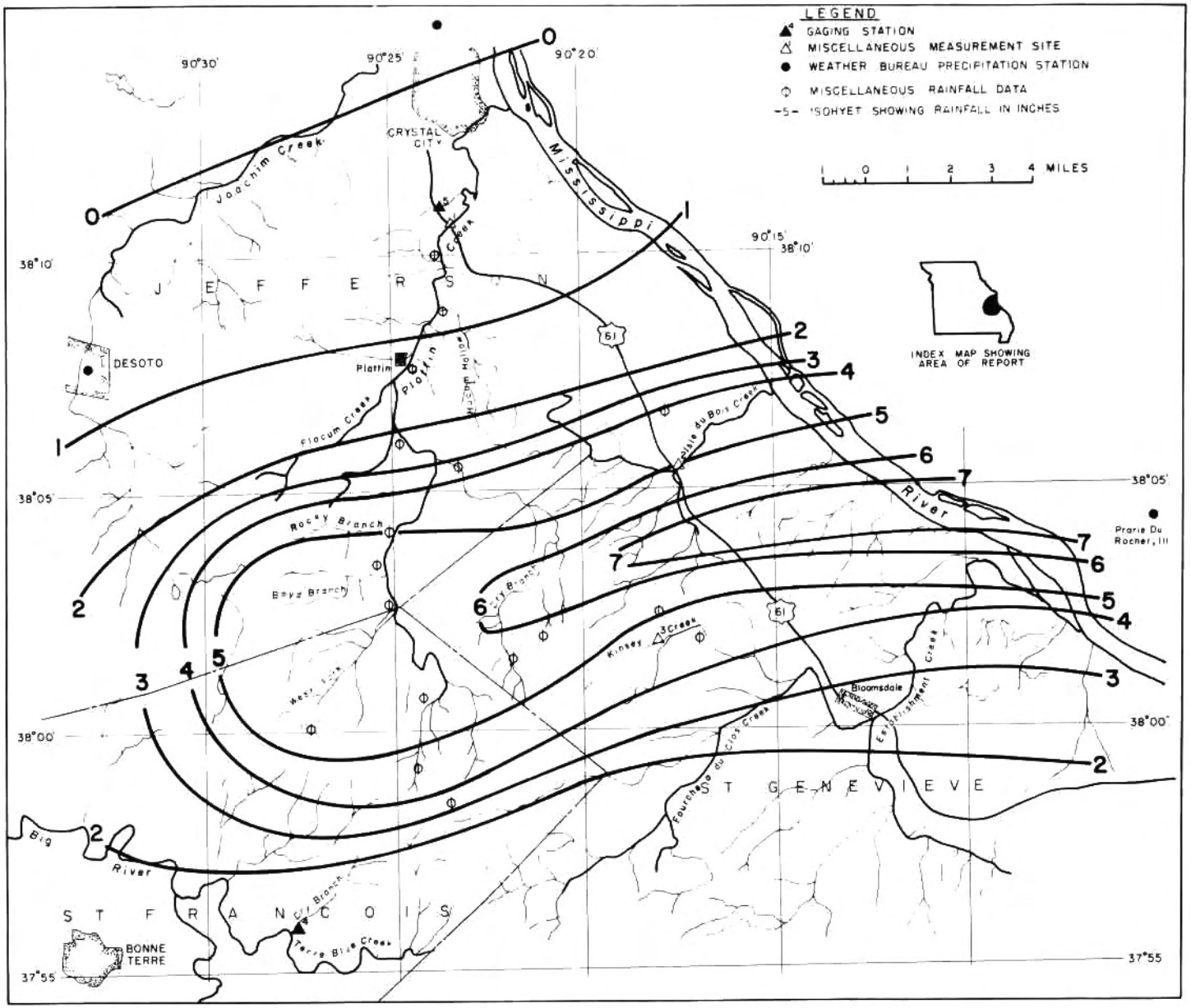

Figure 1. — Isohyetal map of east central Missouri showing storm rainfall of June 17-18 and location of flood measuring sites. Flood of June 17-18, 1964.

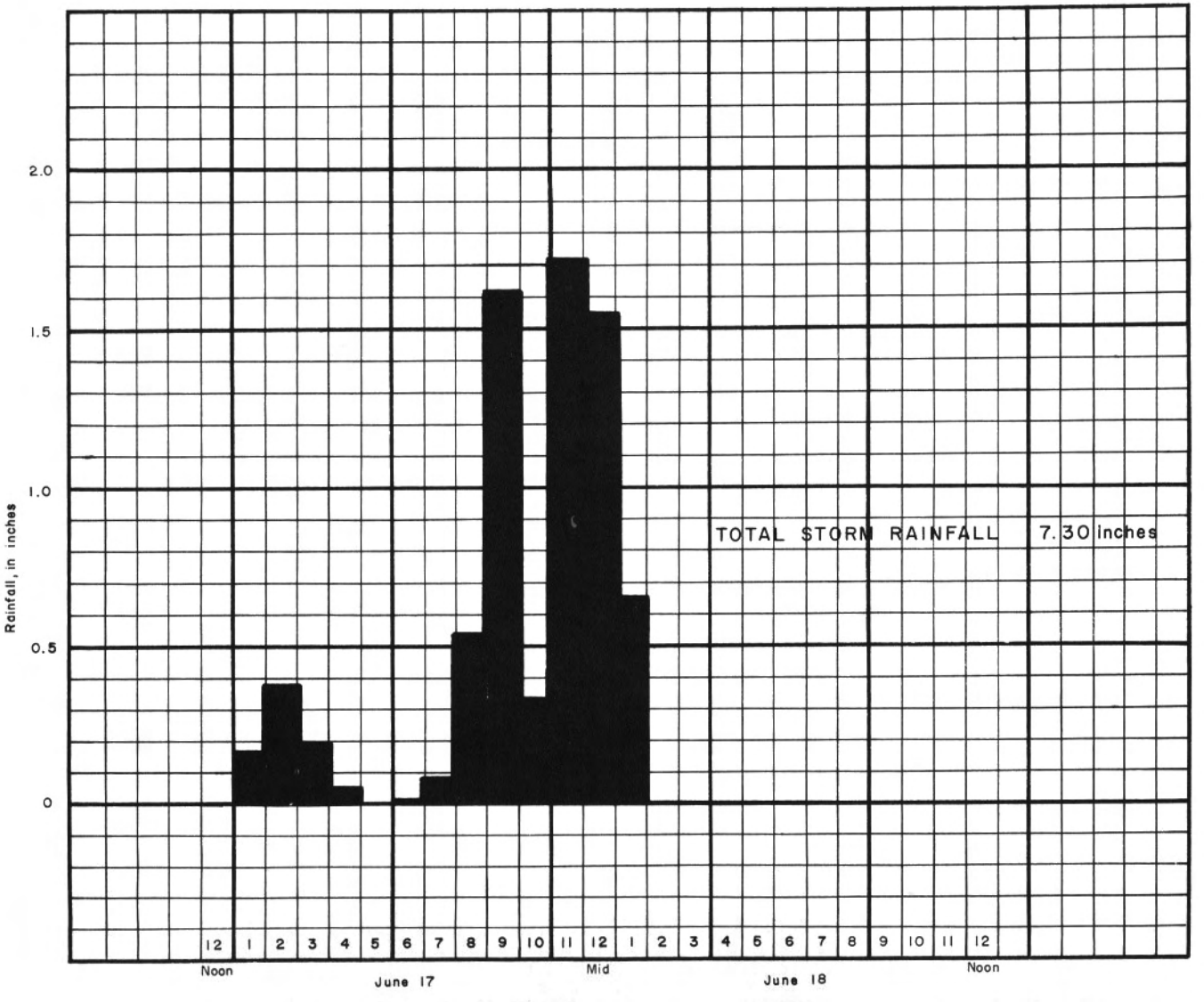

Figure 2. — Diagram showing hourly rates of precipitation, Prairie du Rocher, Illinois for storm of June 17-18, 1964.

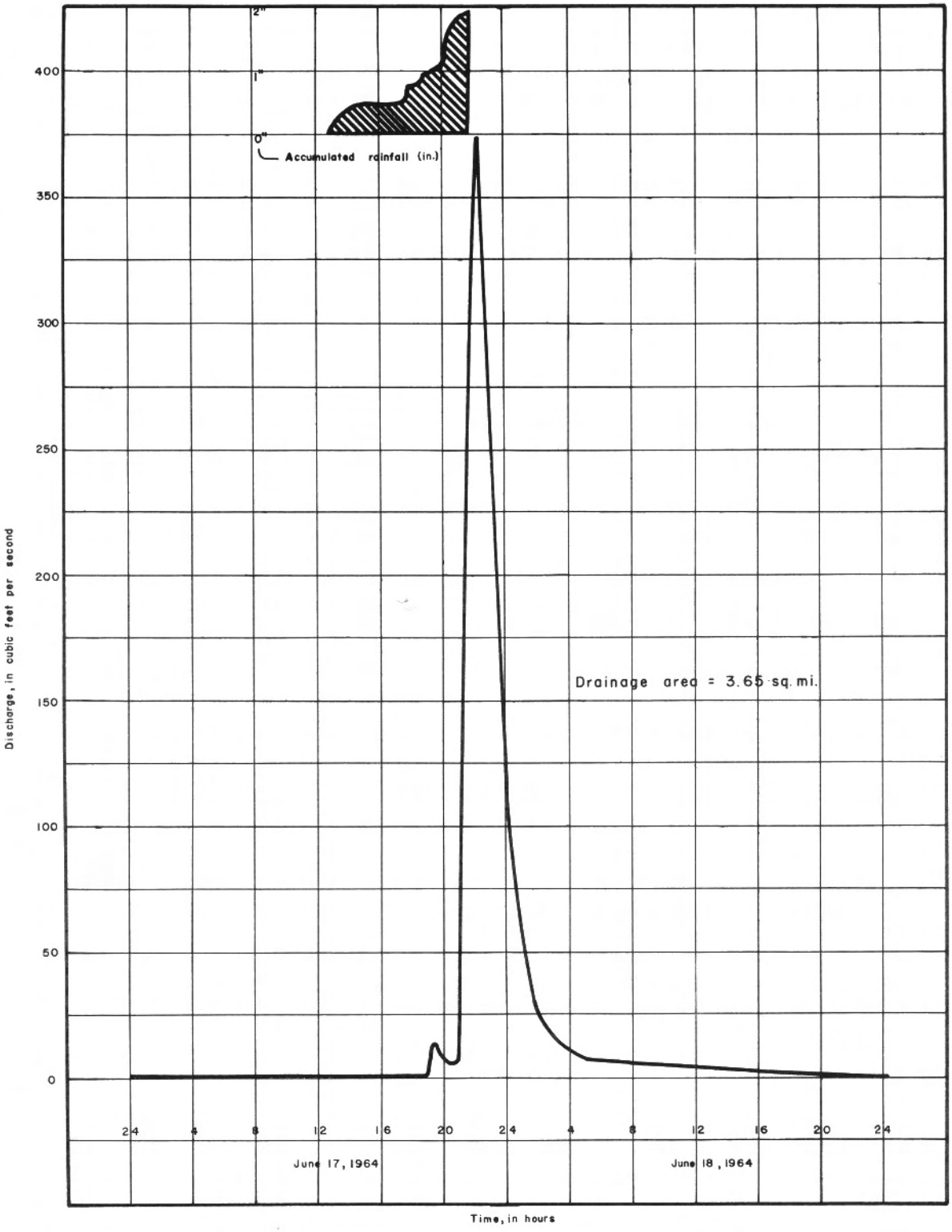

Figure 3. — Typical flood hydrograph. Dry Branch near Bonne Terre, Missouri. Flood of June 17-18, 1964

Figure 3 shows a typical hydrograph of the storm runoff. This hydrograph was taken from a recording station in the fringe area of rainfall and does not reflect an outstanding flood, but is given to show the shape of the hydrograph and the rapidity with which the discharge rises and falls. The rainfall is also shown but noted to be only a small fraction of that experienced in the areas of more intense rainfall.

The effect of intense rainfall is illustrated by the photograph, firgure 4, which shows the excessive scour at bridge abutments and highway fill. This damage occurred at a bridge over Isle du Bois Creek on U.S. Highway 61.

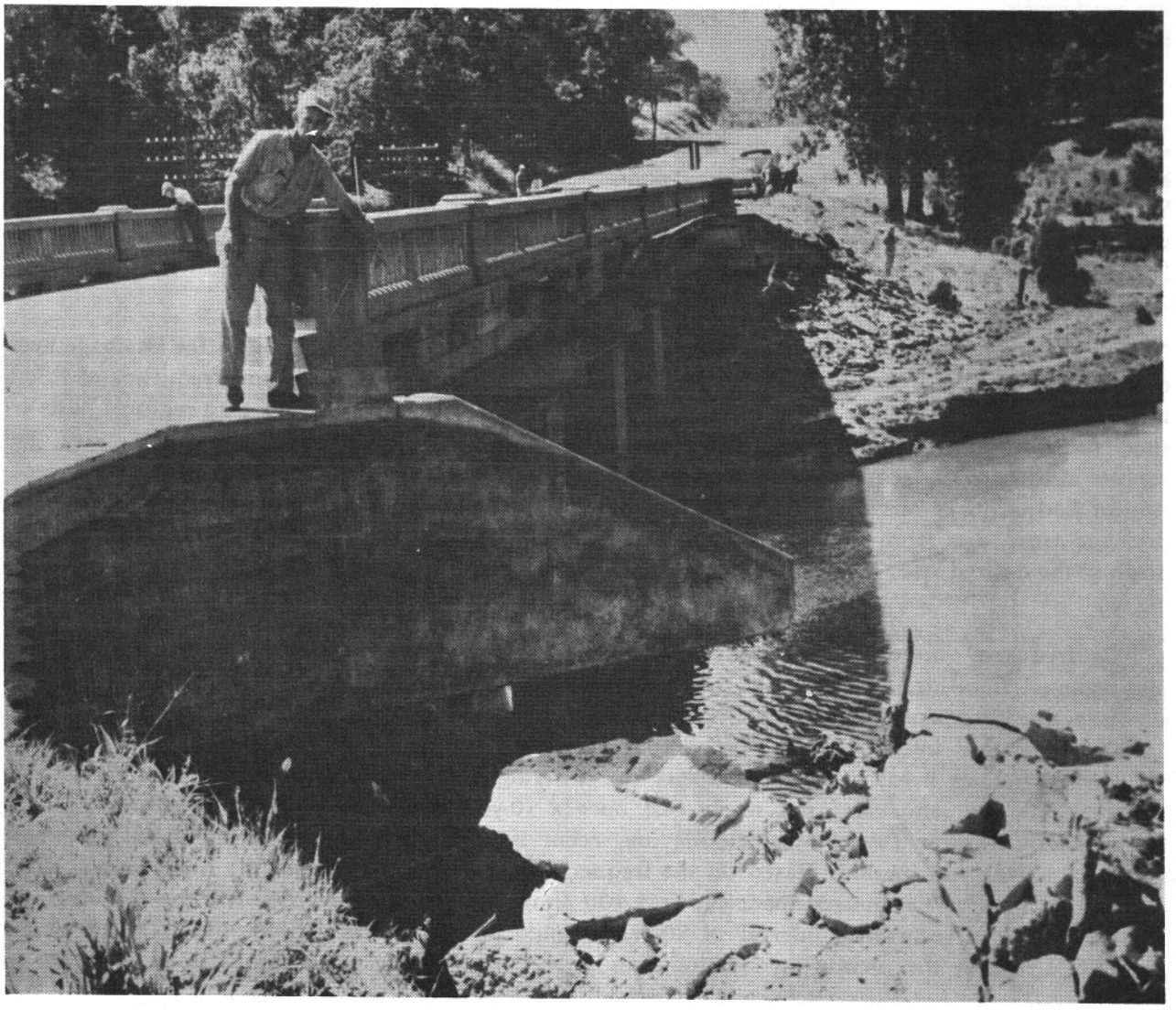

Figure 4. — View of damaged bridge over Isle du Bois Creek at U. S. Highway 61 crossing. Note complete wash-out of left abutment fill and under highway.

HISTORY AND FREQUENCY OF FLOODING

Major floods originate from two main sources: (1) the headwater floods which result from intense rainfalls causing excessive runoff from the upland areas and (2) the backwater floods which result from flooding on the Mississippi River as the highwater elevation extends into the lower portions of the streams draining into the Mississippi River. These two types of floods have different effects and the damage resulting from each are distinctive.

Major backwater floods from the Mississippi River have occurred in 1785, 1844, 1903, 1927, 1944, and 1951. These floods were of sufficient magnitude to inundate portions of the lowland areas of the creeks mentioned in this report. The backwater flood affects more people than does the headwater flood, as most of the population in the area is at the mouth of Plattin Creek and near the Mississippi River.

The first major headwater flood known occurred in 1899. Another outstanding headwater flood occurred in 1938. A more recent headwater flood in an adjacent basin occurred in April 1957; however, only a small part of the area concerned within this flood report was located within the boundaries of the 1957 storm. The flood of June 1964 was the highest and most damaging headwater flood in the memory of any of the local citizens. One elderly resident said it was the highest in at least 80 years. This would identify the 1964 flood as the highest since 1884.

The discharges computed at sites indicated in this report were unusually high for drainage areas of this size. Publications by the U.S. Geological Survey on the magnitude and frequency of floods in Missouri (Searcy, 1955 and Patterson, 1964) giving frequency of floods on a regional basis are cited for methods to estimate the frequency of flooding on ungaged basins in a specific area. The reports cited provide frequency estimates for drainage areas greater than 5 square miles. Two creeks studied had drainage areas less than 5 square miles. To provide frequency estimates for these smaller drainage areas, data from 7 small-area gages in the vicinity were used to extend the frequency curves down to the desired size. The results of this study are shown on figures 5-7.

The frequency curves give discharge estimates for any recurrence interval up to 50 years. The mean annual flood is, by definition, the graphical mean determined by the intersection of the visually best fitted frequency line and the 2.33-year recurrence interval line. The discharge given for the 50-year recurrence interval can be expected to be equaled or exceeded on the average of once in a 50 year period, or it has a 2-percent chance of occurring in any year. The consideration here is the long-term average and does not imply that once a 50-year flood has occurred it will not re-occur for another 50-years. Two 50-year floods may occur in the same year or one might not be experienced in a 100 year period. Based on the frequency plots, the discharge of the mean annual flood of Plattin Creek at the measurement site is 4,400 cubic feet per second (cfs), and the discharge for a flood having a recurrence interval of 50 years would be 13,000 cfs. The frequency graph of Isle du Bois Creek at the measuring site indicates a discharge for the mean annual flood of 1,800 cfs and a discharge for the 50-year recurrence interval flood of 5,200 cfs.

The frequency graph of Kinsey Creek at the measuring site gives a discharge for the mean annual flood of 700 cfs and a discharge for the 50-year recurrence interval flood of 2,090 cfs.

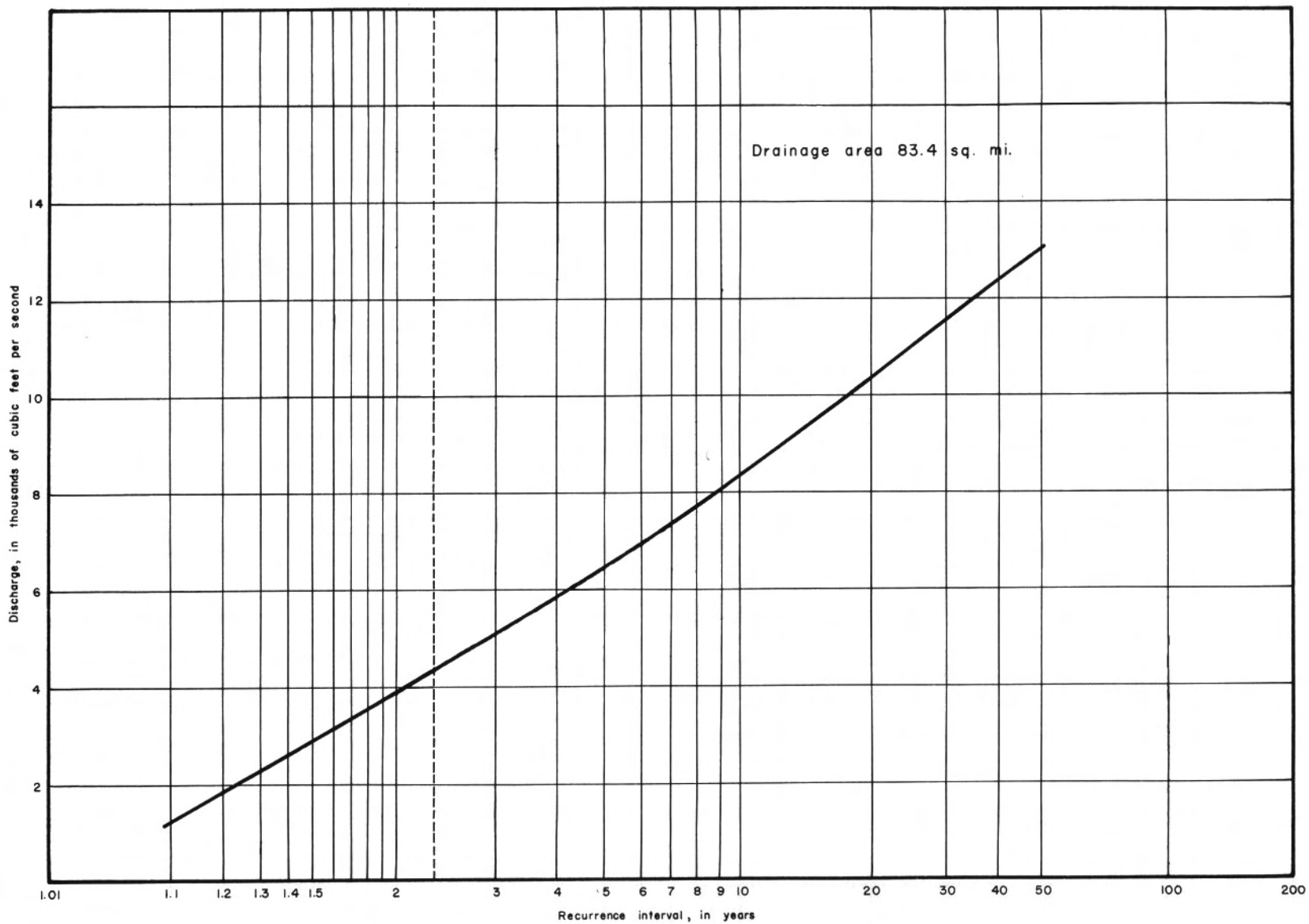

Figure 5. — Regional frequency curve for Plattin Creek at U. S. Highway 61 crossing.

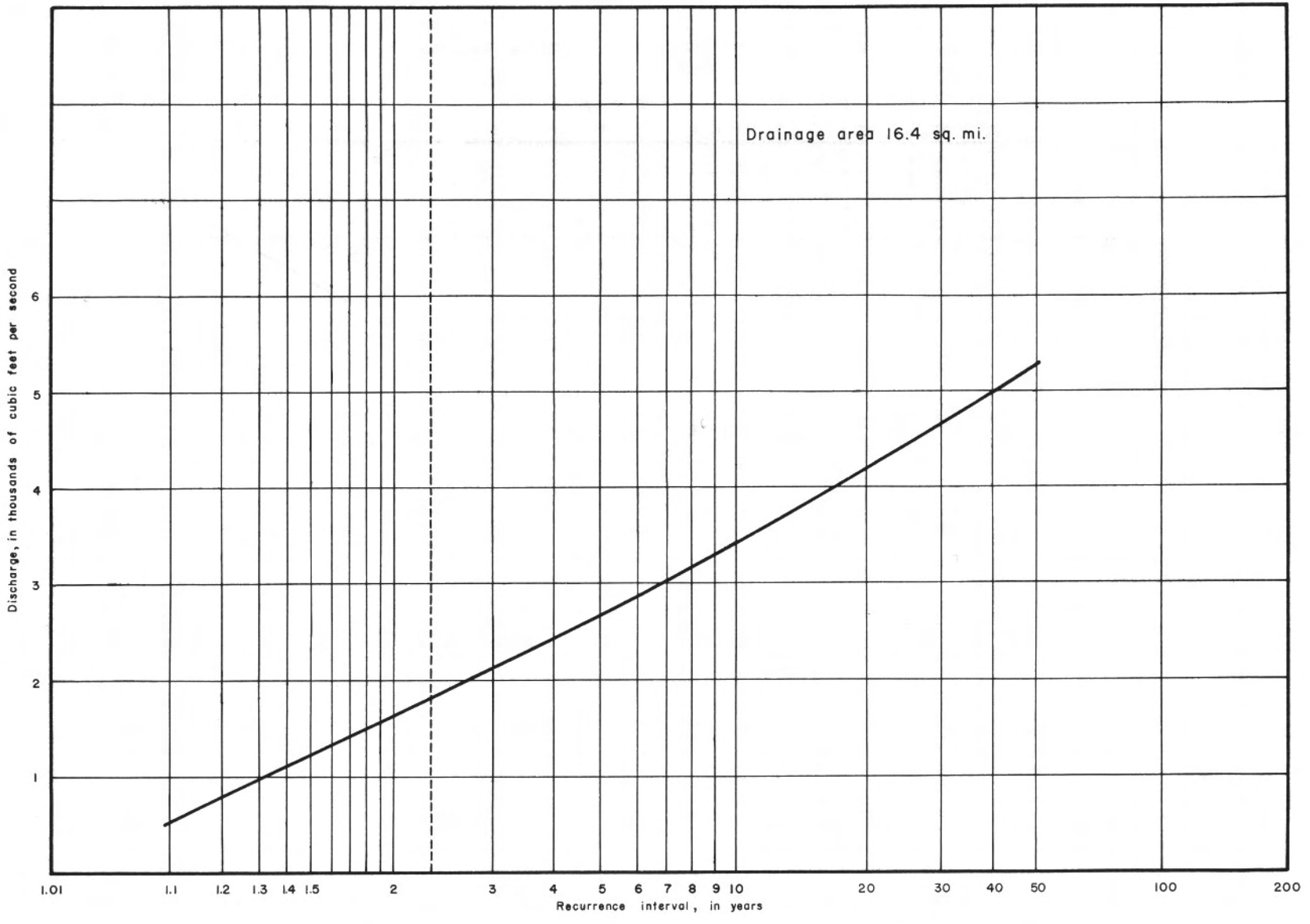

Figure 6. — Regional frequency curve for Isle du Bois Creek at U. S. Highway 61 crossing.

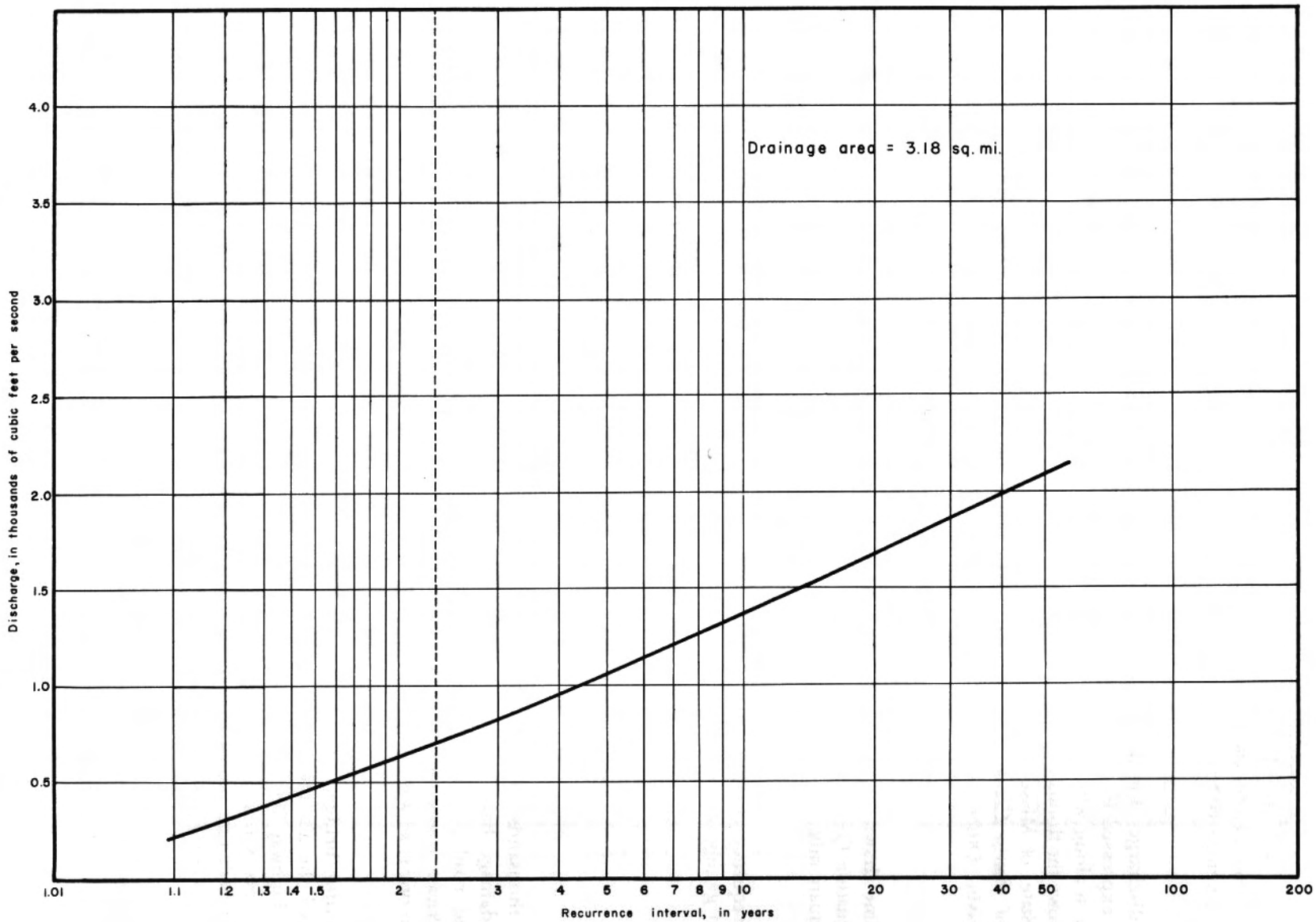

Figure 7. — Regional frequency curve for Kinsey Creek at Kinsey, Missouri.

Measured peak discharges for the 1964 flood at the above mentioned sites were 30,100 cfs, 28,400 cfs and 11,600 cfs respectively as shown in table 2 and indicate the relative magnitude of the flood when compared to the 50-year flood.

Peak discharges for the floods of June 17-18, 1964, were determined at 4 sites. These peak discharges, expressed in cubic feet per second per square mile (cfsm) are plotted against drainage area on figure 8 along with discharges at many other locations throughout Missouri at various times. The graph shows the floods of June 1964 on Isle du Bois Creek and Kinsey Creek are the highest known in the State of Missouri. They indicate a recurrence interval well in excess of 100 years. The discharge of Plattin Creek plots low because the intense rainfall occurred only on the headwater area of the basin. Other gaging stations nearby reflected the rapid decrease of rainfall toward the fringe areas.

The line drawn on figure 8 represents a 60 percent Myers rating and is a graphical expression of the equation $Q=6000\ A^{0.5}$ where Q equals cubic feet per second and A represents the drainage area in square miles. The line is relative however, and is used only for comparison.

The frequency computations are based on existing records of streamflow in the regular network of stream gaging stations of the U.S. Geological Survey.

FLOOD DAMAGES

Many thousands of dollars damage resulted from the flash flood of June 1964, but estimates of total damage have not been made. A County Road Engineer reported $15,000 spent to replace gravel and road fills and to clean culverts. Automobiles and farm machinery were swept down the creeks. Private roads and fields were scoured and severely damaged. Five hundred feet of blacktop surface on one road was washed away. Several county bridges were damaged or destroyed.

One major bridge, on U.S. Highway 61 across Isle du Bois Creek, was severly damaged as water scoured the abutments and road fills and overflowed the road bridge. Water was 1.3 feet deep over the highway and overflowed the road for a distance of 660 feet. The highway fill at the left abutment was scoured away leaving the bared abutment sitting on the piling 10 to 12 feet above the stream bed. The highway concrete slab was left suspended in mid-air for a distance of approximately 15 feet (see fig. 4).

It was estimated that 5,000 acres of cropland was covered with water. Huge piles of debris were lodged against trees, rocks, posts, and buildings.

Numerous homes in the area were damaged. Strong currents swept away the contents of homes and buildings. Many were trapped in their homes and had to be evacuated by boat.

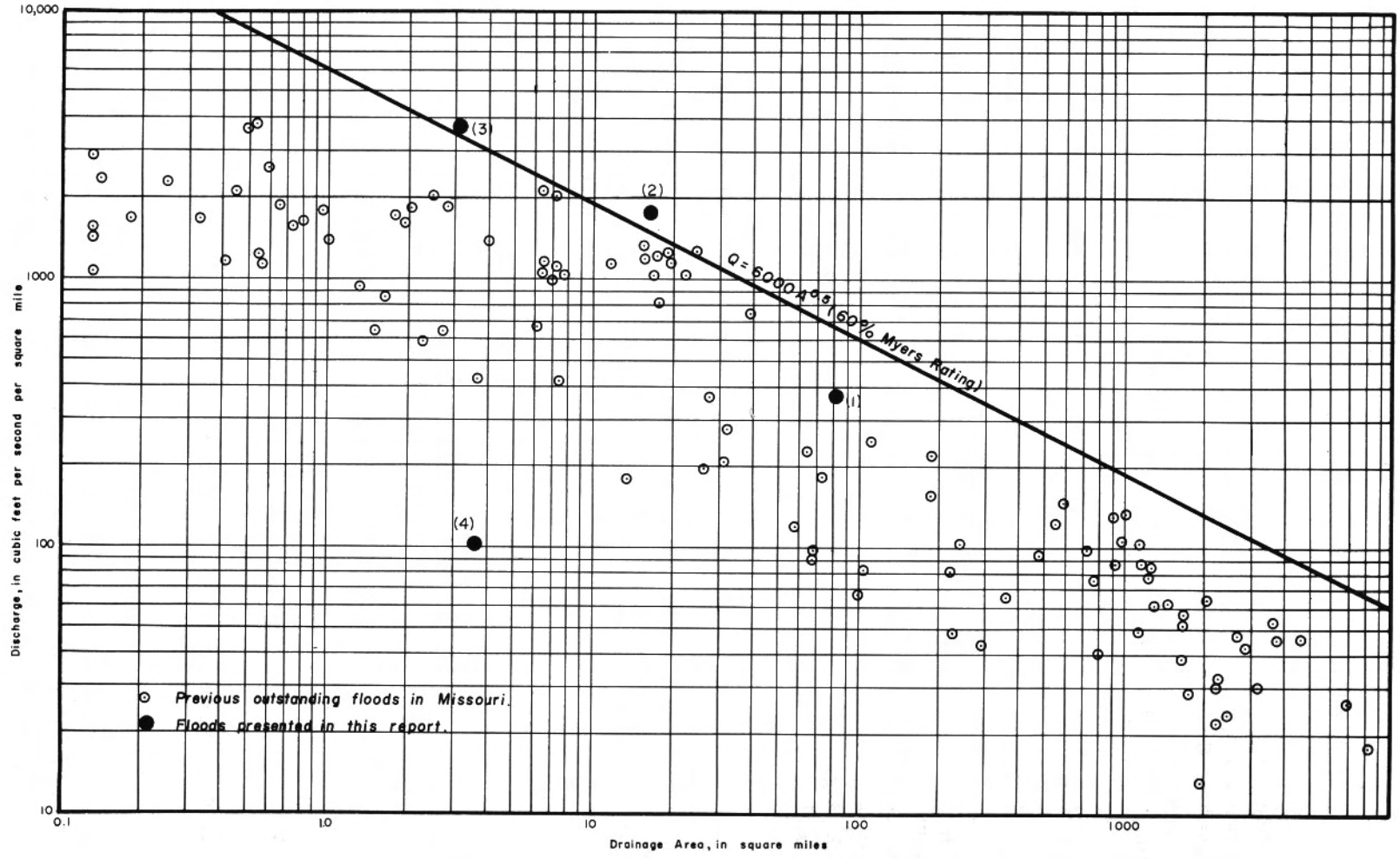

Figure 8. — Relation of unit peak discharge to drainage area — Missouri floods.

MEASUREMENT OF FLOOD DISCHARGE

Flood measuring conditions necessitated computation of discharge by indirect methods. This requires a transit-stadia survey of the site to define high water profiles and physical features. Detailed instructions regarding the computation of discharge by these methods are available in many publications of the U.S. Geological Survey. Table 2 gives the results of these measurements and indicates the magnitude of peak flows.

FLOOD PROFILES

The gathering of stream profile data was considered important for the Plattin Creek basin, which is of major significance in Jefferson County. High-water marks for the June 1964 flood were defined along the creek and levels run to reference them to sea level datum. The profiles of figure 9 give the slope of the water surface during peak discharge and the slope of the bed of the stream for Plattin Creek. Figure 9 could serve to define the inundated areas along the creek. The profiles of West Fork and Dry Fork, both major tributaries to Plattin Creek, were also partially defined.

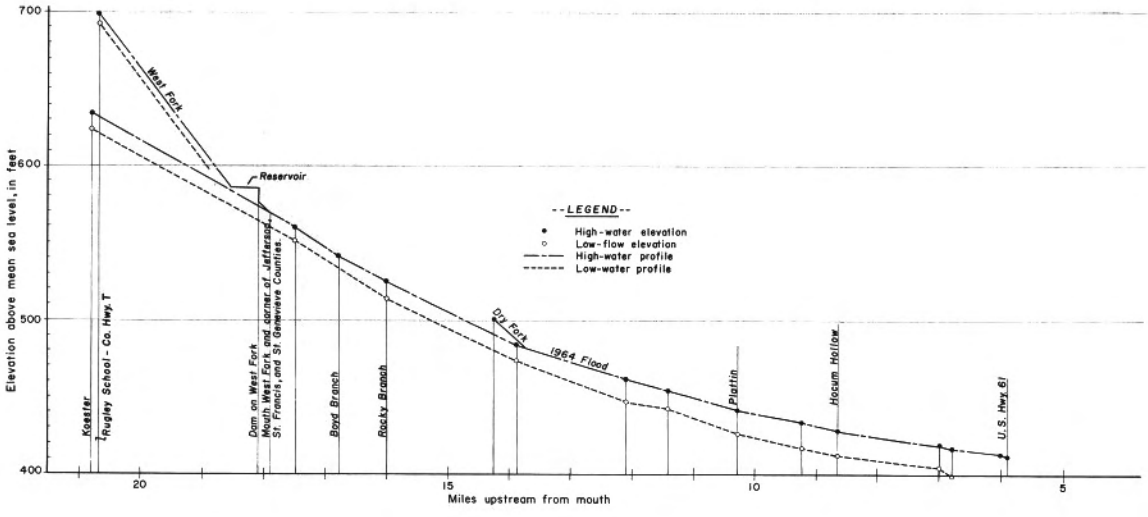

Figure 9. — Profile of water surface elevation in Plattin Creek during peak discharge, flood of June 17-18, 1964.

The U.S. Corps of Engineers recently completed a study of Plattin Creek. (United States Corps of Engineers, 1964). They computed a water surface profile and estimated inundated areas for Plattin Creek for a 200-year flood. The flood of June 1964 was significantly higher than their estimated 200-year flood which again points out the rarity of the June 1964 event.

SUMMARY

The floods of June 17-18, 1964, in east central Missouri were the most outstanding ever documented for small drainage areas in Missouri. Figure 8 illustrates the magnitude of the subject floods when compared to previous floods in Missouri. The line shown is the Myers rating 60 percent line and provides a measure for comparison.

Rainfall amounts and intensities were unusually high for this area as shown on figures 1 and 2 and table 1.

Table 2 is a summary of flood stages and discharges and shows extreme flooding from small areas. The numbers for the measurement sites are also shown on the map.

TABLE I — Results of Bucket Survey
Storm of June 17-18, 1964, in East Central Missouri

Location	Rainfall (inches)	Remarks
Festus, Mo.	0	U.S. Weather Bureau station
Telegraph School 1 mi W.	<0.5	Mr. Huber observation
Hocum Hollow confluence	1.0	Mr. Freese Plastic rain gage
Plattin Store	1.0	Plastic rain gage
High Ridge School 1½ mi SW	2.5	Straight sided can
Dry Fork 1 mi from mouth	5	Mr. Wagner Straight bucket
Rocky Branch confluence	5	Large can
Boyd Branch confluence	4.75	Mr. Rugley, Jr. Rain gage on post
West Fork Reservoir	>5	Mr. Rugley, Sr. Rain gage on post
Dry Branch Headwater	>6	Mr. E. Sickman Rain gage ran over
Rugley School	5	Est. in cans by resident
Koester 3 mi E	6.5	(3" in 1 hr) Plastic rain gage
Koester	5	Plastic rain gage
Koester 2 S	4.75	Mr. L. Carron rain gage
Danby	4	Newspaper report
French Village	3	on wet ground rain gage
Kinsey	7.5	Mrs. Cook plastic rain gage
Kinsey 1 mi E	4.5	Mrs. Taylor plastic rain gage
Dry Branch	1.4	USGS recording gage
Perryville *	.4	
Potosi *	1.35	
DeSoto	.76	
Unionville *	.76	
Farmington*	1.24	
Prairie du Rocher, Ill.*	7.30	
Red Bud, Ill.*	1.81	
Sparta, Ill.*	2.13	
Chester, Ill.*	.55	
Waterloo, Ill.*	.41	

* U.S. Weather Bureau rain gages.

TABLE II — Summary of Flood Stages and Discharges in East Central Missouri for Flood of June 17-18, 1964

No.	Stream & Location	Drainage Area (sq mi)	Maximum Floods					
			Date	Gage* height (feet)	Discharge Cfs	Discharge Cfsm	Ratio to $Q_{2.33}$	Ratio to Q_{50}
1.	Plattin Creek nr Crystal City, Mo.	83.4	June 17, 1964	24.06	30,100	361	6.8	2.3
2.	Isle du Bois Creek nr Ste. Genevieve, Mo.	16.4	June 17, 1964	31.08	28,400	1,732	15.8	5.5
3.	Kinsey Creek at Kinsey, Mo.	3.18	June 17, 1964	–	11,600	3,650	16.6	5.6
4.	Dry Branch nr Bonne Terre, Mo.	3.65	June 17, 1964	2.89	372	102	0.5	–
5.	Murphy Branch nr Crystal City, Mo.	0.45	No Peak					

* Arbitrary datum

Note. – $Q_{2.33}$ in next to last column refers to the theoretical flood that has a recurrence interval of 2.33 years and, by definition, is the geographical interpretation of the mean annual flood. Q_{50} in the last column refers to the 50 year flood.

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