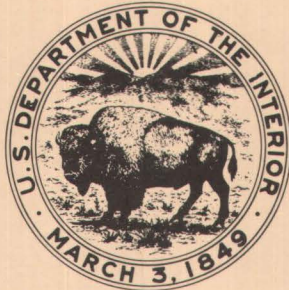


UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY



FLOODS IN THE  
ROCK RIVER BASIN, IOWA

By

Albert J. Heinitz, Hydrologist  
United States Geological Survey

Prepared in cooperation with the  
IOWA STATE HIGHWAY COMMISSION

Open-file Report 74-1047

Iowa City, Iowa  
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# FLOODS IN THE ROCK RIVER BASIN, IOWA

by

Albert J. Heinitz

## ABSTRACT

This report contains flood information for the Rock River basin in Iowa, it updates and supersedes the 1967 report "Floods in Rock River basin, Iowa" by P. J. Carpenter.

The occurrence of an outstanding flood in 1969 and the acquisition of additional flood data in the basin prompted the preparation of this report. The 1969 flood, the greatest flood on the Rock River in at least 45 years, is nearly equivalent to a flood of a 50-year recurrence interval. The 1953 flood was the greatest recorded on Otter Creek. This flood was 1.8 times the 50-year recurrence interval discharge at the gaging station near Ashton.

Flood information is reported for 49.8 miles (80.1 kilometers) on the main stem, 49.6 miles (79.8 kilometers) on the Little Rock River, and 33.0 miles (53.1 kilometers) on Otter Creek. This information is useful to those concerned with the design of bridges and other structures and those involved in regulatory or planning activities on the flood plains of the streams. Included in the report are flood-peak records, frequency curves, water-surface profiles, and bench mark data.

Flood profiles for the Rock River include those for the 1962, 1964, 1965, 1969, and the computed 25- and 50-year floods.

On the Little Rock River and Otter Creek, profiles include those for the 1969 flood and the computed 25- and 50-year floods. Low-water profiles are shown for all reaches.

### INTRODUCTION

This report contains flood information for the Rock River basin in Iowa; it updates and supersedes the 1967 report "Floods in Rock River basin, Iowa" by P. J. Carpenter.

The occurrence of an outstanding flood in April 1969, and the acquisition of additional flood data in the basin prompted the preparation of this report. This flood was the greatest known on the Rock River in at least 45 years (Anderson and Schwob, 1970) and was about equivalent to a 50-year flood. Flood data obtained include profiles and peak discharges on the Rock and Little Rock Rivers up to the Minnesota state line and on Otter Creek up to mile 75.2 (kilometer 121.0) about 1 mile (1.6 kilometers) south of Sibley. The 1969 flood data on the Rock and Little Rock Rivers were published by Anderson and Schwob (1970).

The purpose of this report is threefold:

- 1) To incorporate the information on the outstanding flood of 1969 into the flood records for this basin.
- 2) To include the Otter Creek flood data.
- 3) To provide up-to-date information on flood frequencies and magnitudes in the Rock River basin on the basis of a recent flood-frequency study (Lara, 1973).

The data presented may be used for planning, designing, and operating structures and conducting other activities on or across the streams and flood plains in the basin and for appraising the severity of floods. Information provided includes:

- 1) A description of the physical characteristics of the basin.
- 2) Flood history with brief descriptions of storms causing outstanding floods.
- 3) Flood stages and discharges.
- 4) Profiles of several major floods, the computed 25- and 50-year floods, and a low-water profile.
- 5) Flood-frequency information.
- 6) Bench mark descriptions and elevations.

Conversion factors for converting English units published herein to the International System of units (SI) are given in table 1.

Table 1.--Conversion factors for converting English units to the International System of units (SI).

Multiply English units	By	To obtain SI units
inches	2.54	centimeters
feet	0.3048	meters
miles	1.609	kilometers
square miles	2.590	square kilometers
cubic feet	0.02832	cubic meters
cubic feet per second	0.02832	cubic meters per second

## ACKNOWLEDGMENTS

This report is the seventh of a series prepared in a cooperative project with the Iowa State Highway Commission through the Iowa Highway Research Board. Collection of the basic data and preparation of the report were by the U. S. Geological Survey. Records for stream-gaging stations were obtained as a part of the cooperative program with city, State, and Federal agencies. Acknowledgment of cooperation in operating gaging stations is contained in the annual streamflow reports of the U. S. Geological Survey.

Special acknowledgment is due Donald Riddle, hydrologic technician, U. S. Geological Survey, who prepared the illustrations for the report.

## BASIN DESCRIPTION

The Rock River basin is located in the southwestern corner of Minnesota and the northwestern corner of Iowa (fig. 1). The drainage area is 1,688 square miles (4,372 square kilometers) (Larimer, 1957, p. 367), of which 770 square miles (1,994 square kilometers) are in Iowa. It is the largest tributary basin to the Big Sioux River which, in turn, is tributary to the Missouri River. Parts of Lyon, Sioux, Osceola, and O'Brien Counties constitute the Iowa portion of the basin.

The maximum width of the basin is 40 miles (64 kilometers) and the overall length is approximately 75 miles (121 kilometers). The basin is oriented in a north-south direction. The Rock

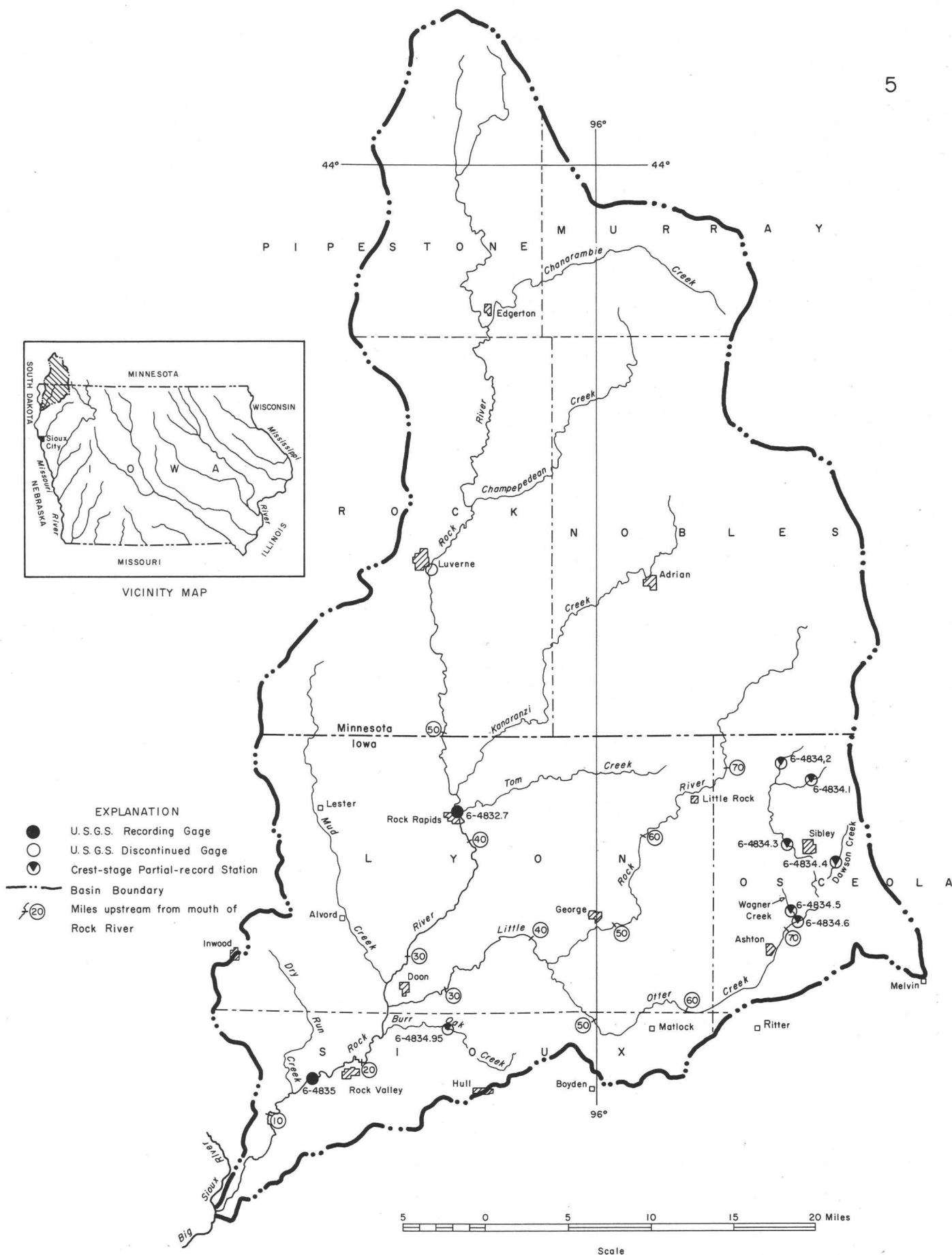


Figure 1. Map of Rock River basin.



River, which rises in Minnesota, flows in a relatively straight south-southwesterly course to its junction with the Big Sioux River. The Rock River has a total length of about 100 miles (161 kilometers) with about 50 miles (80 kilometers) in Iowa. Drainage areas for the principal tributaries of the Rock River in Iowa are listed in table 2.

Table 2.--Drainage areas of the principal tributaries of the Rock River and of the main stem Rock River in Iowa.

Stream	Miles upstream from mouth of Rock River	Bank of entry	Drainage area, square miles	Percent of total area	Drainage area of main stem downstream from tributary, square miles
Rock River at state line	49.8	--	558	33.1	--
Kanaranzi Creek	43.9	Left	205	12.1	777
Tom Creek	42.4	Left	62.1	3.7	851
Mud Creek	27.0	Right	138	8.1	1,049
Little Rock River	25.3	Left	474	28.1	1,524
Burr Oak Creek	23.2	Left	38.9	2.3	1,566
Dry Run Creek	14.1	Right	51.4	3.1	1,656
Rock River at mouth	0	--	1,688	100	--

The topography of the basin in Iowa is the result of (1) the action of glaciers which in the past have intermittently covered the area, (2) the deposition of loess (wind-blown silts), and (3) subsequent erosion. The basin is marked by isolated steep hills and noncontributing depressional areas in the northeast, and flat-to-moderately rolling uplands. The hills bordering the Rock and Little Rock Rivers range in height from 60 feet (18 meters) to 110 feet (34 meters). The total relief in the basin is 350 feet (107 meters). Loess soils cover approximately 80 percent of the area. Sand and gravel deposits are found in the valleys.

The Rock River basin in Iowa is predominantly an agricultural area with about 97 percent of the land area in farms in 1969. Towns range in population from about 100 to 2,800. The 1970 population of the basin area was about 29,000, with 12,300 located in the cities and towns (U. S. Bureau of the Census, 1971).

The Rock River basin in Iowa has a temperate climate. The yearly average temperature for the 1931-60 period was  $47^{\circ}$  F ( $8.5^{\circ}$  C) (U. S. Weather Bureau, 1965, p. 210). The 1931-60 annual precipitation ranged from 25.3 inches (64.3 centimeters) in the west to 27.2 inches (69.1 centimeters) in the east (Schwob, 1966, pt. 1, p. 3). The 1931-60 annual snowfall ranged from 32.4 inches (82.3 centimeters) in the south to 35.1 inches (89.2 centimeters) in the north (U. S. Weather Bureau, 1964, p. 25-29).

## FLOOD HISTORY

Very little is known about floods in the basin prior to 1948 when a stream-gaging station was established at Rock Valley, Iowa. Following is a chronology of some of the significant flood events for which some type of information is available.

1897: Rock River at Rock Valley, Iowa. Gage height, 17.0 feet (5.18 meters), 1,228.8 feet (374.54 meters) above mean sea level, 1929 datum. Reported by the Iowa Highway Commission. Discharge not determined.

June 1914: Rock River at Luverne, Minnesota. Gage height, 13.2 feet (4.02 meters), 1,437.8 feet (438.24 meters) above mean sea level, 1929 datum. Discharge, 11,600 cubic feet per second ( $\text{ft}^3/\text{s}$ ) or 328.5 cubic meters per second ( $\text{m}^3/\text{s}$ ).

September 17-18, 1926: Little Rock River basin. Rainfall of 24 inches (61 centimeters) in less than 18 hours at Boyden, Iowa. Reported by the U. S. Army Corps of Engineers (1945). No flood information available.

The following significant storm events produced some of the larger recorded flood peaks.

June 7, 1953: Rainfall of 11.4 inches (29.0 centimeters) at Ritter, Iowa, was recorded unofficially (Iowa Resources Council, 1956, p. 37). This storm produced an average precipitation varying from 2 inches (5 centimeters) in the north to 8 inches (20 centimeters) in the south of the Iowa part of the Rock River basin. A discharge of 17,400  $\text{ft}^3/\text{s}$  (492.8  $\text{m}^3/\text{s}$ ), 1.8 times the 50-year flood, occurred at the gaging

station on Otter Creek near Ashton. The gage height for this flood was 12.16 feet (3.706 meters), 1,460.39 feet (445.127 meters) above mean sea level, 1929 datum.

June 17-19, 1954: Rock River basin in Iowa. Rainfall of 4 to 6 inches (10 to 15 centimeters) was followed by 1 to 5 inches (2.5 to 12.7 centimeters) on June 20-22. The resulting peak discharge, 19,200  $\text{ft}^3/\text{s}$  (543.7  $\text{m}^3/\text{s}$ ), at Rock Valley was less than a 5-year event. The gage height for this flood was 15.86 feet (4.834 meters), 1,227.67 feet (374.194 meters) above mean sea level, 1929 datum.

March 1962: Flood resulted from melting snow which had accumulated to nearly 40 inches (102 centimeters) in depth. Water content of the snow in the basin varied from about 4 to 6 inches (10 to 15 centimeters). The resulting peak discharge, 28,400  $\text{ft}^3/\text{s}$  (804.3  $\text{m}^3/\text{s}$ ), at Rock Valley was equivalent to about a 10-year event. The gage height for this flood was 16.91 feet (5.154 meters), 1,228.72 feet (374.514 meters) above mean sea level, 1929 datum.

April 1969: Greatest flood recorded on the Rock River was also caused by snowmelt from a snowpack of 15 to 25 inches (38 to 64 centimeters) which had accumulated over the winter. Water content of the snow varied from 4 to 8 inches (10 to 20 centimeters). The peak discharge on the Rock River was nearly equivalent to a 50-year flood. Peak discharge at Rock Valley was 40,400  $\text{ft}^3/\text{s}$  (1,144.1  $\text{m}^3/\text{s}$ ) with a gage height of 17.32 feet (5.279 meters), 1,229.13 feet (374.639 meters) above mean sea level, 1929 datum.

## BASIC DATA

## Gaging-station Records

Two recording stream-gaging stations and seven crest-stage stations are presently operated in the Iowa portion of the Rock River basin. A stream-gaging station was operated at Luverne, Minnesota, for the period 1911-14. The locations of these stations are shown in figure 1. A station description and a list of flood peaks for each of the gaging stations in Iowa are given in Appendix A of this report.

Daily records at the recording stream-gaging stations are published in the annual streamflow publications of the U. S. Geological Survey (See references).

Graphs of annual peak flood discharges for three gaging stations, two on the Rock River and one on Otter Creek, are shown in figure 2.

## Mileage System

River mileages shown on the basin map in figure 1 and those on the profiles in figures 6-13 are in miles upstream from the mouth of the Rock River. They were determined from the best available maps. Highway crossings, mouths of tributaries, and other easily identified points are indicated on the profiles. An index number, such as 9747-25NE, is shown at bridges and other points to aid in identifying the map location. The number 9747-25NE indicates a location in township 97N., range 47W., the northeast quarter of section 25.

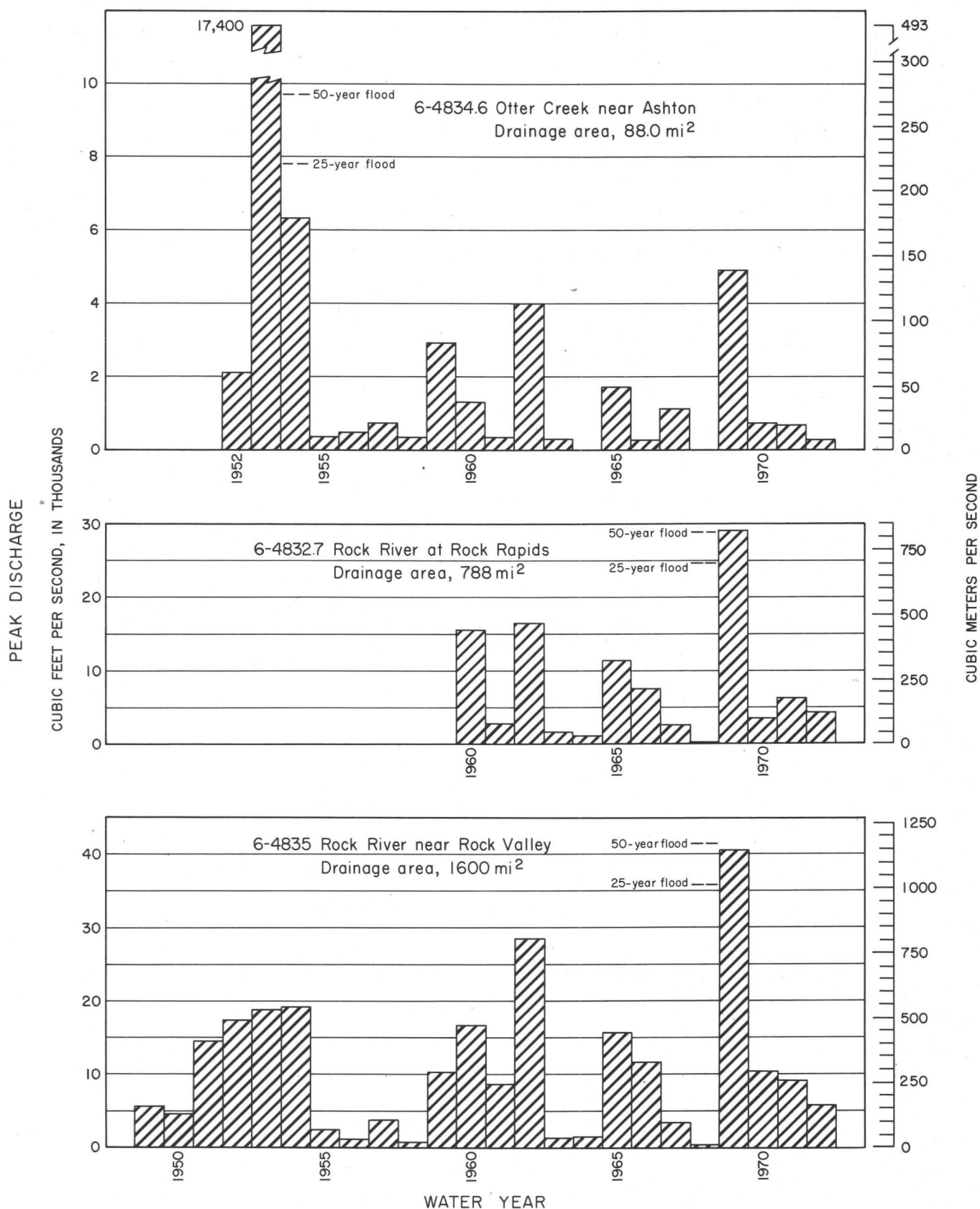


Figure 2. Annual peak discharges for period of record for selected gaging stations in the Rock River basin.



### Bench Marks

A list of the bench marks, with descriptions and elevations, that were used or established in determining water-surface elevations for this report is included in Appendix B of this report. At least one bench mark and a reference point were established at each bridge at the time levels were run. Some of these have since been destroyed by demolition of the old bridges preparatory to new bridge construction. An explanation of the leveling work is contained in the introductory material in Appendix B.

### STREAM PROFILES

Major floods overflow the channels and inundate fields and pasture lands along the channel. This land generally is quite flat and constitutes a relatively wide flood plain. Above bankfull stage, a small increase in flood elevation is usually accompanied by a large increase in discharge. The 50-year flood, for example, is in general only from 0.2 to 0.3 foot (6 to 9 centimeters) higher than the 25-year flood. This relationship is illustrated in the elevation-discharge curves shown in figure 3. Elevation-discharge relationships at other measurement sites in the basin have curves of similar shape.

Profiles of floods on the Rock River include those for March 1962, September 1964, April 1965, April 1969, and the computed 25- and 50-year floods. Also shown is a profile of the low-water condition of August 3, 1966. These profiles are shown in figures 6 to 8.

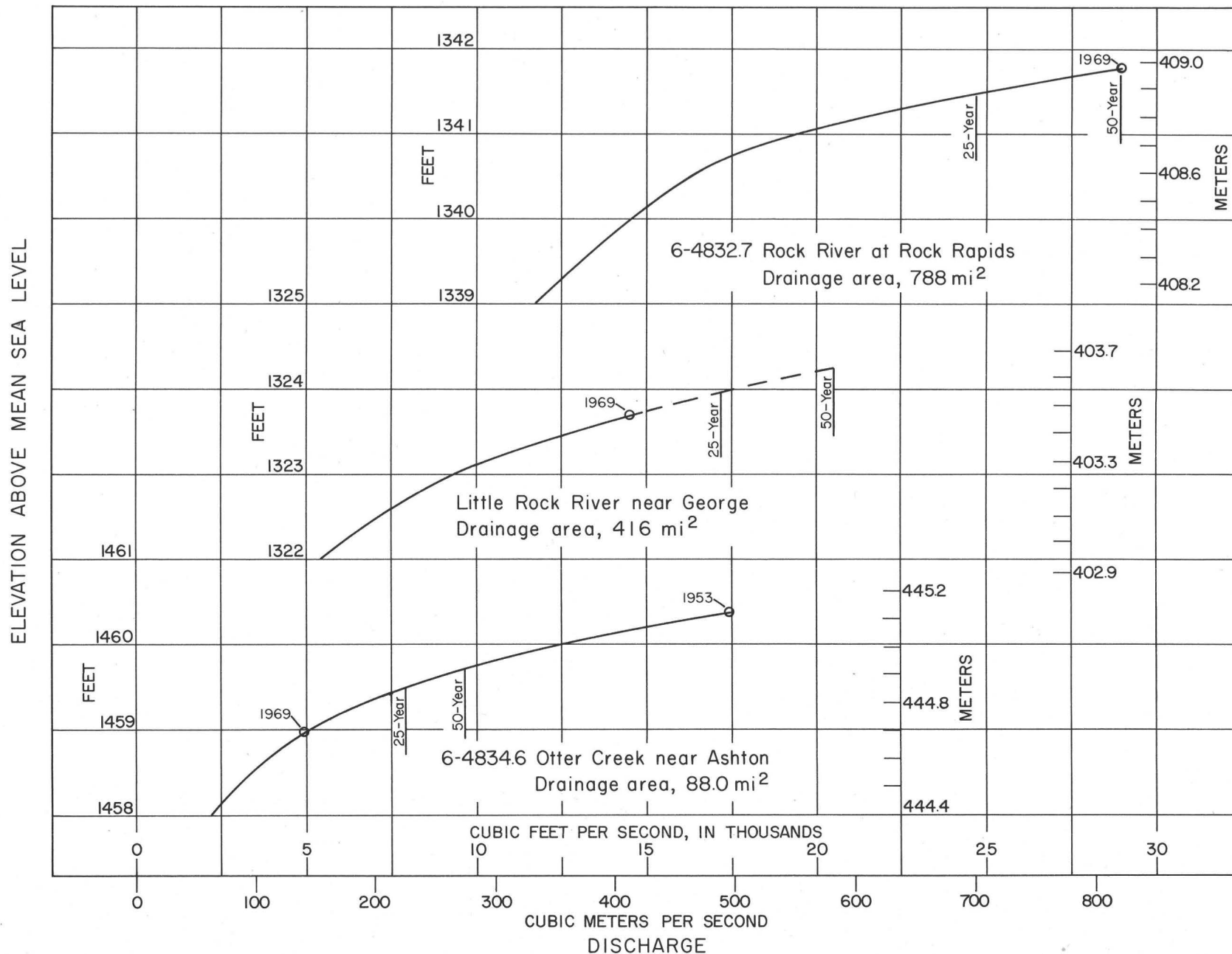


Figure 3. Elevation-discharge relationship for selected sites in the Rock River basin.

Profiles on the Little Rock River and Otter Creek include those for the flood of April 1969, the computed 25- and 50-year floods, and the low-water condition of April 24, 1973. The profiles for the Little Rock are shown in figures 9 to 11, and those for Otter Creek are shown in figures 12 and 13.

High-water marks for all of the floods were obtained at all bridges within 48 hours of the peak stage. Marks were set to define the water-surface elevations upstream and downstream of the bridges. Supplemental marks were set between some bridges to aid in the profile definition. All marks have been referenced to mean sea level, datum of 1929, by leveling.

The 25- and 50-year flood discharges were computed by methods outlined in a flood-frequency report by Lara (1973).

Peak discharges tabulated on the profile sheets were determined from elevation-discharge relations (rating curves) at the gaging stations and supplemental discharge measurement sites.

On the Rock River, the 50-year flood discharge is nearly equivalent to the April 1969 flood. The 50-year flood profile is therefore not shown on the profile sheets.

Elevations for the 25- and 50-year floods on the Little Rock River and Otter Creek were estimated on the basis of elevation-discharge relations at six sites. The elevation-discharge relations for two of these sites are shown in figure 3.

## FLOOD FREQUENCY

Flood-frequency curves for selected gaging stations in the Rock River basin are shown in figure 4. These curves were computed using regional flood-frequency relationships (Lara, 1973). The regional equations relate floods to the size of the drainage area (A), in square miles, and the channel slope (S). The channel slope, in feet per mile, is determined from elevations at points 10 and 85 percent of the distance along the channel from the point of interest to the basin divide.

The following equations will enable the computation of discharges (Q), in cubic feet per second, for selected recurrence intervals (Q subscript) for drainage areas greater than 2 square miles (5.18 square kilometers) in the Rock River basin. The standard error, in percent, shown for each of the equations is an approximate measure of the accuracy of the discharges computed by the regional equations.

	<u>Standard error</u>
$Q_2 = 31.2 A^{0.701} S^{0.490}$	40
$Q_5 = 82.5 A^{0.651} S^{0.445}$	29
$Q_{10} = 143 A^{0.618} S^{0.410}$	26
$Q_{25} = 262 A^{0.579} S^{0.367}$	31
$Q_{50} = 394 A^{0.551} S^{0.335}$	37

Drainage areas greater than 5 square miles (12.95 square kilometers) are listed in Bulletin No. 7 (Larimer, 1957). Smaller drainage areas can be determined from available maps. Curves of channel slope for parts of the Rock River, Little

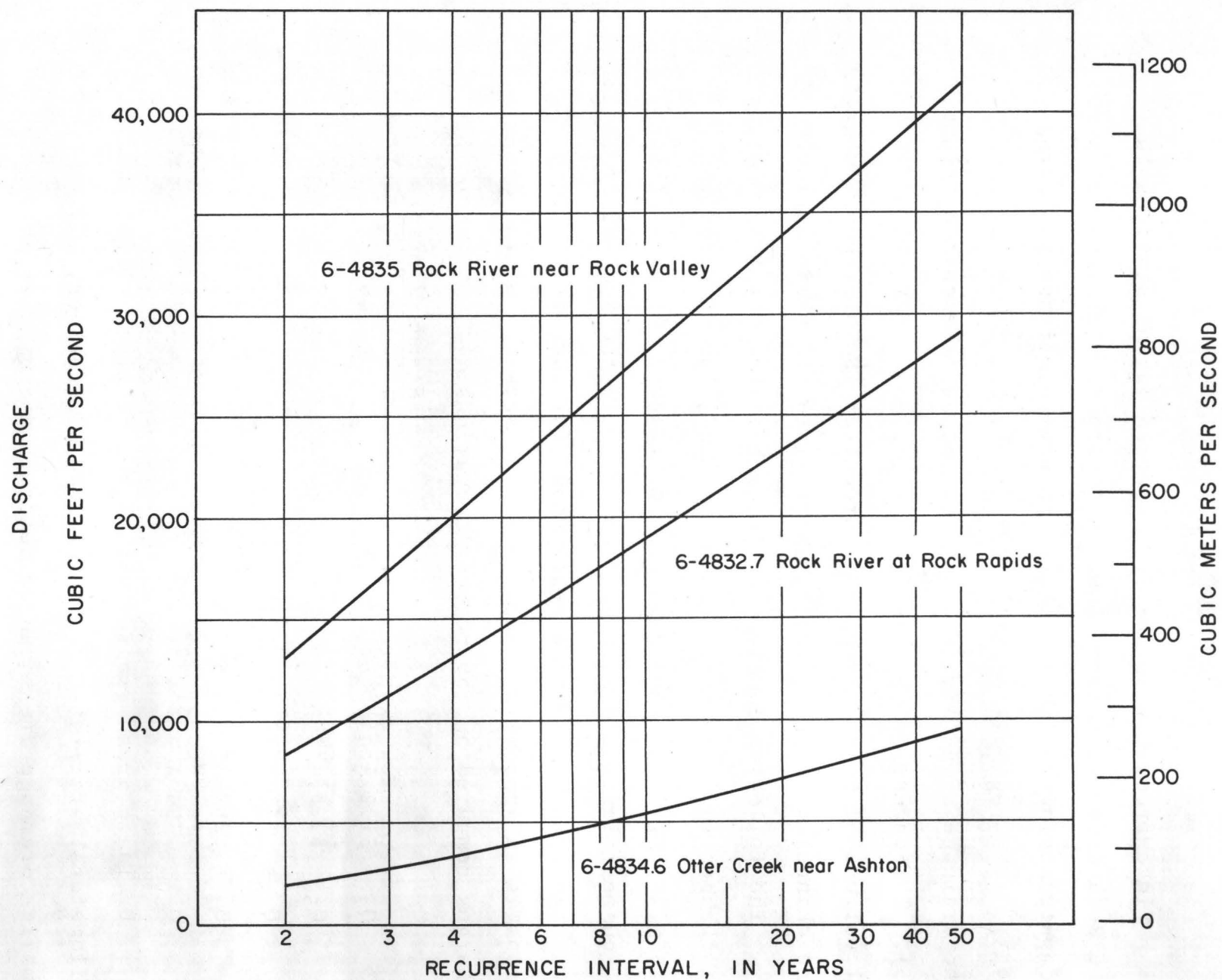


Figure 4. Flood-frequency curves for selected gaging stations in the Rock River basin.

Rock River, and Otter Creek are shown in figure 5. Slopes for other streams can be determined from topographic maps, when available, or by field survey.

#### DISCUSSION

The user of this report is cautioned that the elevation-discharge data presented herein are representative of the physical conditions of the basin at the time of the various floods. The profiles for the 25- and 50-year recurrence-interval floods are based on the assumption that these physical conditions remain unchanged. Changes in the basin can alter the flood magnitude for a given frequency. Examples of these changes include extensive urbanization, implementation of conservation practices, installation of drainage systems, and construction of reservoirs. Changes in the channel conditions immediately downstream from a site can materially affect the elevation-discharge relationship. Examples of such changes include the construction of dams, bridges, or levees; changes in the floodplain vegetative cover; straightening of the channel; and natural scour and fill. Temporary changes can be caused by ice and debris jams which produce backwater conditions and may cause the flood elevations to plot higher than the normal profile.



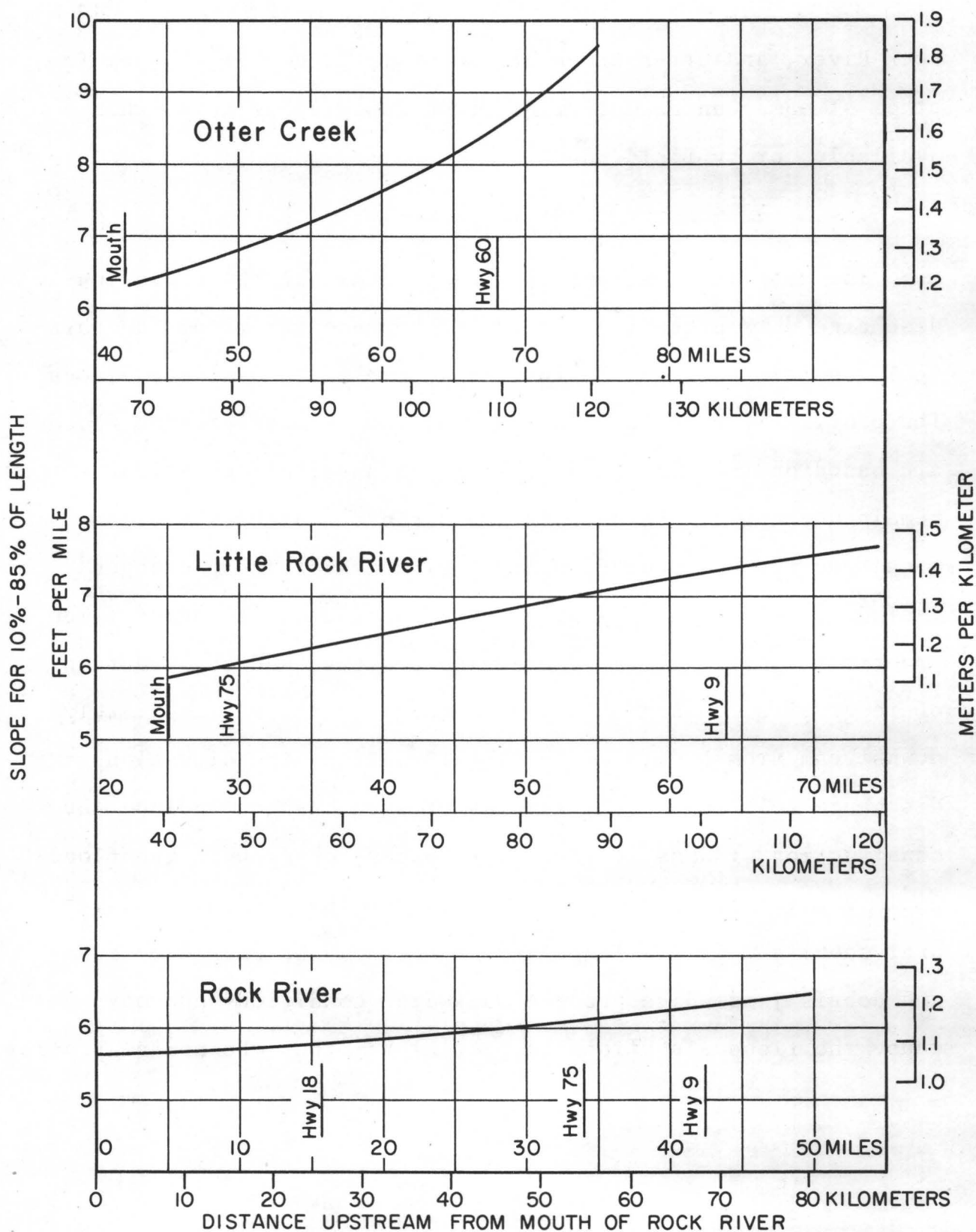


Figure 5. Slope curves for Rock River, Little Rock River, and Otter Creek.

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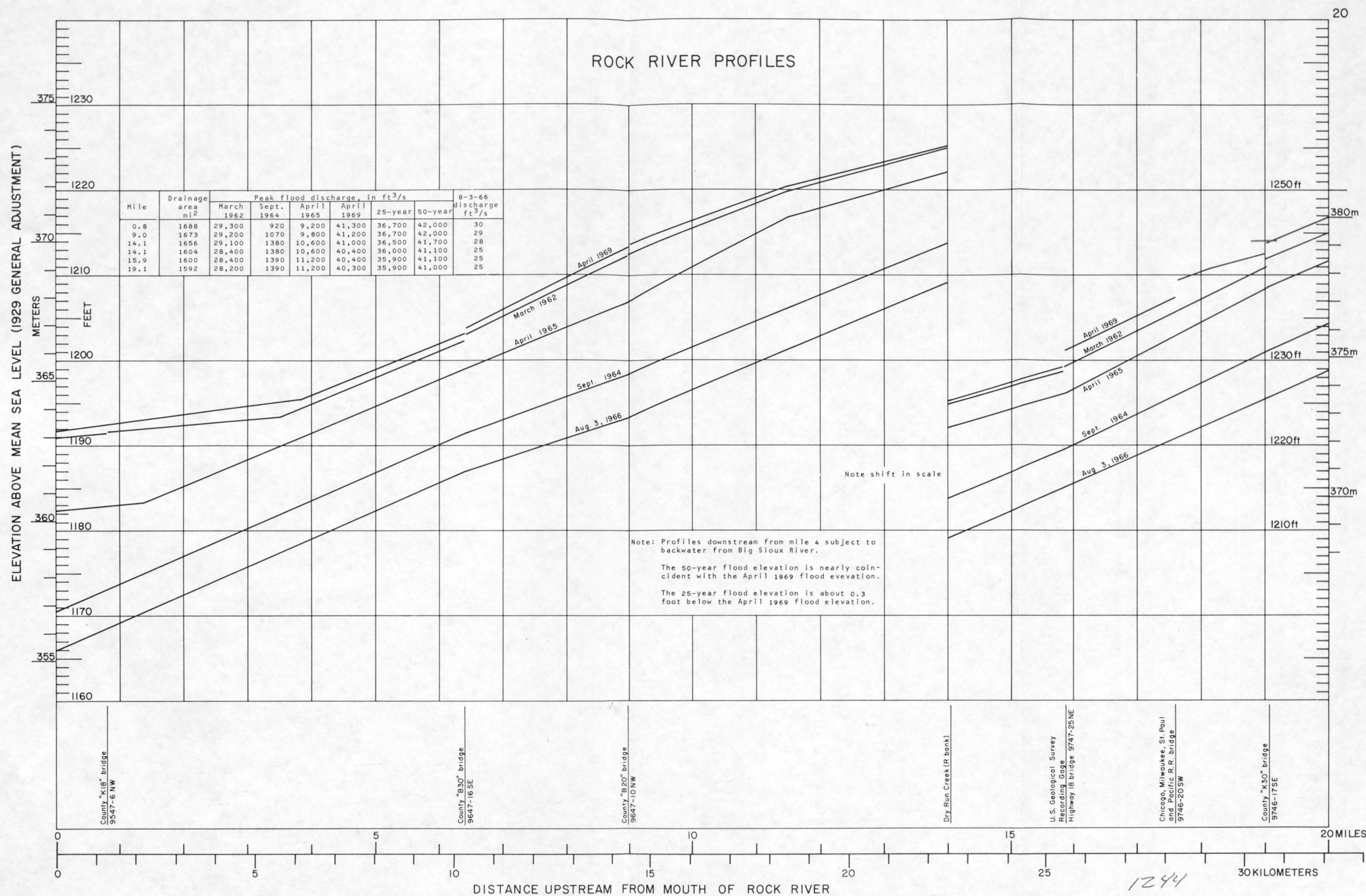


Figure 6. Rock River profiles, mile 0 to mile 20 (kilometer 0 to kilometer 32.2).



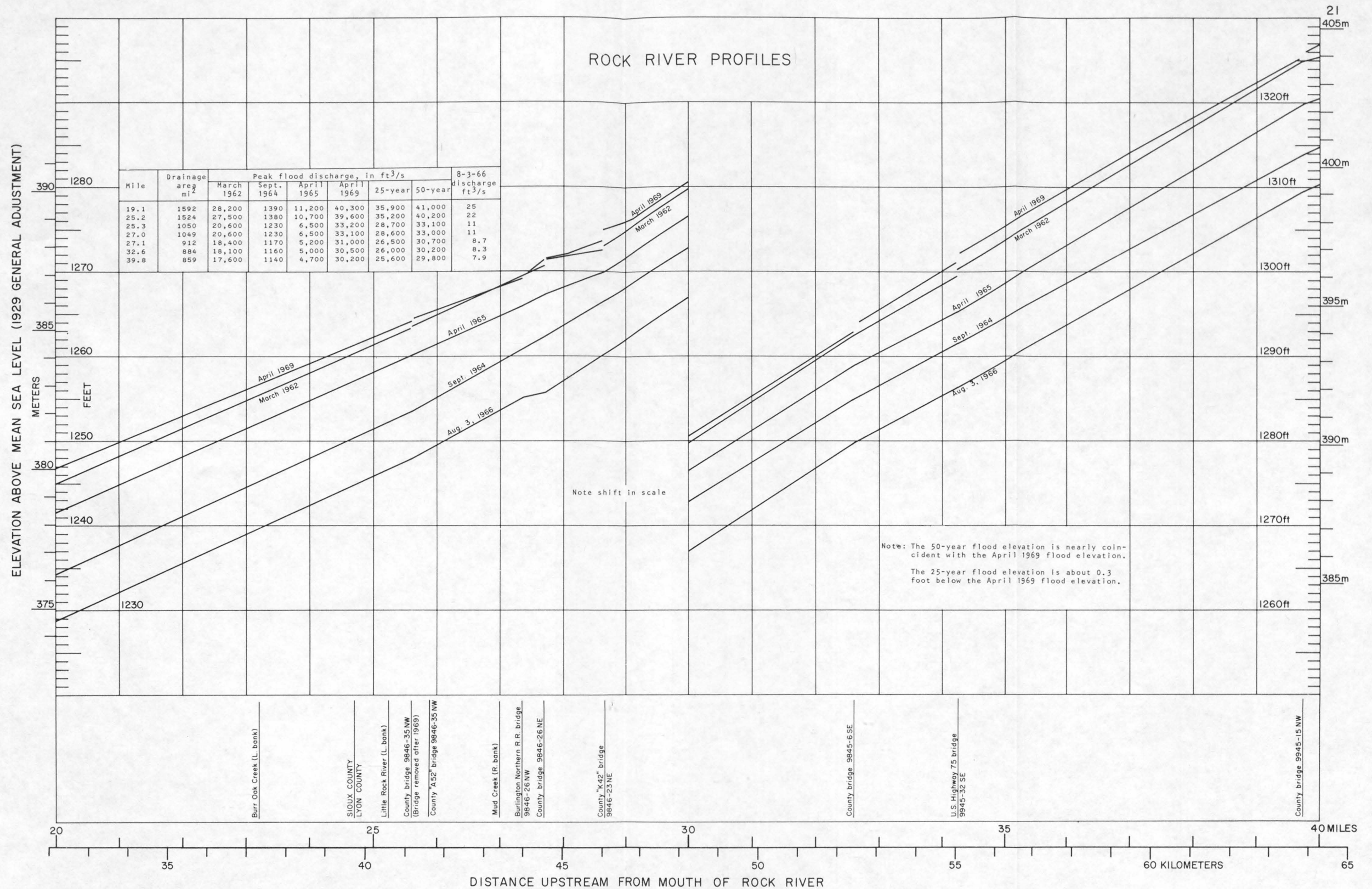


Figure 7. Rock River profiles, mile 20 to mile 40 (kilometer 32.2 to kilometer 64.4).



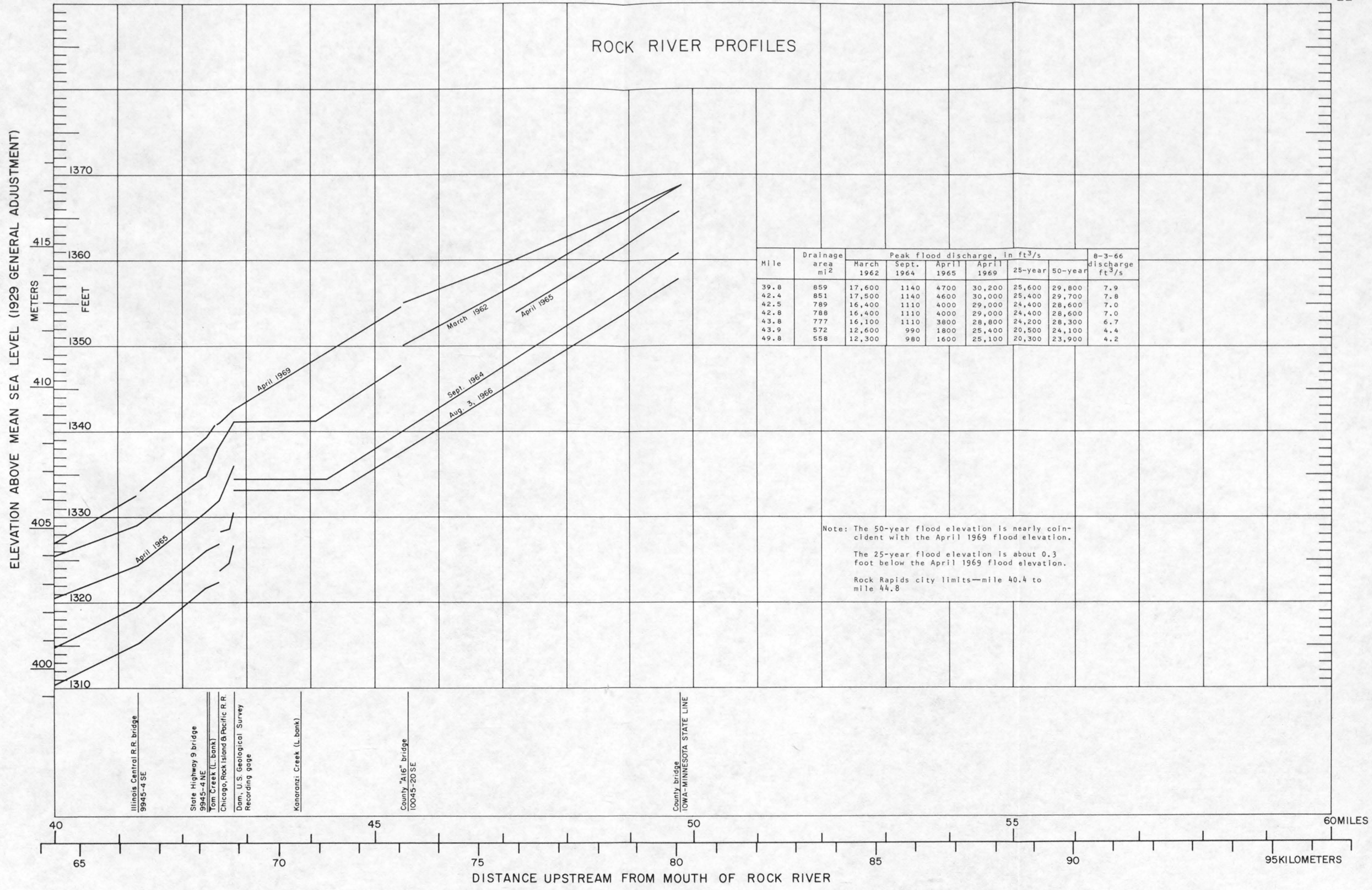


Figure 8. Rock River profiles, mile 40 to mile 49.8 (kilometer 64.4 to kilometer 80.1).



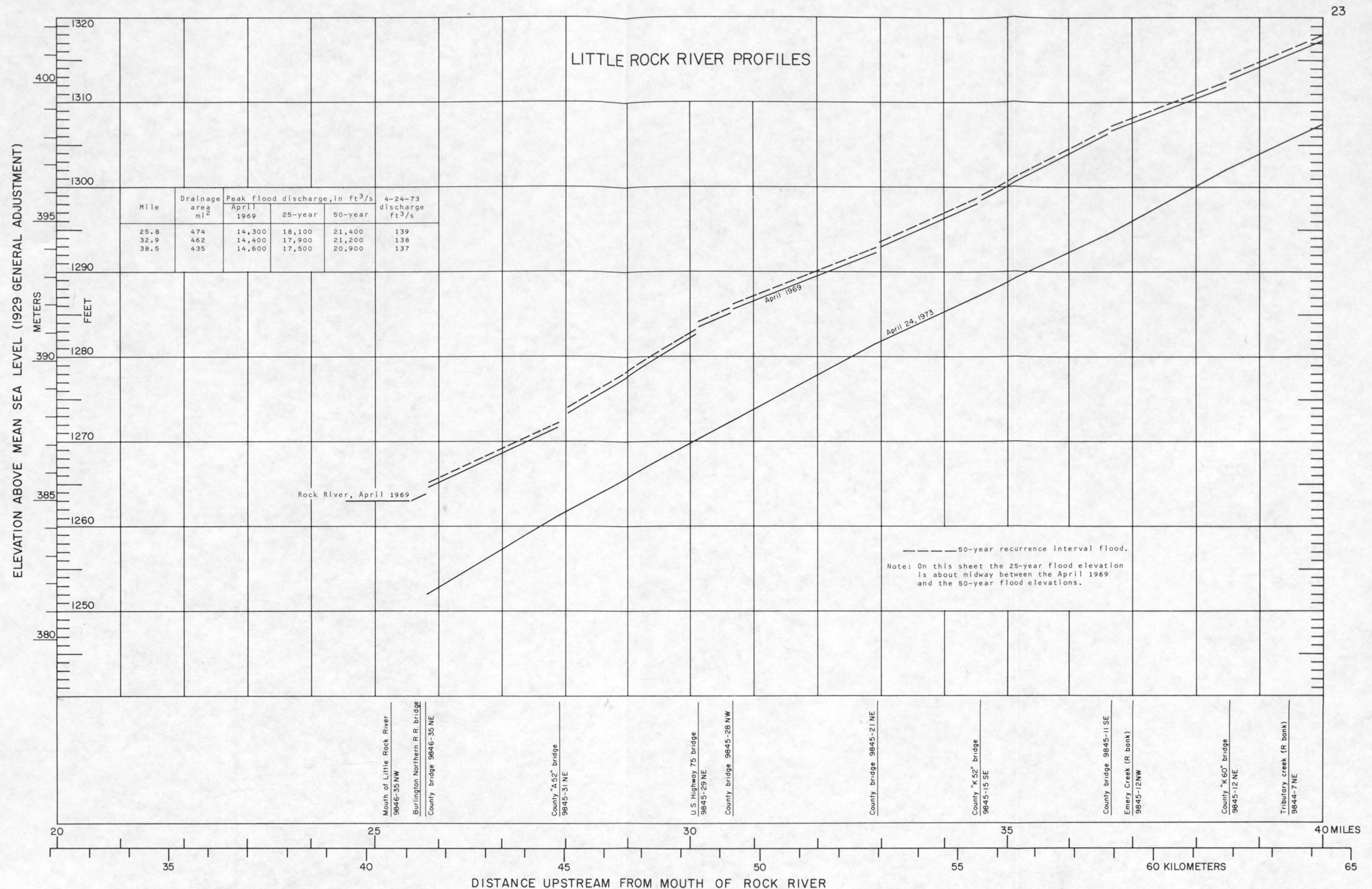


Figure 9. Little Rock River profiles, mile 25.2 to mile 40 (kilometer 40.5 to kilometer 64.4).



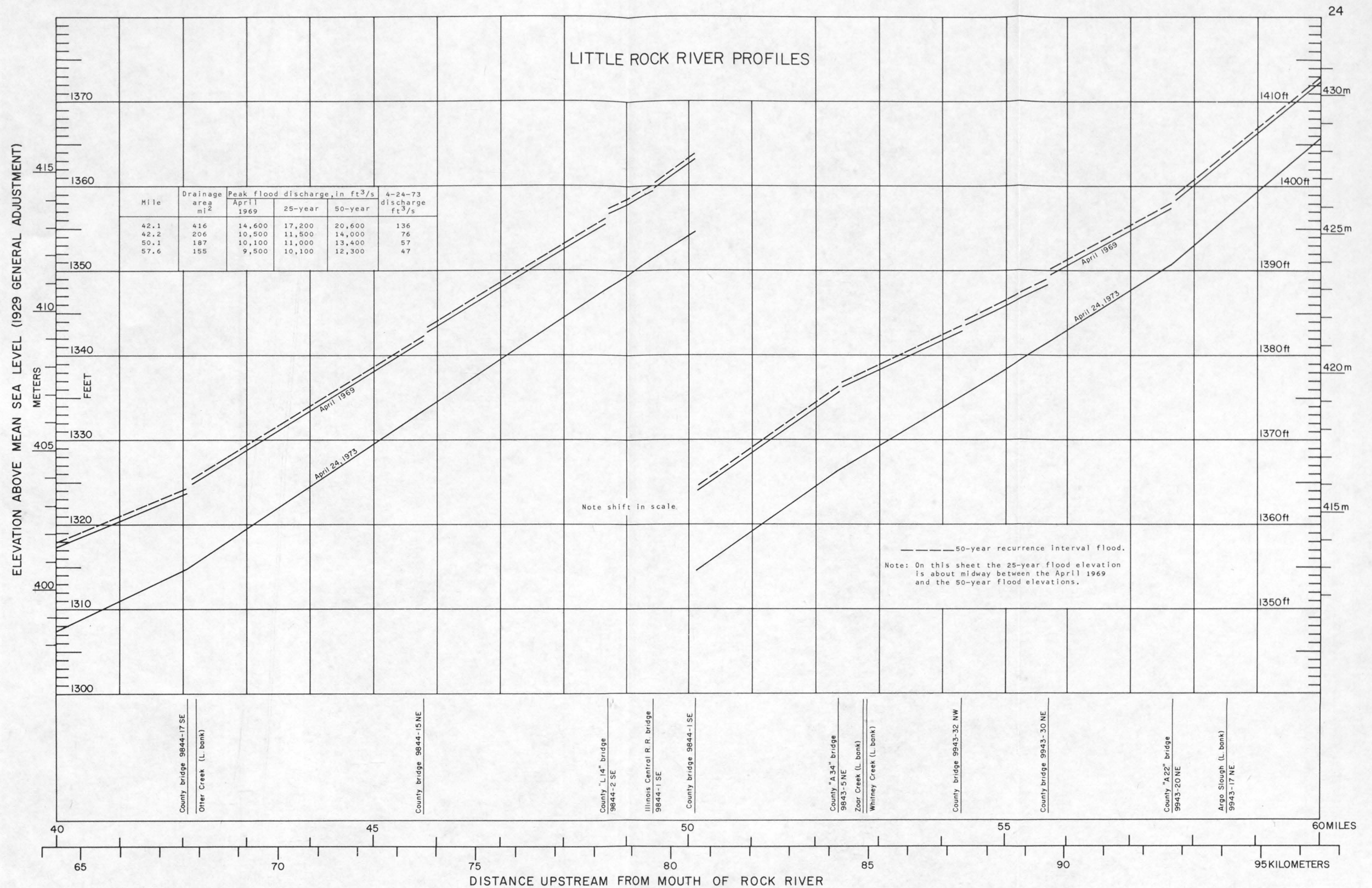


Figure 10. Little Rock River profiles, mile 40 to mile 60 (kilometer 64.4 to kilometer 96.5).



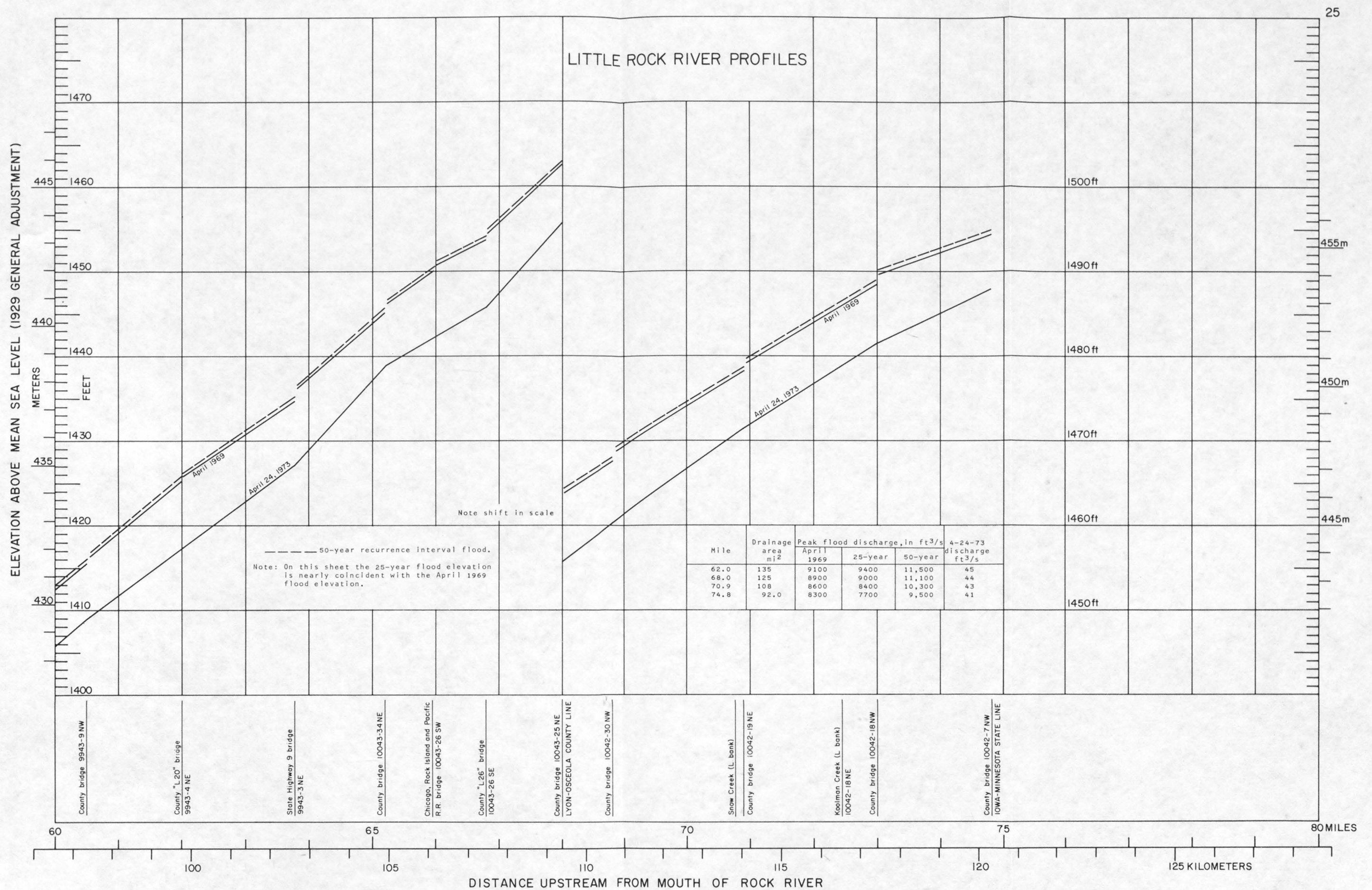


Figure 11. Little Rock River profiles, mile 60 to mile 74.8 (kilometer 96.5 to kilometer 120.4).



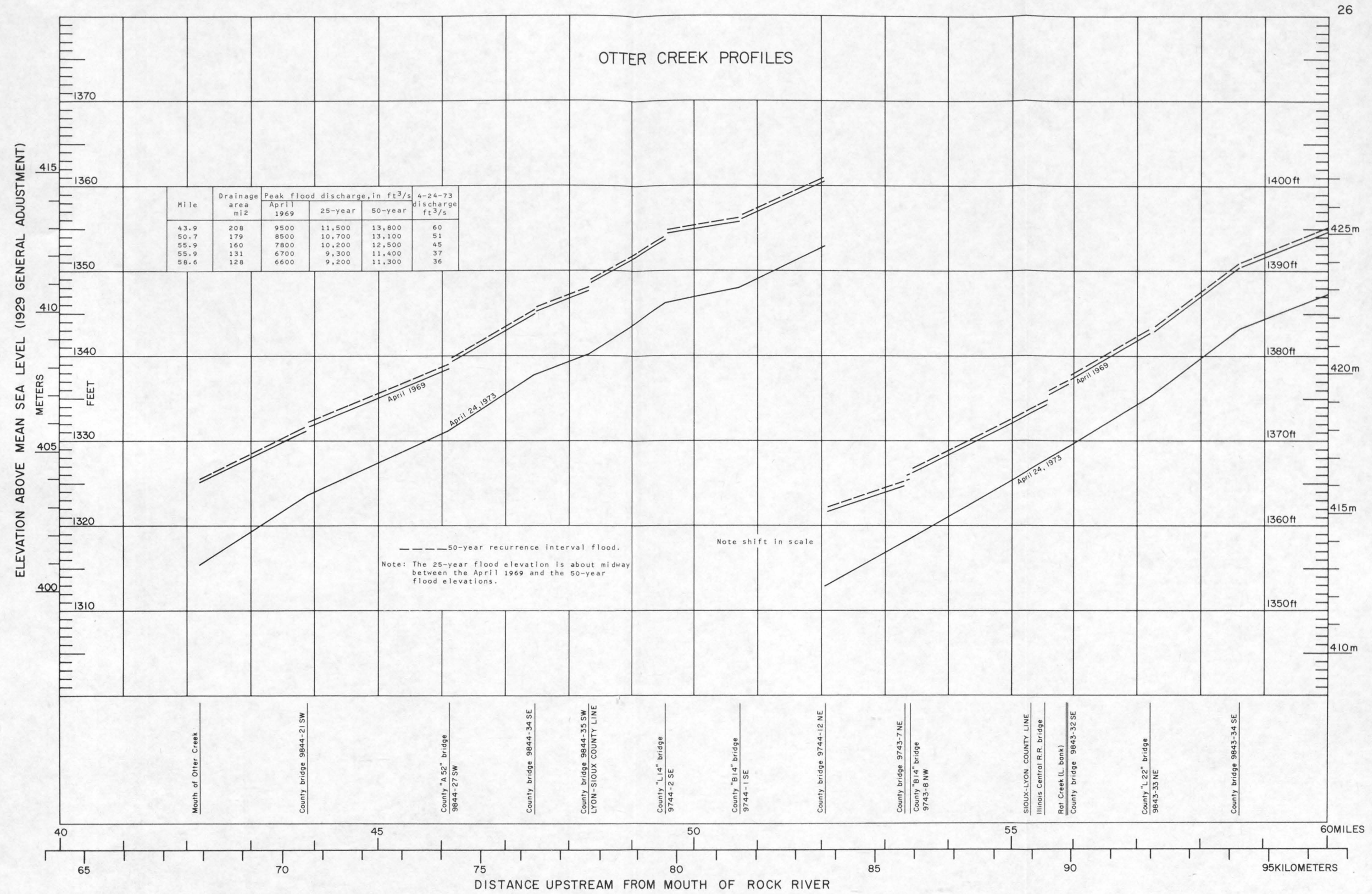


Figure 12. Otter Creek profiles, mile 42.2 to mile 60 (kilometer 67.9 to kilometer 96.5).



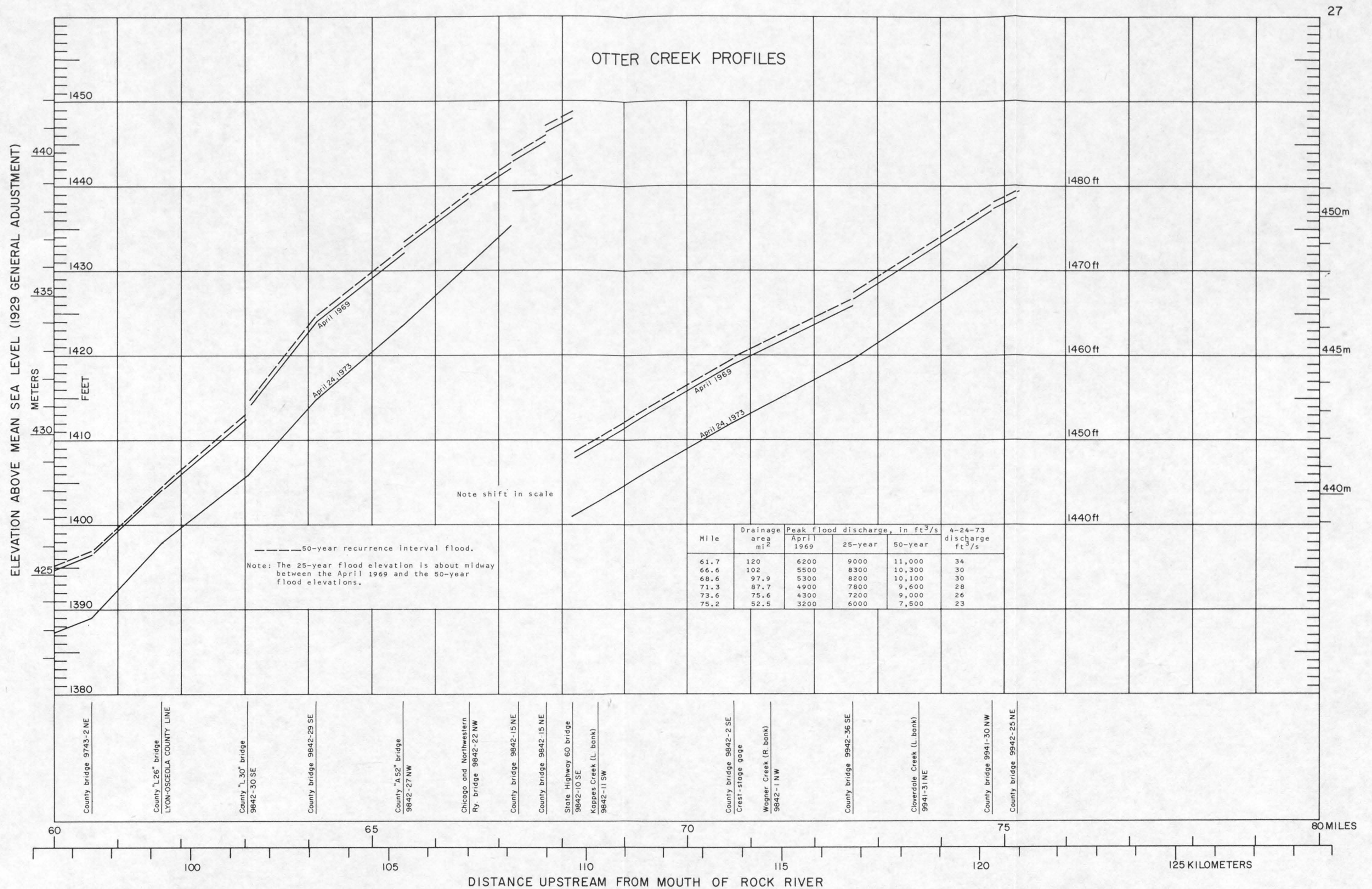


Figure 13. Otter Creek profiles, mile 60 to mile 75.2 (kilometer 96.5 to kilometer 121.0).

## APPENDIX A

## GAGING-STATION RECORDS

The data which follow are the annual peak stages and discharges for seven crest-stage and two recording gaging stations in the Iowa portion of the Rock River basin. Also included for the recording stations are the flood peaks above a selected base. The base discharge is selected so that an average of about three peaks a year can be presented.

Gaging-station records are in the downstream order used by and explained in the annual reports of the U.S. Geological Survey. (See references.) These reports contain data for the recording gaging stations that supplement the information herein, particularly data for antecedent and post-flood periods.

Each gaging-station record has the assigned permanent station number preceding the station name. This number is used to identify the station on figure 1. The descriptive paragraphs following the station name contain material pertinent to the station's location, size of drainage area, type of gage, maximum flood of record, definition of the rating curve, and, when applicable, the base for the flood peaks.

In the location description of the gaging stations, the terms "right" and "left" are used. These directions are determined as viewed facing in the direction of the flow of the stream.



Indirect methods of determining peak discharge are based on hydraulic equations which relate the discharge to the water-surface profile and the geometry of the channel. A field survey is made after the flood to determine the location and elevation of highwater marks and the characteristics of the channel.

Peak-flood elevations (gage heights) for the gaging stations are measured from the zero of the selected datum for the gage. The datum of the gages is referenced to a permanent bench mark on the bridge. For some of the stations, the datum is also referenced to mean sea level.

Annual flood peaks are listed by water years; that is, the 12-month period beginning October 1 and ending the following September 30. This period is designated as the year ending September 30. For example, the period October 1, 1965, to September 30, 1966, is the 1966 water year.

## 6-4832.7 Rock River at Rock Rapids, Iowa

Location.--Lat 43°26'13", long 96°09'58", in NE1/4 SW1/4 sec. 33, T.100 N., R.45 W., Lyon County, on right bank at dam on north side of city park in Rock Rapids, 0.3 mile (0.5 kilometer) upstream from Tom Creek, 0.5 mile (0.8 kilometer) northeast of junction of U.S. Highway 75 and State Highway 9, and at mile 42.8 (kilometer 68.9).

Drainage area.--788 mi<sup>2</sup> (2,041 km<sup>2</sup>).

Gage.--Recording. Datum of gage is 1,331.55 ft (405.856 m) above mean sea level, datum of 1929.

Maximum of record.--April 1969: Discharge 29,000 ft<sup>3</sup>/s (821.3 m<sup>3</sup>/s) April 8, gage height 10.23 ft (3.118 m).

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Remarks.--Base for flood peaks, 2,000 ft<sup>3</sup>/s (56.6 m<sup>3</sup>/s).

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1960	Mar. 30, 1960	8.86	15,500
	Apr. 2, 1960	6.28	8,920
	Apr. 14, 1960	3.33	2,210
1961	Mar. 2, 1961	b3.82	a2,800
1962	Mar. 29, 1962	9.56	16,400
	Apr. 4, 1962	5.46	5,970
	May 23, 1962	4.58	4,290
	May 29, 1962	3.45	2,010
	June 18, 1962	3.64	2,380
	July 6, 1962	3.49	2,080
1963	June 11, 1963	3.18	1,550
1964	Sept. 7, 1964	2.88	1,110
1965	Apr. 2, 1965	4.47	4,000
	Apr. 7, 1965	7.68	11,400
1966	Feb. 10, 1966	6.02	7,580

## Rock River at Rock Rapids, Iowa--(Continued)

Peak stages and discharges				
Water year	Date		Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1967	Apr.	3, 1967	3.72	2,470
1968	Sept.	25, 1968	2.02	191
1969	Oct.	18, 1968	3.61	2,230
	Apr.	8, 1969	10.23	29,000
	June	29, 1969	9.42	18,900
	July	8, 1969	3.90	3,090
	July	23, 1969	3.90	3,090
1970	Apr.	7, 1970	3.63	2,530
	May	28, 1970	4.08	3,450
1971	Feb.	19, 1971	5.30	6,250
	June	10, 1971	3.59	2,450
1972	Mar.	15, 1972	<sup>b</sup> 5.52	<sup>a</sup> 4,200
	May	3, 1972	3.88	3,030

a About

b Affected by ice

6-4834.1 Otter Creek north of Sibley, Iowa  
(Crest-stage station)

Location.--Lat 43°28', long 95°44', in NE1/4 NE1/4 sec. 25, T.100 N., R.42 W., on left downstream wingwall of bridge on county highway L40, 4.0 miles (6.4 kilometers) north of Sibley, Osceola County.

Drainage area.--11.9 mi<sup>2</sup> (30.8 km<sup>2</sup>).

Gage.--Crest-stage gage.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 350 ft<sup>3</sup>/s (9.9 m<sup>3</sup>/s) and by a contracted-opening measurement at 952 ft<sup>3</sup>/s (27.0 m<sup>3</sup>/s).

Maximum of record.--March 1962: Discharge 1,410 ft<sup>3</sup>/s (39.9 m<sup>3</sup>/s) March 31, gage height 8.49 ft (2.588 m).

Remarks.--Only annual peaks are shown.

Water year	Peak stages and discharges		
	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1952	Mar. 29, 1952	<sup>b</sup> 6.95	<sup>a</sup> 300
1953	June 7, 1953	8.06	982
1954	June 20, 1954	7.73	751
1955	Apr. 23, 1955	4.56	52
1956	Mar. 28, 1956	4.12	45
1957		c	
1958		c	
1959	May 30, 1959	7.62	674
1960	Mar. 30, 1960	6.60	229
1961		c	
1962	Mar. 31, 1962	8.49	1,410

## Otter Creek north of Sibley, Iowa--(Continued)

Water year	Peak stages and discharges		Gage height (feet)	Discharge (ft <sup>3</sup> /s)
	Date			
1963			c	
1964			c	
1965	May	15, 1965	6.91	322
1966	June	2, 1966	6.31	166
1967			c	
1968			c	
1969	Apr.	6, 1969	7.97	920
1970	July	13, 1970	6.45	200
1971	Feb.	19, 1971	<sup>b</sup> 6.56	115
1972			c	

a About

b Affected by ice

c Peak stage did not reach bottom of gage

6-4834.2 Schutte Creek near Sibley, Iowa  
(Crest-stage station)

Location.--Lat 43°28', long 95°47', in NW1/4 NW1/4 sec. 23, T.100 N., R.42 W., on left downstream wingwall of culvert on county highway, 5.3 miles (8.5 kilometers) northwest of Sibley, Osceola County.

Drainage area.--1.43 mi<sup>2</sup> (3.70 km<sup>2</sup>).

Gage.--Crest-stage gage.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 75 ft<sup>3</sup>/s (2.1 m<sup>3</sup>/s) and by an indirect measurement at 503 ft<sup>3</sup>/s (14.2 m<sup>3</sup>/s).

Maximum of record.--June 1953: Discharge 503 ft<sup>3</sup>/s (14.2 m<sup>3</sup>/s) June 7, gage height 5.15 ft (1.570 m).

Remarks.--Only annual peaks are shown.

Water year	Peak stages and discharges		
	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1952	Mar. 29, 1952	4.49	175
1953	June 7, 1953	5.15	503
1954	June 19, 1954	4.04	86
1955	Apr. 23, 1955	3.84	62
1956	Aug. 13, 1956	3.55	46
1957	June 18, 1957	3.81	60
1958		c	
1959	May 30, 1959	3.84	62
1960	Mar. 30, 1960	4.17	100
1961	Mar. 27, 1961	3.76	54
1962	June 17, 1962	3.77	55
1963		c	



## Schutte Creek near Sibley, Iowa--(Continued)

Peak stages and discharges				
Water year	Date		Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1964			c	
1965	May	15, 1965	4.47	168
1966	June	2, 1966	4.13	100
1967	Mar.	2, 1967	4.35	d
1968			c	
1969	Apr.	6, 1969	4.98	392
1970			c	
1971	Feb.	19, 1971	<sup>b</sup> 4.11	55
1972			c	

b Affected by ice

c Peak stage did not reach bottom of gage

d Discharge not determined

6-4834.3 Otter Creek at Sibley, Iowa  
(Crest-stage station)

Location.--Lat 43°24', long 95°46', in NW1/4 NE1/4 sec. 14, T.99 N., R.42 W., on right downstream wingwall of bridge on county highway A22, 1.0 mile (1.6 kilometer) northwest of Sibley, Osceola County.

Drainage area.--29.9 mi<sup>2</sup> (77.4 km<sup>2</sup>).

Gage.--Crest-stage gage.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 1,300 ft<sup>3</sup>/s (36.8 m<sup>3</sup>/s) and indirect measurement at 5,430 ft<sup>3</sup>/s (153.8 m<sup>3</sup>/s).

Maximum of record.--June 1953: Discharge 5,400 ft<sup>3</sup>/s (152.9 m<sup>3</sup>/s) June 7, gage height 9.82 ft (2.993 m).

Remarks.--Only annual peaks are shown.

Water year	Peak stages and discharges			Discharge (ft <sup>3</sup> /s)
	Date	Gage height (feet)		
1952	Mar.	29, 1952	8.14	822
1953	June	7, 1953	9.82	5,400
1954	June	20, 1954	9.49	3,860
1955	Apr.	23, 1955	5.96	107
1956	Mar.	28, 1956	5.24	64
1957	Mar.	25, 1957	6.59	175
1958	June	4, 1958	6.12	120
1959	May	30, 1959	7.98	698
1960	Mar.	30, 1960	7.74	554
1961	Mar.	27, 1961	7.07	281
1962	Mar.	31, 1962	c	a2,000
1963			d	

## Otter Creek at Sibley, Iowa--(Continued)

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1964		d	
1965	May 15, 1965	7.17	354
1966	June 2, 1966	6.80	250
1967	June 7, 1967	6.46	184
1968		c	
1969	Apr. 6, 1969	8.75	1,960
1970	Apr. 3, 1970	6.95	210
1971	Feb. 19, 1971	<sup>b</sup> 6.61	160
1972	May 1, 1972	5.33	76

a About

b Affected by ice

c No gage height record

d Peak stage did not reach bottom of gage

6-4834.4 Dawson Creek near Sibley, Iowa  
(Crest-stage station)

Location.--Lat 43°23', long 95°43', NW1/4 NW1/4 sec. 20, T.99 N., R.41 W., on left downstream wingwall of culvert on county highway A30, 1.8 miles (2.9 km) southeast of Sibley, Osceola County.

Drainage area.--4.35 mi<sup>2</sup> (11.27 km<sup>2</sup>).

Gage.--Crest-stage gage.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 400 ft<sup>3</sup>/s (11.3 m<sup>3</sup>/s) and indirect measurement at 4,290 ft<sup>3</sup>/s (121.5 m<sup>3</sup>/s).

Maximum of record.--June 1953: Discharge 4,290 ft<sup>3</sup>/s (121.5 m<sup>3</sup>/s) June 7, gage height 6.21 ft (1.893 m).

Remarks.--Only annual peaks are shown.

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1952	Mar. 29, 1952	5.31	460
1953	June 7, 1953	6.21	4,290
1954	June 30, 1954	5.25	400
1955	Apr. 23, 1955	4.71	110
1956	Aug. 13, 1956	4.06	52
1957	July 3, 1957	4.81	140
1958	June 4, 1958	4.01	140
1959	May 30, 1959	5.73	1,290
1960	Mar. 30, 1960	5.27	440
1961	Mar. 27, 1961	4.67	110
1962	July 5, 1962	4.66	113
1963	July 24, 1963	5.16	328

## Dawson Creek near Sibley, Iowa--(Continued)

Peak stages and discharges				
Water year	Date		Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1964	May	12, 1964	4.47	72
1965	Aug.	21, 1965	4.66	108
1966	June	2, 1966	5.04	247
1967	June	7, 1967	5.61	975
1968	July	20, 1968	4.40	64
1969	June	28, 1969	5.20	360
1970	Apr.	3, 1970	6.11	3,000
1971	Feb.	19, 1971	5.56	80
1972	June	7, 1972	3.74	38

6-4834.5 Wagner Creek near Ashton, Iowa  
(Crest-stage station)

Location.--Lat 43°21', long 95°46', in SW1/4 SE1/4 sec. 35, T.99 N., R.42 W., on downstream end of right abutment of bridge on county highway A34, 2.5 miles (4.0 kilometers) northeast of Ashton, Osceola County.

Drainage area.--7.09 mi<sup>2</sup> (18.36 km<sup>2</sup>).

Gage.--Crest-stage gage.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 300 ft<sup>3</sup>/s (8.5 m<sup>3</sup>/s) and indirect measurements at 1,710 ft<sup>3</sup>/s (48.4 m<sup>3</sup>/s) and 2,840 ft<sup>3</sup>/s (80.4 m<sup>3</sup>/s).

Maximum of record.--June 1953: Discharge 2,840 ft<sup>3</sup>/s (80.4 m<sup>3</sup>/s) June 7, gage height 5.37 ft (1.637 m).

Remarks.--Only annual peaks are shown.

Water year	Peak stages and discharges		
	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1952	Mar. 29, 1952	4.31	390
1953	June 7, 1953	5.37	2,840
1954	June 20, 1954	5.29	2,600
1955	Apr. 23, 1955	3.60	40
1956	Aug. 13, 1956	3.56	32
1957	July 3, 1957	3.96	180
1958	Apr. 5, 1958	3.52	24
1959	May 30, 1959	5.29	2,600
1960	Mar. 30, 1960	4.53	475
1961	Mar. 27, 1961	3.64	52
1962	Mar. 31, 1962	4.58	516



## Wagner Creek near Ashton, Iowa-- (Continued)

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1963		c	
1964	May 12, 1964	3.10	d
1965	Aug. 21, 1965	4.37	395
1966	June 2, 1966	4.59	523
1967	Mar. 2, 1967	3.91	165
1968		c	
1969	Apr. 6, 1969	3.64	210
1970	Mar. 2, 1970	3.18	160
1971	Feb. 19, 1971	<sup>b</sup> 3.55	145
1972	June 7, 1972	2.63	d

b Affected by ice

c Peak stage did not reach bottom of gage

d Discharge not determined

6-4834.6 Otter Creek near Ashton, Iowa  
(Crest-stage station)

Location.--Lat 43°20', long 95°46', in SE1/4 sec. 2, T.98 N., R.42 W., on downstream end of first pier from left bank of bridge on county highway A34, 2.0 miles (3.2 kilometers) northeast of Ashton, Osceola County.

Drainage area.--88.0 mi<sup>2</sup> (227.9 km<sup>2</sup>).

Gage.--Crest-stage gage. Datum of gage is 1,448.23 ft (441.414 m) above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 6,000 ft<sup>3</sup>/s (169.9 m<sup>3</sup>/s) and indirect measurements at 7,080 ft<sup>3</sup>/s (200.5 m<sup>3</sup>/s) and 17,400 ft<sup>3</sup>/s (492.8 m<sup>3</sup>/s).

Maximum of record.--June 1953: Discharge 17,400 ft<sup>3</sup>/s (492.8 m<sup>3</sup>/s) June 7, gage height 12.16 ft (3.706m).

Remarks.--Only annual peaks are shown.

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1952	Mar. 29, 1952	9.88	2,100
1953	June 7, 1953	12.16	17,400
1954	June 20, 1954	11.17	6,320
1955	Apr. 23, 1955	7.14	393
1956	Aug. 13, 1956	7.62	489
1957	July 3, 1957	8.51	754
1958	Apr. 5, 1958	7.01	367
1959	May 30, 1959	10.27	2,880
1960	Mar. 30, 1960	9.37	1,300
1961	Mar. 27, 1961	7.01	367
1962	Mar. 31, 1962	10.65	3,990

## Otter Creek near Ashton, Iowa--(Continued)

Water year	Peak stages and discharges		
	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1963	June 10, 1963	6.61	303
1964		c	
1965	Apr. 1, 1965	11.67	1,700
1966	June 2, 1966	6.16	245
1967	June 7, 1967	9.20	1,120
1968		c	
1969	Apr. 6, 1969	10.77	4,900
1970	Apr. 5, 1970	8.18	730
1971	June 6, 1971	8.00	660
1972	May 1, 1972	6.49	280

c Peak stage did not reach bottom of gage

6-4834.95 Burr Oak Creek near Perkins, Iowa  
(Crest-stage station)

Location.--Lat 43°14'43", long 96°10'38", in SE1/4 sec. 5, T.97 N., R.45 W., on downstream side of bridge at right pier on U.S. Highway 75, 4.2 miles (6.8 kilometers) north of Perkins, Sioux County.

Drainage area.--30.9 mi<sup>2</sup> (80.0 km<sup>2</sup>).

Gage.--Crest-stage gage.

Discharge record.--Stage-discharge relation not defined.

Maximum of record.--June 1972: Discharge unknown June 7, gage height 87.19 ft (26.576 m).

Remarks.--Only annual peaks are shown.

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1966	June 2, 1966	85.75	b
1967	June 7, 1967	85.99	b
1968		a	
1969	Apr. 5, 1969	86.26	b
1970	Mar. 3, 1970	86.30	b
1971	June 6, 1971	86.66	b
1972	June 7, 1972	87.19	b

a Peak stage did not reach bottom of gage

b Discharge not determined

## 6-4835 Rock River near Rock Valley, Iowa

Location.--Lat 43°11'58", long 96°20'22", in NW1/4 NE1/4 sec. 25, T.97 N., R.47 W., Sioux County, on downstream side of bridge on U.S. Highway 18, 1.8 miles (2.9 kilometers) west of Rock Valley, and at mile 15.9 (kilometer 25.6).

Drainage area.--1,600 mi<sup>2</sup> (4,144 km<sup>2</sup>).

Gage.--Nonrecording prior to Aug. 13, 1952; recording thereafter. Datum of gage is 1,211.81 feet (369.360 meters) above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maximum of record.--April 1969: Discharge 40,400 ft<sup>3</sup>/s (1,144.1 m<sup>3</sup>/s) April 7, gage height 17.32 ft (5.279 m).

Remarks.--Base for flood peaks, 3,000 ft<sup>3</sup>/s (85.0 m<sup>3</sup>/s).

Peak stages and discharges			
Water year	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1897		17.0	
1949	Mar. 6, 1949	12.30	5,790
	Mar. 29, 1949	11.75	5,160
	Apr. 8, 1949	12.10	5,530
1950	Mar. 25, 1950	11.48	4,560
	Mar. 28, 1950	11.33	4,320
1951	Mar. 30, 1951	11.37	5,170
	Apr. 5, 1951	14.77	14,300
	June 30, 1951	11.08	4,740
	July 3, 1951	9.81	3,180
1952	Mar. 20, 1952	12.55	6,100
	Mar. 31, 1952	15.30	17,300
1953	Mar. 14, 1953	10.83	4,220
	May 27, 1953	10.27	3,520
	June 8, 1953	15.99	18,900
	June 29, 1953	9.95	3,150
	Aug. 6, 1953	10.83	4,220

## Rock River near Rock Valley, Iowa--(Continued)

Water year	Peak stages and discharges		Gage height (feet)	Discharge (ft <sup>3</sup> /s)
	Date			
1954	Mar.	20, 1954	12.11	5,300
	June	21, 1954	15.86	19,200
1955	Mar.	12, 1955	9.31	2,370
1956	July	2, 1956	7.59	1,160
1957	June	19, 1957	10.55	3,770
	July	3, 1957	9.97	3,050
1958	Apr.	7, 1958	6.18	545
1959	June	1, 1959	14.06	10,200
1960	Mar.	31, 1960	15.38	16,700
	Apr.	2, 1960	14.93	14,100
	Apr.	14, 1960	10.18	2,890
1961	Mar.	2, 1961	13.06	8,580
	Mar.	16, 1961	10.29	3,410
1962	Mar.	30, 1962	16.91	28,400
	Apr.	5, 1962	14.26	11,000
	May	24, 1962	11.02	4,260
	June	18, 1962	11.80	5,220
1963	June	12, 1963	7.56	1,300
1964	Sept.	8, 1964	7.70	1,390
1965	Apr.	2, 1965	13.91	11,200
	Apr.	7, 1965	14.94	15,700
1966	Feb.	10, 1966	14.78	11,700
1967	Mar.	4, 1967	10.06	3,260
	Apr.	4, 1967	9.90	3,110
1968	July	20, 1968	4.16	182



## Rock River near Rock Valley, Iowa--(Continued)

Water year	Peak stages and discharges		
	Date	Gage height (feet)	Discharge (ft <sup>3</sup> /s)
1969	Apr. 7, 1969	17.32	40,400
	June 25, 1969	10.36	3,350
	June 30, 1969	16.03	20,800
	July 10, 1969	12.24	5,740
	July 24, 1969	10.05	3,030
1970	Mar. 4, 1970	13.10	7,350
	Apr. 6, 1970	10.92	3,980
	May 28, 1970	14.05	10,200
1971	Feb. 19, 1971	13.73	9,060
	June 10, 1971	10.72	3,930
1972	Mar. 13, 1972	12.04	5,890
	May 3, 1972	10.45	4,070
	June 7, 1972	11.21	4,740

APPENDIX B  
TEMPORARY BENCH MARKS  
ROCK RIVER BASIN

The temporary bench marks listed in this tabulation have been compiled by the Water Resources Division, Iowa City District, U.S. Geological Survey. Elevations for the bench marks were established by the U.S. Geological Survey except for those established by the U.S. Army Corps of Engineers and the U.S. Soil Conservation Service for which credit is given in the description of the bench mark.

That part of the Rock River basin covered by the level work is the same as that covered by the profiles. Bench marks were set at all bridges, at intermediate points between bridges, and generally at road intersections at one-mile intervals on the level line between bridges.

Level lines run by the U.S. Geological Survey were commenced and terminated at first or second order bench marks established and adjusted by the U.S. Coast and Geodetic Survey or the U.S. Geological Survey. Elevations are in mean sea level datum, 1929 general adjustment. Errors of closure of the level work were adjusted throughout the line to the elevations of the higher order bench marks. The elevations of the temporary bench marks established by the Survey are of third order accuracy.

The bench marks have been identified by an index number which is composed of the Congressional township, range, section

number, and the quarter-section in which they are located. The township and range numbers have been combined into a four-digit number, such as 9548 for Township 95 North and Range 48 West. This is followed by a dash and the section number in which the mark is located. Within the section, the quarter in which the mark is located is designated by NE, SE, NW, or SW. A number in parentheses following this letter designation indicates the number of the mark in that particular quarter section. The index number serves to describe the land-line location of the mark without further reference in the body of the description.

Standard marks such as chiseled squares and crosses were used on concrete and steel. On trees or poles a 20-penny pole spike driven horizontally through a short piece of 1/8-inch galvanized pipe was used. Existing marks were used wherever available and the agency responsible for the mark, when known, is indicated in the description. Marks indicated as (REFERENCE POINT) following the name of the stream were established to permit water surface elevations to be determined by use of a tape and weight.

In the descriptions of the bench marks at the bridges, the directions "right" and "left" are used quite frequently. These directions are determined as viewed facing in the direction of the flow of the stream.

Some common abbreviations used in the descriptions are:

USC & GS - United States Coast and Geodetic Survey

USGS - United States Geological Survey

USCE - United States Army Corps of Engineers

SCS - Soil Conservation Service

INRC - Iowa Natural Resources Council

IHC - Iowa Highway Commission

## ROCK RIVER BASIN

9548-11 NW (1) - In Union County South Dakota about 1 mile north along Highway 46 from the bridge over the Big Sioux River. At 1st railroad crossing at signal on east side of highway; chiselled square on northwest corner of signal base. Elev. 1190.72 ft

9548-15 NE (1) - At the C.M.St.P. & P. railroad bridge over the Big Sioux River about 3-3/4 miles north of Hawarden. On the upstream side of the left pier, 1.4 feet north of the south edge, 6.6 feet east of the center of the track, 5.6 feet below the rails. The mark is a small square with U.S.B.M. chiselled around it. Elev. 1182.297 ft

9647-3 SE (1) - Three miles south and 4 miles west of junction Highway 18 and county road K30 in Rock Valley. At corner sections 2,3,10,11; in power pole at northwest corner of intersection; pole spike and collar. Elev. 1258.43 ft

9647-10 NW (1) - Three miles south and 4-3/4 miles west of the junction of Highway 18 and county road K30 at Rock Valley; at bridge over Rock River at right downstream wingwall; chiselled square on base behind wingwall. Elev. 1217.53 ft

9647-10 NW (2) - Three miles south and about 4-3/4 miles west on county road bridge over Rock River; on left downstream wingwall behind curved abutment guardrail; chiselled square painted red. Elev. 1217.54 ft

9647-10 NW (3) - (REFERENCE POINT) - Three miles south and 4-3/4 miles west of the junction of Highway 18 and county road K30 at Rock Valley. At bridge over Rock River, chiselled arrow on left side of 25th guardrail post from right downstream end of bridge. Elev. 1220.01 ft

9647-16 NE (1) - Four miles south and 5 miles west of the junction of Highway 18 and county road K30 at Rock Valley. At a 90° bend from east to north. One hundred feet west of bend at south end of a concrete box culvert, chiselled square at southwest junction of headwall and wingwall. Elev. 1203.36 ft

9647-16 SE (1) - Five miles south and 5 1/2 miles west of junction of Highway 18 and county road K30 in Rock Valley. At county road B30 bridge over the Rock River on upstream end right abutment; chiselled square. Elev. 1210.40 ft

9647-16 SE (2) - Five miles south and 5 1/2 miles west of junction of Highway 18 and county road K30 in Rock Valley. At county road B30 bridge over the Rock River on left downstream wingwall; chiselled square. Elev. 1215.72 ft

- 9647-16 SE(3) - (REFERENCE POINT) - Five miles south and 5-1/2 miles west of the junction of Highway 18 and county road "K30" in Rock Valley, at the county road "B30" bridge over the Rock River, on the right side of the 29th guard-rail post from the right downstream end of the bridge; chiselled arrow. Elev. 1215.77 ft
- 9647-17 NE(1) - 4-1/2 miles south and 6 miles west of the junction of Highway 18 and county road "K30" at Rock Valley, along county road "B30" at "T" intersection to the north, about 33 feet south of centerline of county road "B30" and 16 feet northeast of a power pole; concrete post with standard brass tablet stamped USC&GS, Hudson #2, 1949. Elev. 1218.39 ft
- 9647-18 SE (1) - 4-1/2 miles south and 7 miles west of the junction of Highways 18 and county road "K30" at Rock Valley, at electrical power substation, at SW corner of intersection; pole spike and collar in power pole. Elev. 1215.07 ft
- 9647-19 SE (1) - First road to south, west of Rock River on county road "B30" to bend to west in county gravel road in first power pole west of road on north side of road; spike & collar in road side painted red. Elev. 1196.86 ft
- 9647-20 SW (1) - First road to south, west of Rock River on county road "B30" to bend to west in county gravel road in brace pole on east side of road; spike and collar painted red. Elev. 1192.59 ft
- 9647-30 SW (1) - 7-1/2 miles north and 2-1/4 miles east of the junction of Highways 10 and 12 in Hawarden, at bridge over the Big Sioux River, in left downstream end wing pile; pole spike and collar. Elev. 1183.94 ft
- 9647-31 SW (1) - At first bridge upstream from mouth of Rock River in power pole east of bridge on upstream side of road at "K30" intersection; spike and collar painted red. Elev. 1183.28 ft
- 9648-35 NE (1) - (6-1/2 miles north of Hawarden) in South Dakota, about 3.5 miles north along the C.M.St.P. & P. RR bridge over the Big Sioux River, about .6 mile west of the county road bridge over the Big Sioux River, at C.M. St. P. & P. RR bridge #T-586 over a dry gully; top of bolt on southwest or right upstream bridge seat. Elev. 1198.09 ft
- 9743-4 NW (1) - One mile north of Matlock along north-south county road at T road east, in southeast corner of intersection, on top of south end of corrugated metal pipe; painted cross. Elev. 1394.32 ft by SCS



9743-5 SW (1) - One mile west of Matlock on east-west county road "B14" bridge over Otter Creek, in center of upstream headwall; chiselled square. USGS "UE 29 LMTA". Elev. 1374.81 ft

9743-8 NW (1) - One mile west of Matlock on north-south county road bridge over Otter Creek, on top of right upstream abutment; plug. Elev. 1375.64 ft

9743-8 NW (2) - (REFERENCE POINT) - One mile west of Matlock on east-west county road "B14" bridge over Otter Creek; top of 15th vertical from right downstream abutment. Elev. 1376.66 ft

9744-1 S (1) - About 2-1/2 miles west of Matlock at county road "B14" bridge over Otter Creek, on top of curb at left downstream end of bridge; chiselled cross. Elev. 1363.90 ft

9744-1 S (2) - (REFERENCE POINT) - About 2-1/2 miles west of Matlock at county road "B14" bridge over Otter Creek, on top of downstream guardrail post, 19th post from left end of bridge; chiselled arrow. Elev. 1365.95 ft

9744-1 NW (1) - 3 miles west and 0.5 mile north from the west edge of Matlock on county road "L14" main bridge over Otter Creek, in right upstream wingwall piling; nail and disc set vertically. Elev. 1358.62 ft

9744-2 SE (1) - Three miles west of Matlock in northwest corner of intersection, 16 feet north and 43 feet west of crossroads, in center of north headwall of culvert; chiselled square. Elev. 1361.97

9744-2 SE (2) - (REFERENCE POINT) - Three miles west and 0.5 mile north from the west edge of Matlock on county road "L14" main bridge over Otter Creek; top of handrail at 11th vertical from right abutment. Elev. 1361.34 ft

9744-2 NW (1) - Six miles south and 0.6 mile west of intersection of State Highway 339 and county road "A34" at George, on east-west county road bridge over Otter Creek, on top of right upstream end wingwall piling; nail and disc. Elev. 1352.98 ft

9744-11 NE (1) - Three miles west of Matlock in southwest corner of intersection, 210 feet south, 40 feet west and 2.7 feet lower than crossroads, 1.5 feet northeast of power pole; a standard tablet in top of concrete post projecting 1 inch above ground and stamped "1359 30 LMT 1963". Elev. 1359.163 ft

- 9744-12 NE (1) - Two miles west and 0.4 miles south of Matlock on county road bridge over Otter Creek, on left downstream bridge seat; chiselled square. Elev. 1364.22 ft
- 9744-12 NE (2) - Two miles west and 0.4 miles south of Matlock on county road bridge over Otter Creek, on right downstream corner of bridge; painted cross. Elev. 1367.43 by SCS
- 9744-12 NE (3) - (REFERENCE POINT) - Two miles west and 0.4 mile south of Matlock on north-south county road bridge over Otter Creek, at station 100 from left downstream abutment; 2 file marks. Elev. 1369.95 ft
- 9746-2 SE (1) - About 1-3/4 miles south of Doon on county road "B14" at small creek bridge; chiselled square on junction of abutment and wingwall. Elev. 1270.20 ft
- 9746-11 SW (1) - Two miles north, 2-1/4 miles east of junction Highway 18 and county road "K30" in Rock Valley; chiselled square on right upstream wingwall of bridge on gravel road. (Also left upstream wingwall of box culvert) Elev. 1266.26 ft
- 9746-12 NW (1) - Three miles north and 3 miles east of junction Highway 18 and county road "K30" in Rock Valley at "K30" intersection of county road "B14" and gravel road going east at intersection of sections 1, 2, 11, 12. 72 feet south, 49 feet east, and 2.6 feet lower than T-road east, between telephone pole and fence projecting 2 inches above ground; a standard tablet stamped "1264 50 LMT 1963" painted "BM 1264.4". Elev. 1264.369 ft
- 9746-15 SW (1) - One mile north and 1-1/16 mile east of junction of Highway 18 and county road "K30" in Rock Valley, in left downstream wingpile of bridge over unnamed creek; pole spike and collar. Elev. 1245.65 ft
- 9746-17 SE (1) - On county road "K30" bridge over Rock River just north of Rock Valley, on downstream right wingwall behind wingpost; chiselled square painted red. Elev. 1249.26 ft
- 9746-17 SE (2) - (REFERENCE POINT) - At county road "K30" bridge over the Rock River north of Rock Valley, at 11th guardrail post from the left downstream end of bridge; chiselled arrow. Elev. 1251.87 ft
- 9746-21 NE (1) - At the northwest edge of Rock Valley on county gravel road extension of 17th Street, at pony truss bridge over a small creek, on left downstream wingwall; chiselled square. Elev. 1251.85 ft

9746-21 NW (1) - At north edge of Rock Valley at Rock River overflow bridge, at left upstream abutment behind wingpost; top of bolt. Elev. 1247.53 ft

9746-29 NW (1) - At west edge of Rock Valley about 1/4 mile west of airport, at concrete overflow bridge on Highway 18, on left downstream curb; Iowa State Highway Commission plug. (overflow measurement bridge for USGS gaging station) Elev. 1241.96 ft

9746-30 NW (1) - One and one-half miles west on Highway 18 from junction of Highway 18 and county road "K30" in Rock Valley, in west wingpile nearest highway of bridge over road ditch on south side of road; railroad spike. Elev. 1233.05 ft

9747-25 NE (1) - On U.S. Highway 18 west of Rock Valley at bridge over Rock River (USGS recording gage), on right downstream curb at end of bridge; Iowa State Highway Commission plug. (Also used as USGS BM #3). Elev. 1235.84 ft

9747-25 NE (2) - At U.S. Highway 18 bridge over Rock River west of Rock Valley, on left downstream wingwall; chiselled square. Elev. 1235.76 ft

9747-25 SW (1) - 3/4 mile south and 3 miles west of junction of Highway 18 and county road "K30" at Rock Valley, at 90° bend in road, in power pole along north side of road at bend; pole spike and collar. Elev. 1228.30 ft

9747-35 NW (1) - Four miles southwest of Rock Valley on left bank of Rock River at curve in road (coming from east turning south), on north side of road in power pole No. E 35 M1; spike and collar near base, painted red. Elev. 1231.24 ft

9842-2 SE (1) - (REFERENCE POINT) - One mile east and 1-1/4 miles north from intersection of county road and State Highway 60 at northeast corner of Ashton at county road bridge over Otter Creek, on top of downstream handrail at station 50, 4 feet right from edge of left pier; chiselled cross. Elev. 1468.50 ft

9842-2 SE (2) - One mile east and 1-1/4 miles north from intersection of county road and State Highway 60 at northeast corner of Ashton at county road bridge over Otter Creek, on top of downstream curb at left end of bridge; chiselled cross. Elev. 1466.83 ft

9842-10 SE (1) - On State Highway 10 bridge over Otter Creek near northeast corner of Ashton, on left downstream wingwall; Iowa State Highway Commission brass plug. Elev. 1454.71 ft

- 9842-10 SE (2) - (REFERENCE POINT) - On State Highway 10 bridge over Otter Creek near northeast corner of Ashton, on top of downstream concrete handrail 68 feet from left abutment. Elev. 1458.07 ft
- 9842-12 NW (1) - One mile east and 1 mile north from intersection of county road and State Highway 60 at northeast corner of Ashton at county "T" road east, in southeast corner of intersection, on top of 18 inch reinforced concrete pipe; painted cross. Elev. 1471.65 ft, by SCS
- 9842-15 NE (1) - In northeast corner of Ashton on east-west bridge (1st bridge downstream from bridge over Otter Creek on State Highway 60) over Otter Creek, on left downstream abutment; chiselled cross. Elev. 1455.56 ft
- 9842-15 NE (2) - In northeast corner of Ashton on east-west road bridge (1st bridge downstream from bridge over Otter Creek on State Highway 60) over Otter Creek, on left downstream wingwall; painted cross. Elev. 1455.54 ft
- 9842-15 NE (3) - At Ashton, in southwest corner of intersection of State Highway 60 and east-west street going in to Ashton, in power pole; nail in east side. Elev. 1452.22 ft
- 9842-15 NE (4) - At Ashton on street bridge near center of section 15, on top of downstream handrail at left end; most landward bolt. Elev. 1456.23 ft
- 9842-15 NE (5) - (REFERENCE POINT) - At Ashton on street bridge near center of section 15, on top of downstream concrete walk between 9th and 10th handrail posts from right end of bridge, low end of chamfer; marked with a "U". Elev. 1453.52 ft
- 9842-15 NE (6) - (REFERENCE POINT) - In northeast corner of Ashton on east-west bridge (1st bridge downstream from bridge over Otter Creek on State Highway 60) over Otter Creek, on top of downstream handrail just right of 12th handrail post from L abutment; marked with a "U". Elev. 1458.44 ft
- 9842-15 NE (7) - At Ashton about 500 feet downstream from street bridge over Otter Creek near center of section 15; 1 inch diameter pipe in center of 30 foot circular concrete foundation. Elev. 1443.21 ft
- 9842-22 NW (1) - 0.7 mile south of railroad station at Ashton along the Chicago, St. Paul, Minneapolis and Omaha Railroad at bridge over Otter Creek, on left upstream abutment; a standard USC&GS tablet stamped "S-16 1934". Elev. 1446.395 ft



9842-22 SW (1) - 1.5 miles south of Ashton and 0.2 mile west of railroad parallel to State Highway 60 on east-west county road bridge, on right upstream curb; painted cross. Elev. 1441.87 by SCS

9842-27 NW (1) - (REFERENCE POINT) - 1.5 miles south of Ashton and 0.2 mile west of railroad parallel to State Highway 60 on east-west county road bridge, just left of 5th vertical from right downstream abutment; top of handrail. Elev. 1444.13 ft

9842-28 NE (1) - 1.5 miles south of Ashton and 0.2 mile west of railroad parallel to State Highway 60 on east-west county road bridge, on top of right downstream wingwall; chiselled square. Elev. 1444.19 ft

9842-28 SW (1) - Two miles south and 1.5 miles west of Ashton on north-south county road bridge, on right upstream wingwall, 1.2 feet northeast of chiselled cross; painted cross. Elev. 1427.41 ft

9842-28 SW (2) - Two miles south and 1.5 miles west of Ashton on north-south county road bridge, on right upstream wingwall; chiselled cross. Elev. 1427.38 ft

9842-29 SE (1) - (REFERENCE POINT) - Two miles south and 1.5 miles west of Ashton on north-south county road bridge, 30 feet from left downstream end of bridge, on northeast side of 1-1/2 inch drain pipe in concrete deck. Elev. 1427.24 ft

9842-29 SW (1) - 2.5 miles south and 2.5 miles west of Ashton on north-south county road "L30" bridge over Otter Creek, on right upstream curb; cross. Elev. 1420.78 from SCS

9842-30 SE (1) - 2.5 miles south and 2.5 miles west of Ashton on north-south county road "L30" bridge over Otter Creek, on left downstream wingwall on corner; chiselled square. Elev. 1420.77 ft

9842-30 SE (2) - (REFERENCE POINT) - 2.5 miles south and 2.5 miles west of Ashton on north-south county road "L30" bridge over Otter Creek, just left of 10th vertical support from right downstream abutment; top handrail. Elev. 1423.17 ft

9842-31 SW (1) - About 3 miles south and 3.5 miles west of Ashton on north-south county line road bridge, 1st concrete bridge south of Otter Creek bridge, on northeast corner of handrail; "cross". Elev. 1407.34 ft

9842-31 SW (2) - About 3 miles south and 3.5 miles west of Ashton on north-south county line bridge over Otter Creek, on left upstream concrete abutment; chiselled cross. Elev. 1407.70 ft

- 9843-5 NE (1) - 2.5 miles east of George on county road "A34" bridge over Little Rock River, on downstream left wing-wall; cross. Elev. 1382.93 ft
- 9843-5 NE (2) - (REFERENCE POINT) - 2.5 miles east of George on county road "A34" bridge over Little Rock River, top of 11th guardrail post from right downstream abutment; chiselled square. Elev. 1385.08 ft
- 9843-5 NW (1) - Two miles east of George on county road "A34", 44 feet south of county road centerline and 13 feet east of a lane south, in north side of large power pole; railroad spike. Elev. 1378.48 ft
- 9843-6 SW (1) - One mile east of George on north-south county road bridge over Little Rock River, on top of right upstream pile cap; nail set vertically. Elev. 1365.58 ft
- 9843-13 NW (1) - About 1.5 miles south of George on county road "L14" in southeast corner of intersection, 45 feet south and 55 feet east of center of crossroads, in west side of power pole 6 inches above ground; rail spike. Elev. 1403.94 ft
- 9843-32 SE (1) - About 1.25 miles north of Matlock on north-south county road bridge over Otter Creek, on left downstream wingwall at downstream, streamward corner; chiselled square. Elev. 1379.93 ft
- 9843-32 SE (2) - About 1 mile north of Matlock on Illinois Central Railroad bridge over Otter Creek, on top of left upstream pile cap; nail set vertically. Elev. 1377.20 ft
- 9843-32 SE (3) - (REFERENCE POINT) - About 1.25 miles north of Matlock on north-south county road bridge over Otter Creek, on top of downstream handrail just right of 1st vertical from left end of truss. Elev. 1383.94 ft
- 9843-33 NE (1) - About 3/4 mile east and 1.5 miles north from Matlock on north-south county road "L22" bridge over Otter Creek, on top of left downstream wingwall; chiselled cross. Elev. 1390.53 ft
- 9843-33 NE (2) - About 3/4 mile east and 1.6 miles north of Matlock on north-south county road "L22", on overflow bridge north of bridge over Otter Creek, on right downstream corner of bridge, top of handrail bolt holding handrail to concrete; 2 file marks. Elev. 1387.45 ft
- 9843-33 NE (3) - (REFERENCE POINT) - About 3/4 mile east and 1.5 miles north of Matlock on north-south county road "L22" bridge over Otter Creek; on top of 6th vertical from left downstream abutment; chiselled arrow. Elev. 1392.12 ft



- 9843-34 NE (1) - 1-3/4 miles east and 1-1/2 miles north of Matlock on north-south county road bridge over Otter Creek, on left downstream wingwall at corner; chiselled square. Elev. 1392.80 ft
- 9843-34 NE (2) - (REFERENCE POINT) - 1-1/2 miles east and 1-3/4 miles north of Matlock on north-south county road bridge over Otter Creek, on slanting bridge member right of 4th vertical from left downstream abutment, 2 ft above bridge deck on reinforcing plate; chiselled notch. Elev. 1394.40 ft
- 9843-35 SE (1) - About 2-3/4 miles east and 1 mile north of Matlock on north-south county road bridge over Otter Creek, on top of left downstream wingwall piling; nail and disc set vertically. Elev. 1401.08 ft
- 9843-35 SE (2) - About 2-3/4 miles east and 1 mile north of Matlock on north-south county road bridge over Otter Creek, in left downstream wingwall piling; nail in west side. Elev. 1400.87 from SCS
- 9843-35 SE (3) - (REFERENCE POINT) - About 2-3/4 miles east and 1 mile north of Matlock on north-south county road bridge over Otter Creek, on top of downstream handrail at 6th vertical from left end of bridge. Elev. 1403.44 ft
- 9843-36 SE (1) - (REFERENCE POINT) - About 3 miles south and 3.5 miles west of Ashton on north-south county line bridge over Otter Creek, on top of downstream handrail 1 foot right of 1st vertical from left abutment. Elev. 1411.02 ft
- 9844-1 NE (1) - One mile east of George along county road "A34" in southwest corner of intersection, top of south end of concrete box culvert; square on west side. Elev. 1375.73 ft
- 9844-1 SE (1) - About 3/4 mile southeast of George on Illinois Central Railroad bridge over Little Rock River, on horizontal member over first pile from right downstream corner of bridge; top of bolt. Elev. 1364.81 ft
- 9844-1 SE (2) - About 1/3 mile southeast of George on Illinois Central Railroad bridge (overflow), on 2nd bolt from right downstream end of bridge; top of bolt. Elev. 1364.35 ft
- 9844-1 SE (3) - (REFERENCE POINT) - One mile east of George on north-south county road bridge over Little Rock River, top of downstream handrail, 5 feet right of third pile from right abutment; two file marks. Elev. 1370.21 ft

- 9844-1 SW (1) - Near south edge of George on county road "L14" bridge over Little Rock River, on top of right upstream wingpost; cross. Elev. 1365.38 ft
- 9844-1 SW (2) - In southeast corner of George, Iowa along Illinois Central Railroad near curve in county road from southeast to east, 20 feet south of tracks and 20 feet south of extension of county road in north side of utility pole; nail. Elev. 1365.52 ft
- 9844-2 NE (1) - In George along county road "L14" through town, at Illinois Central Railroad crossing, in northwest corner of intersection, in east side of power pole; nail. Elev. 1366.95 ft
- 9844-2 SE (1) - (REFERENCE POINT) - Near south edge of George on county road "L14" bridge over Little Rock River, on top of downstream handrail 90 feet from face of left abutment; 2 file marks. Elev. 1365.17 ft
- 9844-6 SW (1) - Five miles west and 1 mile south of junction of State Highway 339 and county road "A34" at George, at northeast corner of county road intersection, 60 feet east of centerline of north-south road and 30 feet north of east-west road; a U.S. Corps of Engineers concrete monument with 3-inch brass disc stamped "R-7". Elev. 1352.59 ft by USCE
- 9844-7 NW (1) - Five miles west and 1-1/4 miles south of junction of State Highway 339 and county road "A34" at George, on north-south county road "K60" bridge over Little Rock River, on right upstream wingpost at end; cross. Elev. 1320.76 by SCS
- 9844-8 SE (1) - Three miles west and 2 miles south of junction of State Highway 339 and county road "A34" in George, on north-south county road "K64", in northwest corner of intersection near an open gate to cultivated field, about 200 feet north of a white corn crib; USCE concrete monument with a 3-inch brass cap stamped "R8". Elev. 1350.93 by USCE
- 9844-15 NE (1) - Two miles south and 1.5 miles east of junction of State Highway 339 and county road "A34" at George, on east-west county road bridge over Little Rock River, on right downstream corner of bridge on end of backwall planking; top of nut on tie rod through piling. Elev. 1341.20 ft
- 9844-15 NE (3) - (REFERENCE POINT) - Two miles south and 1.5 miles east of junction of State Highway 339 and county road "A34" at George, on east-west county road bridge over Little Rock River, top of downstream wooden handrail just right of center vertical of steel truss. Elev. 1347.75 ft

- 9844-16 SW (1) - Three miles west and 2.8 miles south of junction of State Highway 339 and county road "A34" in George, on north-south county road "K64" bridge over Little Rock River, on left upstream curb. Elev. 1333.01 by SCS
- 9844-17 SE (1) - Three miles west and 2.8 miles south of junction of State Highway 339 and county road "A34" in George, on north-south county road "K64" bridge over Little Rock River, on left downstream wingwall; chiselled square. Elev. 1333.17 by USCE
- 9844-17 SE (2) - (REFERENCE POINT) - Three miles west and 2.8 miles south of junction of State Highway 339 and county road "A34" in George, on north-south county road "K64" bridge over Little Rock River, on top of downstream guardrail 100 feet from face of left abutment; 2 file marks. Elev. 1335.21 ft
- 9844-21 SE (1) - Four miles south and 2-1/4 miles west of intersection of State Highway 339 and county road "A34" at George, 1/4 mile west of "T" road north, on west end of north headwall of culvert on east-west county road; chiselled square. Elev. 1333.98 ft
- 9844-21 SW (1) - Four miles south and 2.7 miles west of intersection of State Highway 339 and county road "A34" at George, at bridge over Otter Creek, on right downstream wingwall pile; USCE tablet. Elev. 1334.25 ft by USGS
- 9844-21 SW (2) - (REFERENCE POINT) - Four miles south and 2.7 miles west of intersection of State Highway 339 and county road "A34" at George, at bridge over Otter Creek, on top of wooden handrail at 8th handrail post from left downstream end of bridge. Elev. 1338.26 ft
- 9844-22 SW (1) - Four miles south and 2 miles west of intersection of State Highway 339 and county road "A34" at George, 800 feet north of "T" road north and 33 feet east of centerline of north-south county road; a USCE disc in concrete monument. Elev. 1389.60 ft by USCE
- 9844-27 SW (1) - (REFERENCE POINT) - Five miles south and 1.5 miles west of intersection of State Highway 339 and county road "A34" at George, on east-west county road "A52" bridge over Otter Creek, on top of 8th guardrail post from left downstream abutment. Elev. 1347.74 ft
- 9844-27 SW (2) - Five miles south and 1.5 miles west of intersection of State Highway 339 and county road "A34" at George, at east-west county road "A52" bridge over Otter Creek, on right downstream curb; painted cross. Elev. 1345.67 ft by SCS

9844-34 SE (1) - (REFERENCE POINT) - 5.8 miles south and 1 mile west of intersection of State Highway 339 and county road "A34" at George, on north-south county road bridge over Otter Creek, on top of pony truss over 1st vertical from right downstream end of bridge; chiselled square. Elev. 1352.04 ft

9844-34 NW (1) - Five miles south and 1.5 miles west of intersection of State Highway 339 and county road "A34" at George, on east-west county road "A52" bridge over Otter Creek, on curb at upstream wingpost; chiselled square. Elev. 1345.67 ft

9844-35 SW (1) - 5.8 miles south and 1 mile west of intersection of State Highway 339 and county road "A34" at George, on north-south county road bridge over Otter Creek, in top of left upstream wingwall pile; nail and disc. Elev. 1347.44 ft

9844-35 SW (2) - Six miles south and 1 mile west of intersection of State Highway 339 and county road "A34" at George, in northeast corner of intersection on north end of 18-inch corrugated metal pipe; cross. Elev. 1346.42 ft by SCS

9844-35 SW (3) - (REFERENCE POINT) - Six miles south and 0.6 mile west of intersection of State Highway 339 and county road "A34" at George, on east-west county road bridge over Otter Creek, downstream-most side of top of turn-buckle slanting east from 3rd vertical from left downstream end of bridge, 2.4 feet above deck. Elev. 1355.10 ft

9845-6 SE (2) - (REFERENCE POINT) - One mile south and one mile west of junction of Highways 27 and 75, at north-south bridge over Rock River, at 1st guardrail post from left downstream end of bridge; chiselled arrow. Elev. 1297.60 ft

9845-6 SE (1) - 3-1/2 miles northeast of Doon on first county road bridge over Rock River below Highway 75 bridge over Rock River, on top of left downstream abutment at corner; chiselled square, painted red. Elev. 1294.23 ft

9845-7 NE (1) - 1-3/4 miles south of the junction of Highways 27 and 75 along diagonal road through section 7, about 150 yards northeast of a farm, at concrete box culvert; chiselled square on east headwall. Elev. 1291.24 ft

9845-11 SE (1) - Six miles west and 1-3/4 miles south of junction of State Highway 339 and county road "A34" at George, on north-south county road bridge over Little Rock River, on top of left downstream pile cap; spike, set vertically. Elev. 1306.54 ft



- 9845-11 SE (2) - (REFERENCE POINT) - Six miles west and 1-3/4 miles south of junction of State Highway 339 and county road "A34" at George, on north-south county road bridge over Little Rock River; top of wooden handrail 5-foot right of 1st vertical from left downstream corner of steel truss bridge. Elev. 1310.62 ft
- 9845-12 NE (1) - (REFERENCE POINT) - Five miles west and 1-1/4 mile south of junction of State Highway 339 and county road "A34" at George, on north-south county road "K60" bridge over Little Rock River; top of 17th handrail post from right downstream abutment, near center of bridge; chiselled arrow. Elev. 1323.16 ft
- 9845-14 SE (1) - Six miles west and 2.7 miles south of junction of State Highway 339 and county road "A34" in George, 34 feet south and 12 feet west of center of road at driveway to farm residence, in west headwall of concrete culvert; a standard tablet stampled "11 GEU 1969 1360". Elev. 1360.170 ft
- 9845-15 SW (1) - 4.5 miles east and 1.5 miles north of Doon on east-west county road "A44", about 200 feet east of farm drive north, on top of north headwall of concrete box culvert 1 foot west of east end; chiselled square. Elev. 1299.87 ft
- 9845-18 NW (1) - About 2-1/2 miles south and 2 miles west of the junction of Highways 27 and 75, about 1/4 mile southwest along diagonal road from intersection, at concrete box culvert over a ditch; chiselled square on east headwall. Elev. 1298.91 ft
- 9845-21 SW (1) - About 3 miles east and 0.5 mile north of Doon, 850 feet east of county bridge over Little Rock River, on north side of road across road from private lane; a USCE concrete monument with 3-inch brass cap, R5. Elev. 1301.76 ft by USCE
- 9845-22 NE (1) - One mile north and 2 miles east of junction of U.S. Highway 75 and State Highway 167, 3 miles east of Doon, on north-south county road "K52" bridge over Little Rock River, on left downstream curb; chiselled square. Elev. 1305.78 ft by SCS
- 9845-22 NE (2) - (REFERENCE POINT) - One mile north and 2 miles east of junction of U.S. Highway 75 and State Highway 167 3 miles east of Doon, on north-south road "K52" bridge over Rock River; on top of 7th steel vertical from left downstream corner of bridge. Elev. 1307.70 ft
- 9845-22 NW (1) - Four miles east and 1 mile north of Doon at north-south county road bridge over Little Rock River, on top of left downstream caisson pier; chiselled cross. Elev. 1292.53 ft

- 9845-22 NW (2) - (REFERENCE POINT) - Four miles east and 1 mile north of Doon on north-south county road bridge over Little Rock River, on horizontal brace of diagonal member 28 feet from left downstream pier. At same elevation as top of wooden handrail. Elev. 1297.42 ft
- 9845-23 NE (1) - One mile north and 2-3/4 mile east of junction of State Highway 167 and U.S. Highway 75 three miles east of Doon, on east-west county road "A44" at small bridge, 500 feet west of farmstead, in southeast pile of southeast wingwall; nail in north side. Elev. 1331.34 ft
- 9845-28 NW (1) - Three miles east of Doon on U.S. Highway 75 bridge over Little Rock River, on right upstream wingwall curb; chiselled square. Elev. 1288.17 ft
- 9845-28 NW (2) - About 3 miles east and 0.5 mile north of Doon on east-west county road bridge over Little Rock River, on top of downstream end of center pier; top of large bolt. Elev. 1284.00 ft
- 9845-28 NW (3) - (REFERENCE POINT) - About 3 miles east and 0.5 mile north of Doon on east-west county road bridge over Little Rock River, on top of steel truss 15 feet from left downstream abutment; chiselled notch. Elev. 1290.28 ft
- 9845-28 NW (4) - (REFERENCE POINT) - About 3 miles east of Doon on U.S. Highway 75 bridge over Little Rock River, on top of downstream handrail 99 feet from left abutment; marked with "U". Elev. 1292.79 ft
- 9845-29 NE (1) - Three miles east of Doon on U.S. Highway 75 bridge over Little Rock River, on left downstream wingwall curb; chiselled square. Elev. 1290.76 ft
- 9845-30 SE (1) - 1.5 miles east of Doon on east-west county road "A52" bridge over Little Rock River, on right upstream wingwall curb; chiselled square. Elev. 1282.32 ft
- 9845-31 NE (1) - 1.5 miles east of Doon on east-west county road "A52" bridge over Little Rock River, on left downstream wingwall curb; chiselled square. Elev. 1282.28 ft
- 9845-31 NE (2) - 1.5 miles east of Doon on east-west county road "A52", 10 feet west of southwest corner of bridge over Little Rock River; a USCE concrete monument with a 3-inch brass cap stamped "R-3". Elev. 1282.11 ft by USCE
- 9845-31 NE (3) - (REFERENCE POINT) - 1.5 miles east of Doon on east-west county road "A52" bridge over Little Rock River, on top of downstream handrail, right of 15th handrail post from right abutment; 2 chiselled marks. Elev. 1284.26 ft



- 9846-23 NE (1) - At county blacktop road bridge over Rock River north of Doon, on top of right downstream pier (old abutment); chiselled square painted red. Elev. 1273.52 ft
- 9846-23 NE (2) - (REFERENCE POINT) - About 1/2 mile north of Doon on county road bridge over Rock River, on left side of 4th guardrail post (on guardrail) from left downstream end of bridge; chiselled arrow. Elev. 1280.16 ft
- 9846-23 SE (1) - On county road overflow bridge just west of blacktop road near north city limits of Doon, on right upstream pier in top of landward upstream rivet; chiselled cross painted red. Elev. 1270.92 ft
- 9846-23 SE (2) - About 1/2 mile north of the north edge of Doon at bridge over the Rock River on left downstream wingwall; chiselled cross (found). Elev. 1276.44 ft
- 9846-24 NE (1) - One-half mile north of 90° bend in Highway 167 at north edge of Doon, in middle of section 24 on diagonal gravel road, 300 yards northeast of a farm house on west side of road at a concrete box culvert; chiselled square on east headwall. Elev. 1303.20 ft
- 9846-24 SW (1) - About 1/2 mile north of Doon at county bridge over Rock River, on left upstream wingwall; chiselled cross (found). Elev. 1276.52 ft
- 9846-25 SW (1) - At the south edge of Doon at the "Doon Garage", on the concrete base of the south pillar, at the southwest corner of the pillar; chiselled cross (found). Elev. 1285.44 ft
- 9846-26 NE (1) - At the northwest corner of Doon, on overhead truss bridge over Rock River, on bridge seat bolt on left downstream bridge seat; chiselled cross. Elev. 1268.98 ft
- 9846-26 NE (2) - (REFERENCE POINT) - At northwest corner of Doon, 1/4 mile west of county road bridge over Rock River on guardrail on left side of 3rd guardrail post from right downstream end of bridge; chiselled arrow. Elev. 1274.76 ft
- 9846-35 NE (1) - (REFERENCE POINT) - About 0.5 mile south of Doon on county road bridge over Little Rock River, on top of downstream handrail post, 15th post from left abutment; two file marks. Elev. 1271.97 ft
- 9846-35 NW (1) - About 1 mile west from south edge of Doon on county road bridge over Rock River on left downstream abutment seat, on top of bolt holding anchor plate to abutment; chiselled cross painted red. Elev. 1265.73 ft

- 9846-35 NW (2) - (REFERENCE POINT) - About 3/4 mile west of the southwest corner of Doon, at bridge over the Rock River on downstream guardrail at right side of 4th vertical member from right downstream end bridge; chiselled arrow. Elev. 1272.32 ft
- 9846-36 NW (1) - About 0.5 mile south of Doon on county road bridge over Little Rock River, on left upstream wingwall behind wingpost; chiselled square. Elev. 1269.97 ft
- 9941-30 SW (1) - About 2.5 miles south of Sibley on north-south county bridge over Otter Creek, on top of downstream handrail just right of 7th vertical support from right end of bridge; marked with "U". Elev. 1488.41 ft
- 9942-24 SE (1) - 1.5 miles south of Sibley at county road intersection, in northwest corner of intersection on top of north end of a reinforced concrete pipe culvert. Elev. 1486.30 ft by SCS
- 9942-25 NE (1) - About 2 miles south of Sibley on north-south county road bridge over Otter Creek, on left downstream wingwall piling; nail in southwest side. Elev. 1484.69 ft
- 9942-25 NE (2) - (REFERENCE POINT) - About 2 miles south of Sibley on north-south county road bridge over Otter Creek, on top of downstream wooden handrail 42 feet from right end of bridge. Elev. 1487.90 ft
- 9942-25 SE (1) - About 2.5 miles south of Sibley on north-south county bridge over Otter Creek, on top of left upstream abutment; chiselled square. Elev. 1488.48 ft
- 9942-36 SE (1) - About 3.5 miles south of Sibley on north-south county road bridge over Otter Creek, on top of left downstream wingwall piling; scaffold nail set vertically. Elev. 1470.78 ft by SCS
- 9942-36 SE (2) - (REFERENCE POINT) - About 3.5 miles south of Sibley on north-south county road bridge over Otter Creek, 8 feet from left end of concrete curb; marked with "U". Elev. 1472.91 ft
- 9943- 3 NE (1) - One mile south and 1 mile west of Little Rock, on State Highway 9 bridge over Little Rock River, on end of right downstream wingwall; chiselled cross. Elev. 1443.65 ft
- 9943- 3 NE (2) - (REFERENCE POINT) - One mile south and 1 mile west of Little Rock, on State Highway 9 bridge over Little Rock River, on top of downstream handrail 84 feet from left end of bridge; chiselled arrow. Elev. 1446.35 ft

- 9943- 4 SE (1) - Two miles south and 2 miles west of Little Rock in northwest corner of intersection of county roads, on top of north end of corrugated metal pipe culvert; painted cross. Elev. 1448.30 ft
- 9943- 4 SE (2) - Two miles west and 1.5 miles south of Little Rock on north-south county road "L20" bridge over Little Rock River, on left downstream wingwall piling; pole spike and collar. Elev. 1428.40 ft
- 9943- 4 SE (3) - (REFERENCE POINT) - Two miles west and 1.5 miles south of Little Rock on north-south county road "L20" bridge over Little Rock River, on top of steel handrail at 2nd post from left downstream end of bridge. Elev. 1431.90 ft
- 9943- 4 SW (1) - Two miles south and 3 miles west of Little Rock on east-west county road bridge over Little Rock River, on left upstream wingwall piling; pole spike and collar. Elev. 1419.29 ft
- 9943- 8 SE (1) - Three miles east and 4 miles north of George along north-south county road at "T" road east, about 27 feet north and 24 feet west of intersection, in east side of power pole 1 foot above ground; railroad spike. Elev. 1424.99 ft
- 9943-9 NW (1) - (REFERENCE POINT) - Two miles south and 3 miles west of Little Rock on east-west county road bridge over Little Rock River, on top of wooden handrail at 5th handrail post from right downstream corner of bridge. Elev. 1422.39 ft
- 9943-16 NW (1) - Three miles east and 3.6 miles north of George, on north-south county road bridge over small creek, on left upstream wingwall piling; nail on south-west side 1 foot below top. Elev. 1410.14 ft
- 9943-19 NE (1) - Three miles north and 1.6 miles east of George on small bridge on east-west county road "A22" on left downstream wingwall; square. Elev. 1404.48 ft
- 9943-19 NW (1) - Three miles north and 1 mile east of George on south side of east-west road "A22" about 150 feet east of crossroads, in north side of power pole; nail. Elev. 1434.14 ft
- 9943-19 SW (2) - Two miles north and 1 mile east of George, in northeast corner of intersection of county roads, in north side of power pole at First Baptist Church; nail. Elev. 1442.90 ft
- 9943-19 SW (3) - Two miles north and 1.4 miles east of George on east-west county road, 36 feet north of road and east of farm drive north, in south side of power pole; nail. Elev. 1425.74 ft

9943-30 NE (1) - Two miles north and 1.9 miles east of George on east-west county road bridge over Little Rock River, on left upstream wingwall piling; nail and disc set vertically. Elev. 1394.82 ft

9943-30 NE (2) - Two miles north and 1.9 miles east of George on county road bridge over Little Rock River, on rim of caisson pier at left downstream end of truss; three file marks. Elev. 1394.06 ft

9943-30 NE (3) - (REFERENCE POINT) - Two miles north and 1.9 miles east of George on county road bridge over Little Rock River, on downstream side of bridge, on left side of 1st vertical member from right downstream end of truss; chisel mark. Elev. 1399.02 ft

9943-31 SE (1) - 1.5 miles east of George along county road "A34" on north side of road in south side of telephone pole; nail. Elev. 1376.07 ft

9943-32 NW (1) - (REFERENCE POINT) - About 1 mile north and 2 miles east of George, at county road bridge over Little Rock River, on top of downstream handrail post, 14th post from left; chiselled arrow. Elev.

9944-23 NE (1) - Three miles north of George along State Highway 339 at intersection with county road "A22", 50 feet south and 26 feet west of crossroads, in center of west headwall of concrete culvert; a standard tablet stamped "4 GEU 1969 1457". Elev. 1456.509 ft

9944-36 SW (1) - In George at the corner of North Virginia and East Iowa Streets, 23 feet east and 68 feet north of center of cross streets, 11 feet west of Ebenezer Presbyterian Church; a standard tablet set in corner of sidewalk, stamped "1389 3GEU 1969". Elev. 1389.389 ft

9945- 4 SE (1) - (REFERENCE POINT AND BENCHMARK) - In southeast part of Rock Rapids on Illinois Central railroad bridge over Rock River, on downstream end of crossmember between tie and 2nd vertical member from right downstream end of bridge; chiselled arrow. Elev. 1338.55 ft

9945- 9 NE (1) - In southeast 1/4 Rock Rapids where diagonal road parallel to Illinois Central railroad tracks turns north and crosses tracks at bottle gas depot, in west side of power pole at bottle gas station; pole spike and collar. Elev. 1341.85 ft

9945-10 SE (1) - 1-2/3 miles east and 2 miles south of the junction of Highways 75 and 9 in Rock Rapids, at point where railroad parallels a diagonal road and crosses an east-west road, along north side of east-west road and between railroad and diagonal road in a power pole; twin 60<sup>d</sup> spike on west side of pole. Elev. 1337.58 ft



9945-15 SE (1) - Two miles east and 3 miles north of the junction of county road "A34" and Highway 75, along north-south gravel road at a creek bridge, on right downstream curbing; chiselled square. Elev. 1327.92 ft

9945-15 NW (1) - About 2 miles south of junction of Highways 75 and 9 in Rock Rapids and 1.3 miles east to county road bridge over Rock River, in top of downstream landward rivet anchoring truss to right downstream pier; chiselled cross painted red. Elev. 1325.12 ft

9945-15 NW (2) - (REFERENCE POINT) - 1-1/2 miles east and 2 miles south of the junction of Highways 75 and 9 in Rock Rapids, at east-west bridge over the Rock River, by 15th rivet on left downstream batter post; chiselled arrow. Elev. 1330.49 ft

9945-22 SE (1) - Two miles east and 2-1/2 miles north of the junction of Highway 75 and county road "A34" along north-south gravel road, 200 feet north of farm house on west side of road, at concrete box culvert on right downstream (northwest) corner of headwall; chiselled square. Elev. 1336.36 ft

9945-26 NW (1) - Two miles east and 2 miles north of the junction of county road "A34" and Highway 75, in northeast corner of intersection; northwest corner of 4" concrete post section marker. Elev. 1339.12 ft

9945-26 NW (2) - Two miles east and 2 miles north of the Highway 75 bridge over the Rock River at intersection that has a dead end road to the west, 100 feet east of intersection on east road at 1st telephone pole; pole spike and collar. Elev. 1339.64 ft

9945-32 SE (1) - On Highway 75 bridge over Rock River south of Rock Rapids at end of right downstream main truss in top of bolt holding anchor plate to pier; chiselled cross painted red. Elev. 1309.90 ft

9945-32 SE (2) - (REFERENCE POINT) - Six miles south of junction of Highways 75 and 9 in Rock Rapids on Highway 75 bridge over Rock River, on handrail at left side of 9th guardrail post from right downstream end of bridge; chiselled arrow. Elev. 1312.89 ft

9945-33 NE (1) - One mile north and 1 mile east of the Highway 75 bridge over Rock River at 90° bend in gravel road, at west side of bend, in telephone pole; pole spike. Elev. 1315.98 ft

9945-33 SE (1) - One mile east of the Highway 75 bridge over the Rock River along county road "A34", 100 feet north of "A34" on gravel road, at concrete box culvert, on west headwall; chiselled arrow. Elev. 1331.52 ft

- 10042- 7 NE (1) - 3.5 miles north and 1.5 miles east of Little Rock, on east-west county road bridge over Little Rock River on Iowa-Minnesota border, on left upstream pile cap; railroad spike. Elev. 1497.00 ft
- 10042- 7 NE (2) - (REFERENCE POINT) - 3.5 miles north and 1.5 miles east of Little Rock on east-west county road bridge over Little Rock River, on Iowa-Minnesota border, on top of downstream wooden hadrail, just right of 4th vertical from right end of bridge; marked with "U". Elev. 1499.70 ft
- 10042- 7 SW (1) - Three miles north and 1.5 miles east of Little Rock on east-west county road bridge over Little Rock River, on right upstream wingwall behind wingpost; chiselled cross. Elev. 1495.62 ft by SCS
- 10042-18 NW (1) - (REFERENCE POINT) - Three miles north and 1.5 miles east of Little Rock on east-west county road bridge over Little Rock River, on top of downstream steel handrail just left of 10th post from right end of bridge; chiselled "U". Elev. 1497.97 ft
- 10042-19 NE (1) - 1-3/4 miles east and 2 miles north of Little Rock on east-west county road bridge over Little Rock River on left downstream wooden curb; most landward bolt head (set vertically). Elev. 1480.19 ft by SCS
- 10042-19 NE (2) - (REFERENCE POINT) - 1-3/4 miles east and 2 miles north of Little Rock on east-west county road bridge over Little Rock River, on top of downstream wooden handrail, 25 feet from left end of bridge; marked with "U". Elev. 1482.18 ft
- 10042-30 NW (1) - One mile north and 1-1/4 miles east of Little Rock on east-west county road bridge over Little Rock River, on middle piling of left downstream wing-wall; pole spike and collar. Elev. 1473.75 ft
- 10042-30 NW (2) - (REFERENCE POINT) - One mile north and 1-1/4 miles east of Little Rock on east-west county road bridge over Little Rock River, on top of downstream wooden handrail 3 feet right of right edge of center concrete span of bridge. Elev. 1477.41 ft
- 10043-25 NE (1) - One mile east and 0.5 mile north of Little Rock on north-south county road between Lyon and Osceola Counties, on bridge over Little Rock River, on right downstream wingwall piling; pole spike and collar. Elev. 1465.54 ft
- 10043-25 NE (2) - (REFERENCE POINT) - One mile east and 0.5 mile north of Little Rock on north-south county road between Lyon and Osceola Counties, on bridge over Little Rock River, on top of downstream wooden handrail at 12th post from right end of bridge. Elev. 1469.26 ft



- 10043-25 SW (1) - At north edge of Little Rock on north-south county road "L26" bridge over Little Rock River, on right upstream wingwall at upstream corner; chiselled cross. Elev. 1461.87 ft by SCS
- 10043-26 SE (1) - (REFERENCE POINT) - At north edge of Little Rock on north-south county road "L26" bridge over Little Rock River, on top of steel handrail at 9th post from left downstream abutment; two chisel marks. Elev. 1464.19 ft
- 10043-26 SW (1) - About 0.5 mile west of Little Rock on Chicago, Rock Island and Pacific Railway bridge over Little Rock River, on right downstream abutment; chiselled square. Elev. 1457.51 ft
- 10043-26 SW (2) - About 0.5 mile west of Little Rock on Chicago, Rock Island and Pacific Railway bridge over Little Rock River, on left downstream abutment; chiselled square. Elev. 1454.48 ft
- 10043-34 NE (1) - About 1.5 miles west of Little Rock on east-west county road bridge over Little Rock River, on left downstream bridge abutment downstream of wingpost; chiselled square. Elev. 1453.90 ft
- 10043-34 NE (2) - (REFERENCE POINT) - About 1.5 miles west of Little Rock on east-west county road bridge over Little Rock River, on top of downstream handrail between 12th and 13th handrail post from left abutment; 2 file marks. Elev. 1455.92 ft
- 10043-34 NW (1) - Two miles west of Little Rock in south-east corner of intersection of county roads, in east side of power pole 1 foot above ground; scaffold nail. Elev. 1518.94 ft by SCS
- 10045- 8 NE (1) - 4-1/2 miles north of Rock Rapids on east-west county road bridge over Rock River at right downstream end of main truss in landward side of pile cap; spike and collar painted red. Elev. 1371.00 ft
- 10045- 8 NE (2) - (REFERENCE POINT) - At the Iowa-Minnesota state line bridge over the Rock River, 17 feet left of right downstream batter post on guardrail; chiselled arrow. Elev. 1376.13 ft
- 10045-16 SW (1) - Three miles north of junction of Highways 75 and 9 in Rock Rapids at "T" type intersection of county roads, on south side of road just after road turns east (coming from north), in telephone pole in pasture; spike and collar painted red. Elev. 1353.47 ft

- 10045-16 SW (2) - Three miles north of junction of Highways 75 and 9 in Rock Rapids at "T" type intersection of county roads, on north side of road just after road turns east (coming from north), in power pole; spike and collar painted red. Across road from benchmark 10045-16 SW (1). Elev. 1361.18 ft
- 10045-17 NE (1) - About 1 mile south of the Iowa-Minnesota state line bridge over the Rock River, 250 yards north of a lone corn crib on east side of road, at small wooden bridge, on right downstream pile; pole spike and collar. Elev. 1368.57 ft
- 10045-20 NE (1) - About 1-3/4 miles south from the Iowa-Minnesota state line bridge over the Rock River, at south side of bend in north-south gravel road, at small wooden creek bridge in southwest wingpile; spike. Elev. 1354.28 ft
- 10045-20 SE (1) - Two miles north of junction of Highways 75 and 9 in Rock Rapids at county road bridge over Rock River, on downstream left caisson pier at end of main truss, in landward rivet; chiselled cross painted red. Elev. 1356.62 ft
- 10045-20 SE (2) - (REFERENCE POINT) - Two and one-half miles south of the Iowa-Minnesota state line bridge over the Rock River at right side of 1st vertical member from left downstream end of bridge, on guardrail; chiselled arrow. Elev. 1360.78 ft
- 10045-28 SW (1) - One-half mile north of Rock Rapids along blacktop road east of and parallel to Illinois Central Railroad tracks, 1/8 mile north of gun club, the blacktop turns and crosses railroad tracks, on east side of lane going north along east side of railroad tracks, in power pole directly north of the turn; pole spike and collar. Elev. 1353.90 ft
- 10045-33 SE (1) - On Highway 9 bridge over Rock River in Rock Rapids in downstream right end of wingwall guardrail, in top of end concrete post; chiselled square painted red. Elev. 1348.50 ft
- 10045-33 SE (2) - In Rock Rapids at east end of north 2nd Avenue on downstream side of road entering Island Park, in riverward side of power pole; spike and collar painted red. Elev. 1343.26 ft
- 10045-33 SE (3) - (REFERENCE POINT AND BENCHMARK) - In Rock Rapids City Park at bridge at south entrance, 1 foot left of 4th guardrail post from junction of right downstream wingwall and abutment headwall; a chiselled square. Elev. 1327.12 ft

10045-33 SW (1) - At USGS recording gage in Rock Rapids in retaining wall of dam; USGS bronze tablet.  
Elev. 1340.50 ft

10045-33 SW (2) - In Rock Rapids in City Park at USGS gaging station; top of outside staff gage on right wingwall of dam. (Top of gage plate reads 6.72 feet).  
Elev. 1338.28 ft

10045-33 NW (1) - In northwest quarter Rock Rapids along black-top road which parallels Illinois Central Railroad track going north from town, on left downstream bridge curb of bridge over small creek; a chiselled square.  
Elev. 1344.90 ft