FLOODS IN THE NISHNABOTNA RIVER BASIN, IOWA

By David A. Eash and Albert J. Heinitz

U.S. GEOLOGICAL SURVEY

Open-File Report 91-171

Prepared in cooperation with the
Highway Research Advisory Board,
Highway Division,
Iowa Department of Transportation
Research Project HR-140

Iowa City, Iowa
1991

U.S. DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
	Length	
inch (in)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
square foot (ft^2)	0.09290	square meter
acre	4,047	square meter
acre	0.4047	square hectometer
square mile (mi^2)	2.590	square kilometer
	Volume	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer
	Mass	
ton, short (2,000 lb)	0.9072	megagram
ton per acre	2.242	megagram per square hectometer

Sea Level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 -- a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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ABSTRACT

Flood-elevation profiles and flood-peak discharges for floods during 1972, 1982, and 1987 in the Nishnabotna River basin are given in this report. The profiles are for the 1972 flood on the West and East Nishnabotna Rivers, the 1982 flood on Indian Creek, and the 1987 flood on the lower West Nishnabotna River. A flood history describes rainfall conditions and reported damages for floods occurring during 1947, 1958, 1972, 1982, and 1987. Discharge for the 1982 flood on Indian Creek is 1.1 times larger than the 100-year recurrence interval discharge.

INTRODUCTION

Evaluation of flood hazards, and the planning, design, and operation of various structures on flood plains require information about floods. Flood reports supply specific information for selected floods, and are used by planners and engineers to evaluate the magnitude and frequency of floods in a river basin.

Purpose and Scope

This report provides information on flood stages and discharges, flood magnitude and frequency, and bench-mark data for the Nishnabotna River basin. It also presents flood-elevation profiles for the 1972, 1982, and 1987 floods. The 1972 profiles are for 107 miles on the West Nishnabotna River, 84 miles on the East Nishnabotna River, and 4 miles on the Nishnabotna River. The 1982 profile is for 9 miles on Indian Creek. The 1987 profiles are for 47 miles on the lower West Nishnabotna River and 4 miles on the Nishnabotna River. A flood history describes rainfall conditions and reported damages for floods occurring during 1947, 1958, 1972, 1982, and 1987.

Acknowledgments

This report is the thirteenth in a series prepared in cooperation with the Highway Research Advisory Board, Highway Division, Iowa Department of Transportation. Various Federal, State and local agencies cooperated in the collection of the streamflow records used in this report, acknowledgment of which is contained in the annual streamflow reports of the U.S. Geological Survey (USGS).

STUDY AREA

The Nishnabotna River basin is located in southwestern Iowa and drains into the Missouri River 10 miles south of the Iowa-Missouri border (figs. 1 and 2). The basin covers 2,819 square miles in Iowa and includes parts of 12 counties. The two major tributaries of the Nishnabotna River are the West Nishnabotna River and the East Nishnabotna River, with drainage areas of 1,649 and 1,148 square miles, respectively. The West and East Nishnabotna Rivers follow parallel, southerly courses for about 100 miles before joining at their confluence, 4 miles upstream of Hamburg, to form the Nishnabotna River.

The topography of the Nishnabotna River basin is characterized by broad, rolling uplands and wide valleys; an indication that the basin has reached a stage of geologic maturity. The soil cover of the basin generally consists of a mantle of loess deposited during the interglacial periods and following the

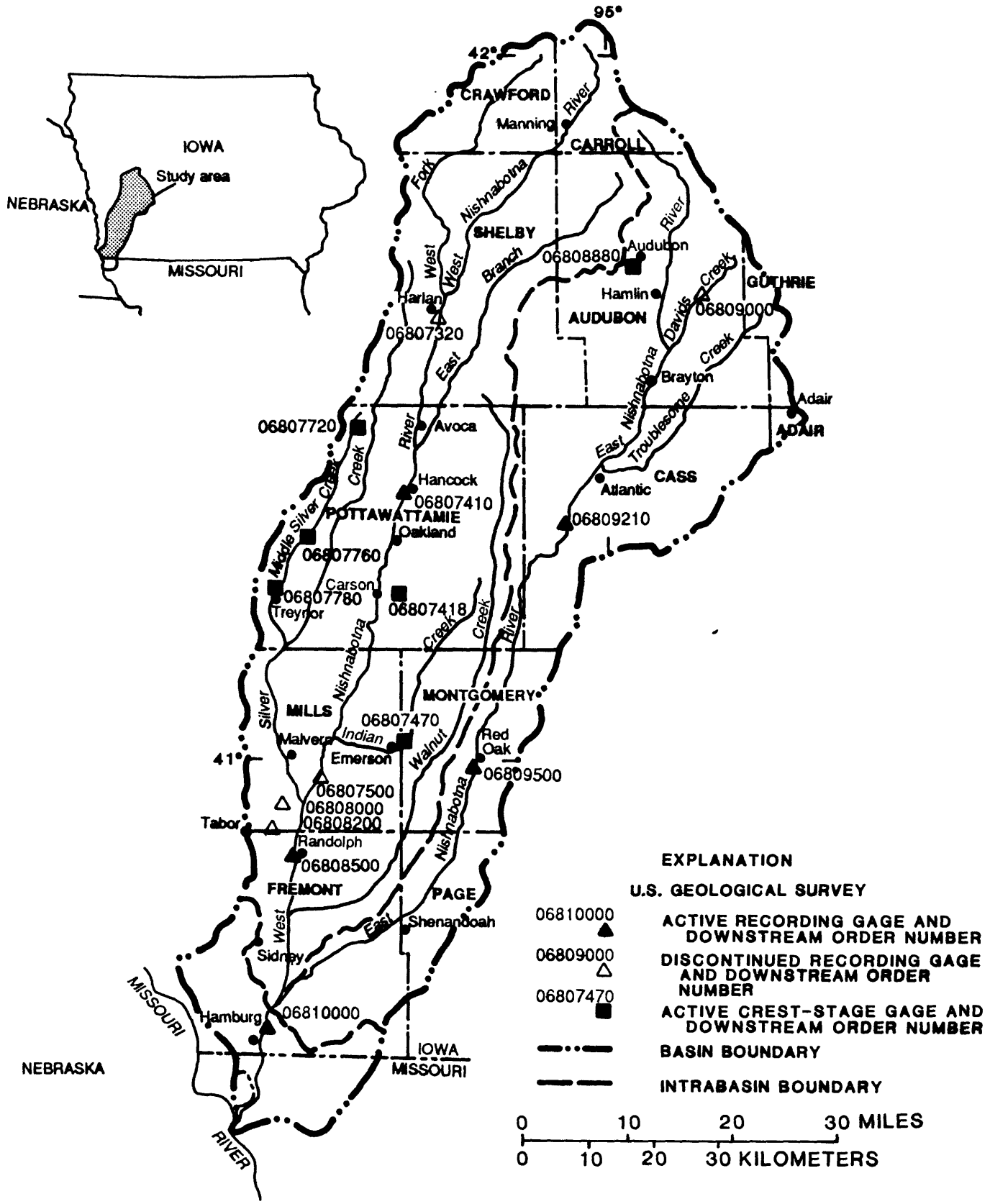

Figure 1.--Location of active and discontinued gaging stations in the Nishnabotna River basin.

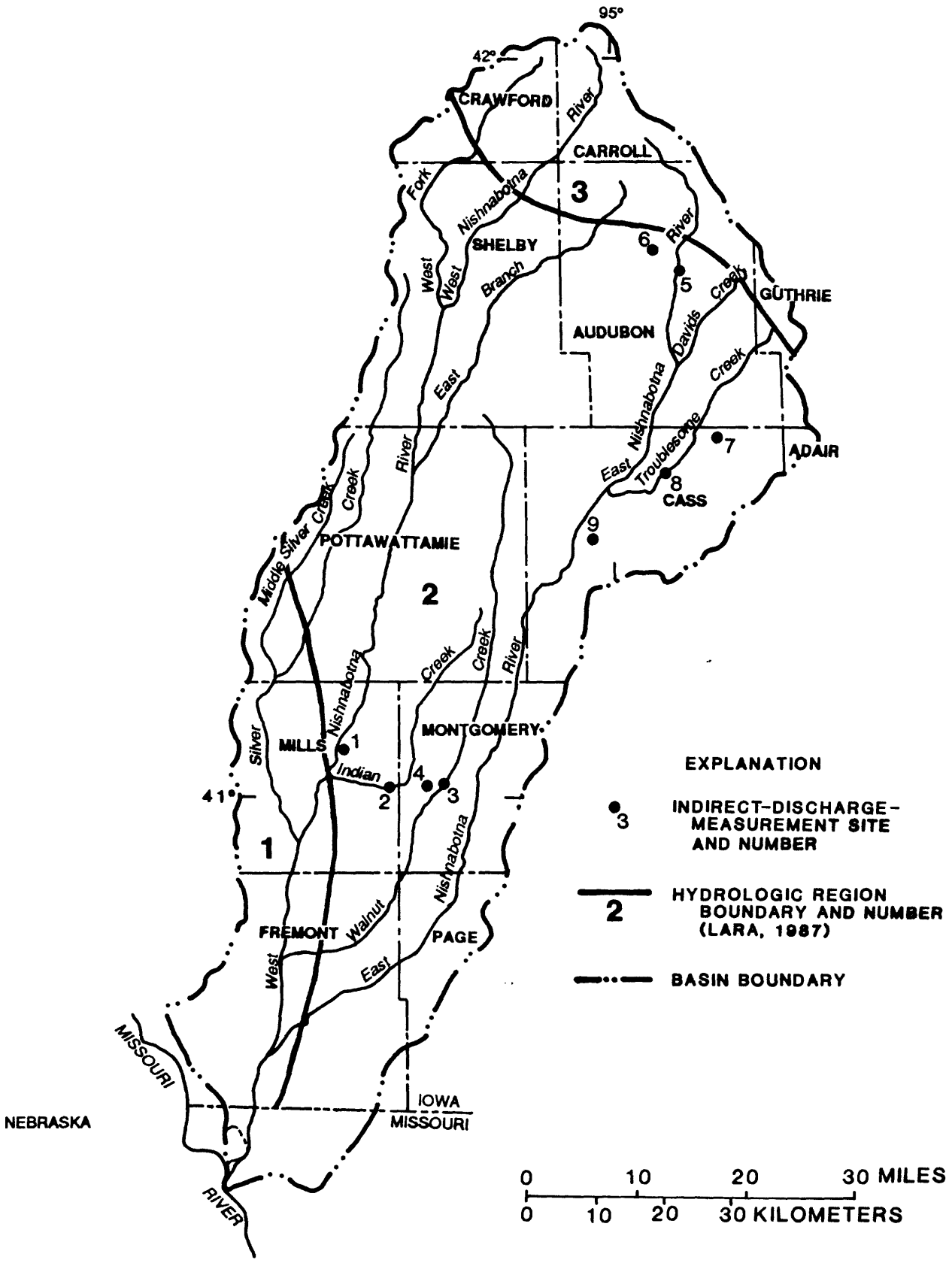

Figure 2.--Location of hydrologic regions and miscellaneous measurement sites in the Nishnabotna River basin.

advance of ice sheets in Iowa. The loess is almost 100 feet thick in places near the western edge of the basin; it decreases in thickness from west to east until it is only 3 to 8 feet thick on the ridges in the northeast part of the basin (Iowa Natural Resources Council, 1955, p. 3).

Before the turn of the century, streams draining the Nishnabotna River basin were naturally sluggish and meandering, but extensive channel straightening during the early 1900's altered the streamflow characteristics of the basin. Channel straightening occurred in about 90 percent of the lower 100 miles of the West Nishnabotna River, and in about 75 percent of the lower 100 miles of the East Nishnabotna River. Continuous levees were constructed along each bank upstream of Hamburg from the material excavated during this channelization work (Iowa Natural Resources Council, 1955, p. 3, 37). Channelization and levee construction has continued since 1929 for local sections of streams in the basin (U.S. Army Corps of Engineers, 1974, p. 6-7). Land use in the basin is predominantly agricultural with some livestock operations.

Normal annual precipitation (1951-1980) for the area is about 33 inches, based on data from the National Oceanic and Atmospheric Administration. Records of the USGS show that the mean annual runoff is from 5.4 to 7.0 inches for the Nishnabotna River basin.

FLOOD HISTORY

Floods in the Nishnabotna River basin have been documented since 1918 in annual reports of the USGS (see references). The first gaging station established in the river basin was on the East Nishnabotna River at Red Oak (06809500) in May 1918.

The active and discontinued USGS gaging stations used in this report are shown in figure 1, and are listed in table 1. Selected discharges and recurrence intervals for each of the major floods described in this section, and maximum, known flood-peak discharges for each gaging station are listed in table 1. Known flood peaks at miscellaneous, USGS, indirect-measurement sites are listed in table 2, and the locations of these sites are shown in figure 2. Graphs of the annual peak discharges for six gaging stations are shown in figures 3-8. The graphs illustrate that the 1947, 1958, 1972, 1982, and 1987 flood peaks are among the largest on record for these selected gaging stations.

Historical information concerning the magnitude and severity of floods that occurred in the Nishnabotna River basin before 1912 is scant. A report by the U.S. Army Corps of Engineers (1940, p. 19-26) lists damage-causing floods that reportedly occurred during 1849, 1851, 1867, 1881, 1882, 1883, 1902, and 1903, and descriptions of 12 floods which occurred from 1912 to 1939. The floods which occurred from 1912 to 1939 caused considerable damage, but are not reported as being record-high floods. The peak discharge on the East Nishnabotna River at Red Oak (06809500), on June 7, 1917, is the fourth largest on record (fig. 7).

The severe flooding that affected much of Iowa during June 1947, also involved the Nishnabotna River basin. Frequent rains from the latter half of May through June saturated the soils in the basin. The rain from four intense thunderstorms during June 1947 caused four distinct flood peaks in the Nishnabotna River basin (Iowa Natural Resources Council, 1955, p. 28-35). The first flood occurred in the East Nishnabotna River basin and was caused primarily by rainfall over the eastern tributaries of the East Nishnabotna River on June 1-2. Rainfall on June 3-5 in the lower part of the Nishnabotna River basin caused the second flood to occur primarily south of the Cass and Pottawattamie County lines on the West and East Nishnabotna Rivers and other tributaries. An intense thunderstorm on June 12-13 was so widespread, that it caused the third flood to be severe throughout the entire basin on the main streams and most tributaries along their entire lengths. The Iowa Natural Resources Council (1955) reports that two deaths were caused by this third flood in Red Oak. The combined effects of the antecedent moisture conditions and another storm on June 21-22 caused the fourth flood, which produced the maximum discharge for the period of record on the Nishnabotna River above Hamburg (06810000). A discharge of 55,500 ft^3/s (cubic feet per second) was

Table 1.--Selected flood-peak discharges at active and discontinued gaging stations in the Nishnabotna River basin

[mi^2, square mile; ft^3/s, cubic foot per second; $(ft^3/s)/mi^2$, cubic foot per second per square mile; *, maximum flood-peak discharge known for site; --, insufficient record to compute discharge or flood frequency using Bulletin 17B (Interagency Advisory Committee on Water Data, 1981) or unit runoff]

Station number (fig. 1)	Station name and location[a]	Period of flood record[b]	Drainage area (mi^2)	Date	Gage height (feet)[c]	Discharge (ft^3/s)	Recurrence interval (years)[d]	Unit runoff [$(ft^3/s)/mi^2$]
06807320	West Nishnabotna River at Harlan (mile 95.65)	1978-82	316	09-13-78	26.18	*14,500	--	45.9
06807410	West Nishnabotna River at Hancock (mile 75.14)	1960-88	609	09-13-72	22.12	*26,400	45	43.3
06807418	Graybill Creek near Carson (mile 5.05)	1966-88	45.9	06-26-66	81.00	--	--	--
06807470	Indian Creek near Emerson (mile 8.95)	1966-88	37.3	06-15-82	92.63	[e]*15,800	[f]1.1	424
				05-26-87	91.78	9,600	45	257
06807500	West Nishnabotna River at White Cloud (mile 40.28)	1919-24	967	07-30-22	19.4	*10,600	--	11.0
06807720	Middle Silver Creek near Avoca (mile 25.39)	1953-88	3.21	06-14-76	11.21	*1,200	30	374
06807760	Middle Silver Creek near Oakland (mile 12.98)	1953-88	25.7	07-04-73	14.73	*2,110	60	82.1
06807780	Middle Silver Creek at Treynor (mile 6.28)	1953-88	42.7	07-04-73	17.06	*3,700	95	86.7
06808000	Mule Creek near Malvern (mile 1.8)	1954-69, 1987	10.6	08-21-54	[g]15.84	*2,070	[h]7	195
				05-26-87	[i]26.06	2,060	[h]7	194
06808200	Spring Valley Creek near Tabor (mile 1.5)	1956-64	7.65	07-30-58	15.48	*4,150	--	542
06808500	West Nishnabotna River at Randolph (mile 31.50)	1947, 1949-88	1,326	06- -47	[j]24.	--	--	--
				07-03-58	17.70	16,500	2	12.4
				09-14-72	21.71	18,500	3	14.0
				06-15-82	23.51	27,600	7	20.8
				05-26-87	24.50	*40,800	30	30.8
06808880	Bluegrass Creek at Audubon (mile 5.21)	1966-88	15.4	09-11-72	86.05	--	--	--
06809000	Davids Creek near Hamlin (mile 8.0)	1952-73	26.0	07-02-58	19.35	*22,700	[f]2.2	873

Table 1.--Selected flood-peak discharges at active and discontinued gaging stations in the Nishnabotna River basin --Continued

Station number (fig. 1)	Station name and location[a]	Period of flood record[b]	Drainage area (mi^2)	Date	Gage height (feet)[c]	Discharge (ft^3/s)	Recurrence interval (years)[d]	Unit runoff [(ft^3/s)/mi^2]
06809210	East Nishnabotna River near Atlantic (mile 84.60)	1958, 1961-88	436	07-02-58	22.49	[e]*34,200	80	78.4
				09-12-72	22.81	26,700	25	61.2
06809500	East Nishnabotna River at Red Oak (mile 53.50)	1917-25, 1936-88	894	06-07-17	21.7	23,500	15	26.3
				06-13-47	23.2	36,200	90	40.5
				07-03-58	22.27	35,600	90	39.8
				09-13-72	27.43	*38,000	100	42.5
				06-15-82	18.86	13,000	4	14.5
				05-26-87	17.08	9,820	2	11.0
06810000	Nishnabotna River above Hamburg (mile 13.80)	1917, 1922-23, 1929-88	2,806	06-07-17	21.00	--	--	--
				06-24-47	26.03	*55,500	[f]1.3	19.8
				07-06-58	22.75	14,600	2	5.20
				09-15-72	27.42	25,200	7	8.98
				06-15-82	27.25	29,100	12	10.4
				05-27-87	[k]28.14	31,400	17	11.2

[a]Miles measured along stream from mouth of stream.
[b]Water years (Oct. 1-Sept. 30) listed in table 3 with flood peaks.
[c]Gage datum in sea level for continuous record-gaging stations is listed in table 4.
[d]Flood frequency computed using Bulletin 17B (Interagency Advisory Committee on Water Data, 1981).
[e]Discharge computed from an indirect measurement.
[f]Ratio of flood discharge to that of the 100-year flood, Bulletin 17B.
[g]Gage located downstream from bridge.
[h]Flood frequency computed using 1954-69 period of record. Basin became partially regulated by construction of 24 impoundment dams during 1954-56.
[i]Gage located upstream from culvert.
[j]Approximate.
[k]Levee broke upstream from gaging station.

Table 2.--Flood-peak discharges at miscellaneous, indirect measurement sites in the Nishnabotna River basin

[mi^2, square mile; ft^3/s, cubic foot per second; $(ft^3/s)/mi^2$, cubic foot per second per square mile]

Site number (fig. 2)	Stream	Location	Drainage area (mi^2)	Date	Discharge (ft^3/s)	Unit runoff [$(ft^3/s)/mi^2$]
1	West Nishnabotna River Tributary near Hastings	SE1/4 sec. 6, T.72N., R.40W., Mills County, at bridge on county road M16, 2.5 mi north of Hastings.	1.13	05-26-87	483	427
2	Indian Creek at Emerson	SE1/4 sec. 24, T.72N., R.40W, Mills County, at bridge on county road H34, at east edge of Emerson.	43.4	09-18-60	2,220	51.2
3	Walnut Creek near Red Oak	NW1/4 sec. 13, T.72N, R.39W., Montgomery County, at bridge on county road, 3 mi northwest of Red Oak.	106	09-18-60	978	9.23
4	Crabapple Creek near Hawthorne	NW1/4 sec. 21, T.72N, R.39W., Montgomery County, at bridge on county road, 2 mi north of Hawthorne.	10.2	09-18-60	1,530	150
5	East Nishnabotna River near Audubon	SE1/4 sec. 23, T.80N, R.35W., Audubon County, at bridge on county road, 2.5 mi east of Audubon.	81.8	07-02-58	20,500	251
6	Blue Grass Creek Tributary No. 1 near Audubon	NW1/4 sec. 4, T.80N, R.35W., Audubon County, at bridge on county road, 3 mi north of Audubon.	0.057	07-02-58	143	2,510
7	Crooked Creek near Anita	SE1/4 sec. 6, T.77N, R.34W., Cass County, at bridge on county road, 3 mi north and 1.8 mi west of Anita.	23.9	04-12-64 09-11-72	7,530 14,800	315 619
8	Troublesome Creek near Wiota	NW1/4 sec. 29, T.77N, R.35W., Cass County, at bridge on county road, 3 mi northwest of Wiota.	118	04-12-64	7,030	59.6
9	Turkey Creek Tributary near Atlantic	NW1/4 sec. 31, T.76N, R.36W., Cass County, at bridge on county road, 4 mi south of Atlantic.	4	09-11-72	1,640	410

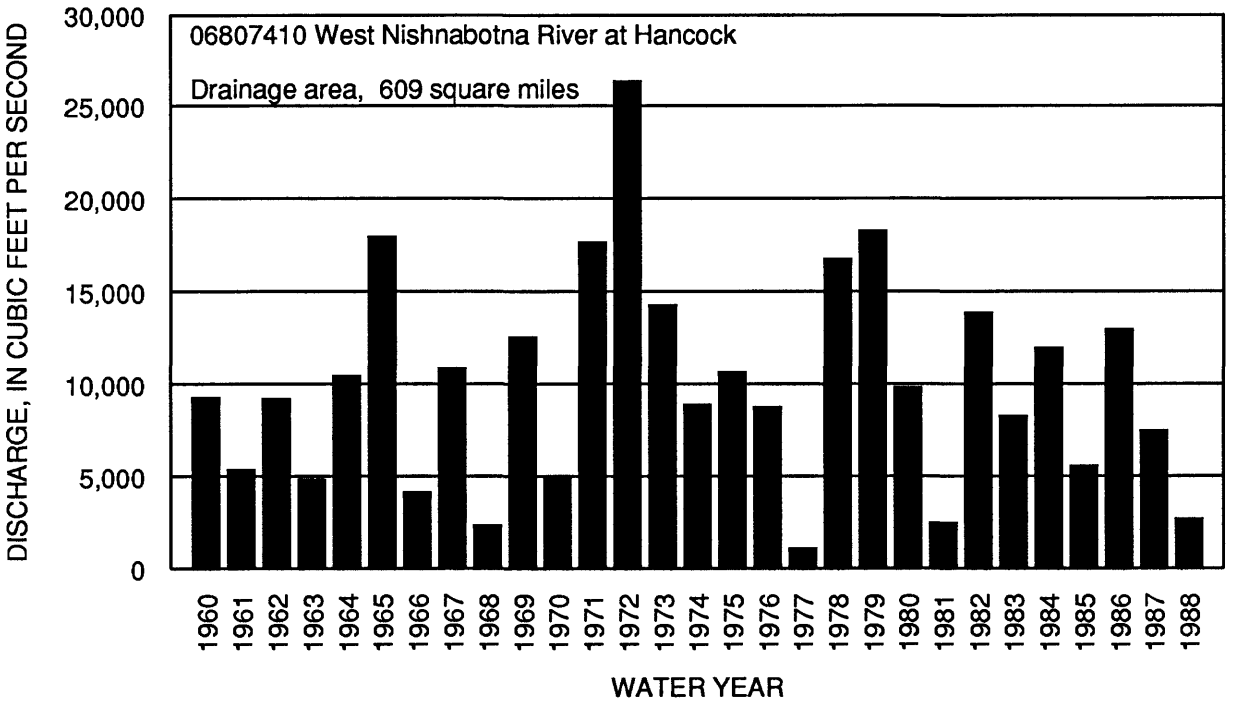

Figure 3.-- Annual peak discharges for period of record

for West Nishnabotna River at Hancock gaging station.

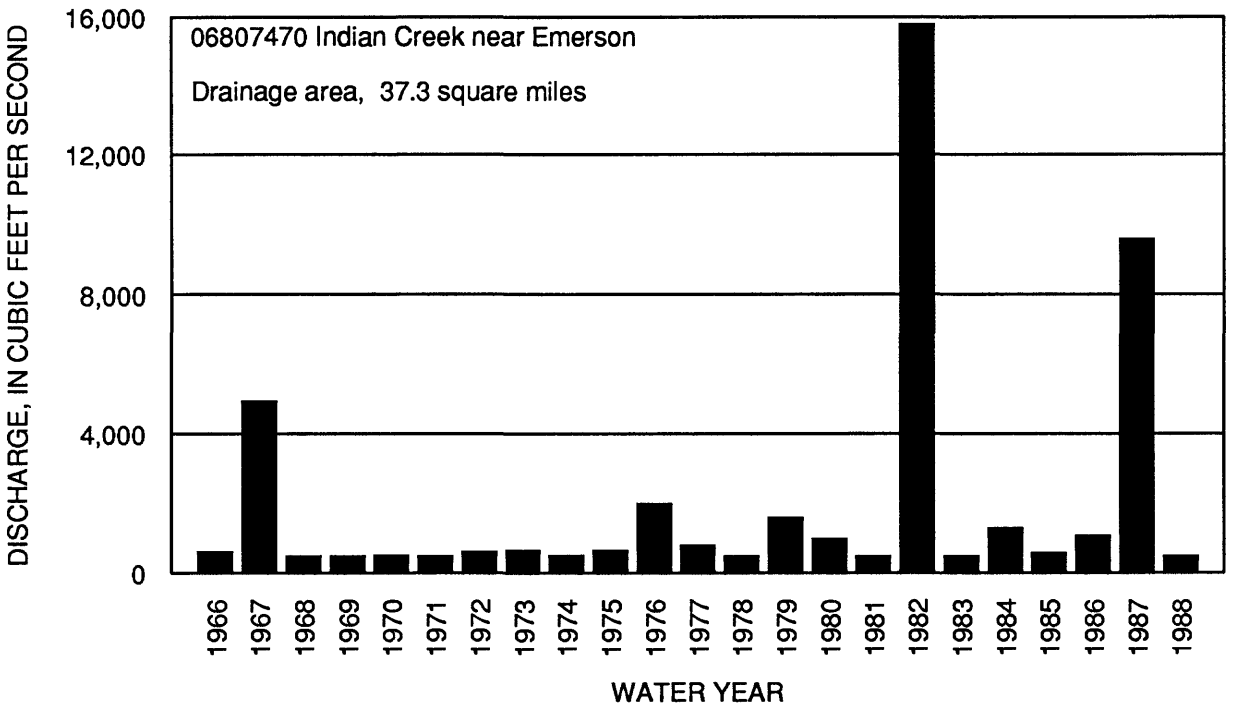

Figure 4.-- Annual peak discharges for period of record

for Indian Creek near Emerson crest-stage gaging station.

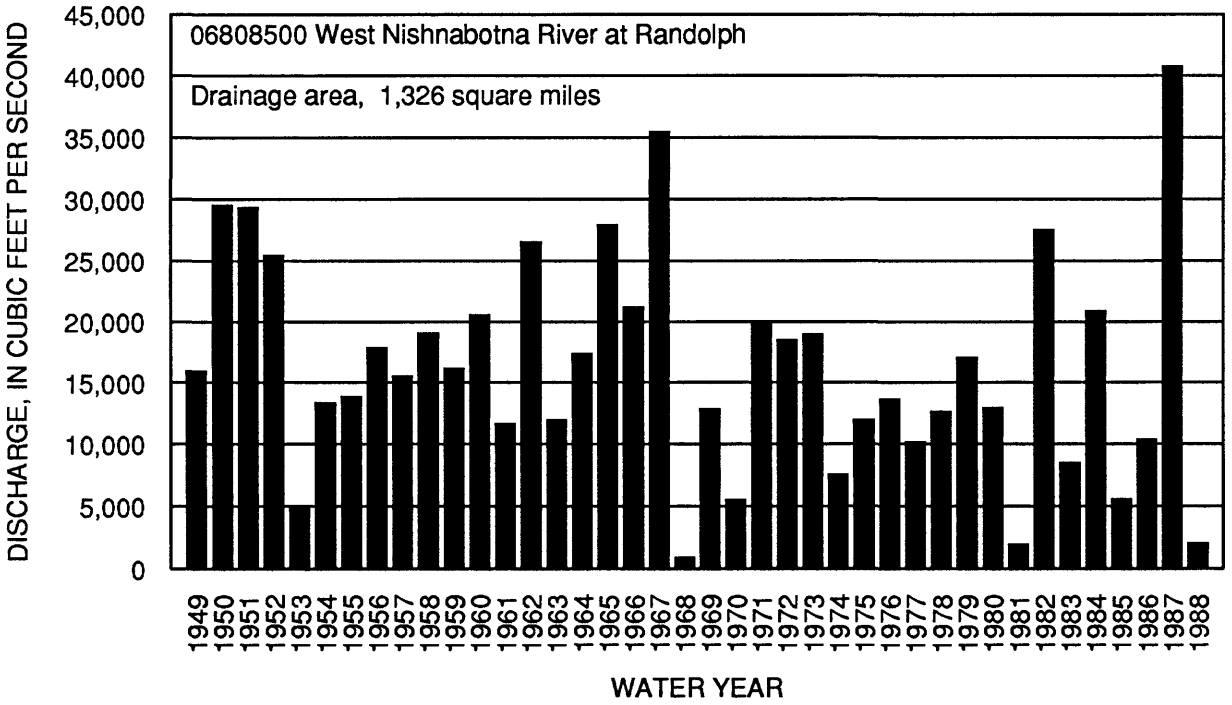

Figure 5.-- Annual peak discharges for period of record

for West Nishnabotna River at Randolph gaging station.

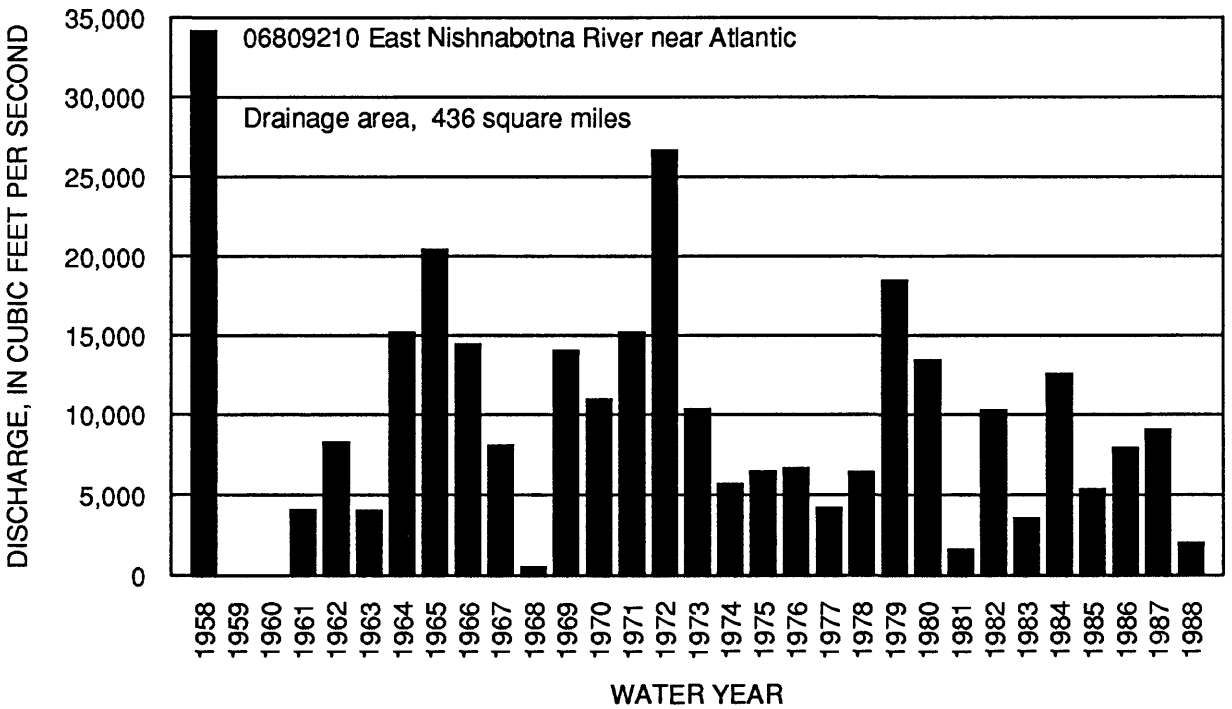

Figure 6.-- Annual peak discharges for period of record

for East Nishnabotna River near Atlantic gaging station.

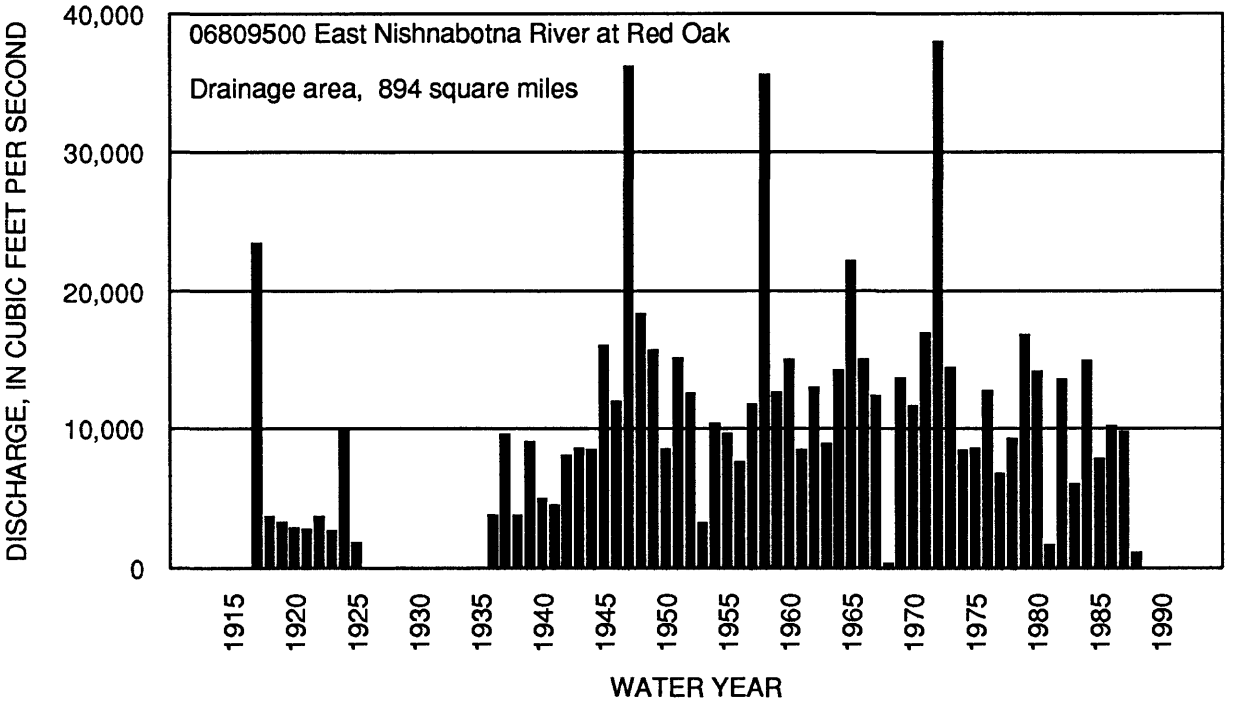

Figure 7.-- Annual peak discharges for period of record for East Nishnabotna River at Red Oak gaging station.

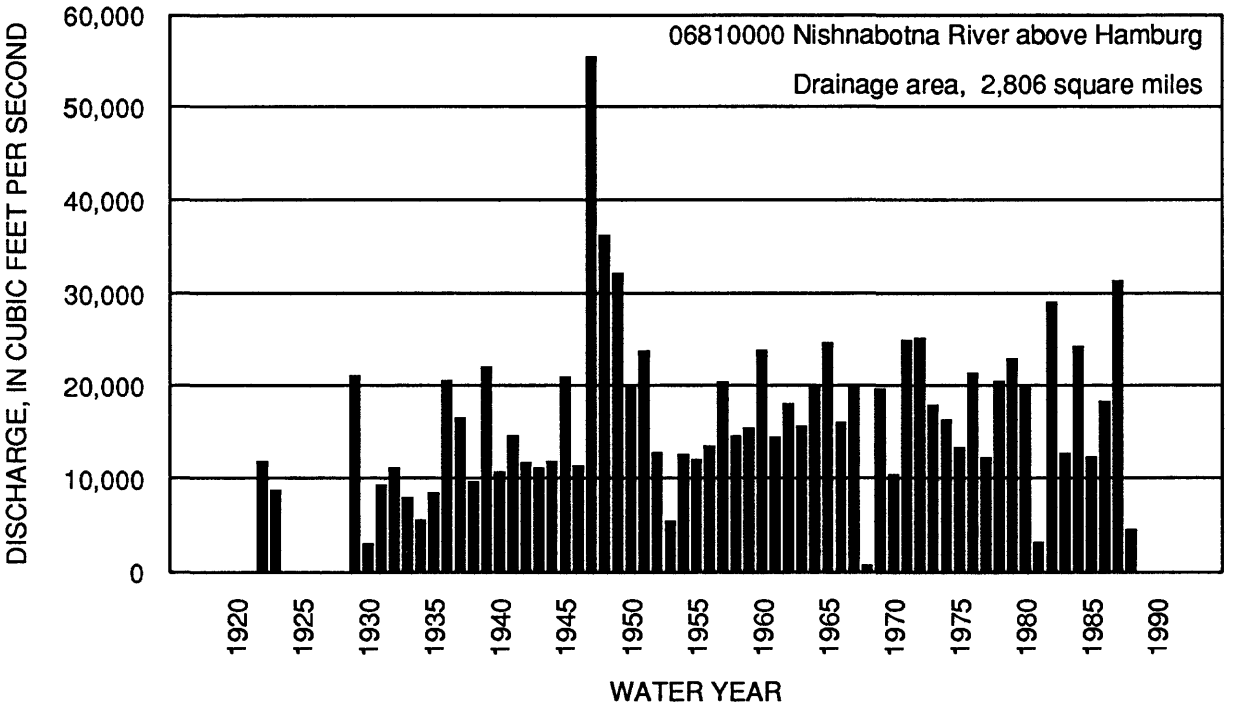

Figure 8.-- Annual peak discharges for period of record for Nishnabotna River above Hamburg gaging station.

recorded for this site on June 24, 1947, which is 1.3 times larger than the Bulletin 17B, 100-year recurrence interval discharge (fig. 8). A discussion of usage and methodologies for determining the 100-year recurrence interval follows in the "Flood Frequency and Magnitude" section. Damages in Fremont and Montgomery Counties from the June 1947 floods totaled $2.4 million (U.S. Department of Commerce and Iowa Department of Agriculture, July 1947, p. 85).

The flood of July 1-3, 1958, in the East Nishnabotna River basin was caused by an intense thunderstorm centered above the headwaters of the basin during the night of July 1. At the city of Audubon, 12.53 inches of rainfall were recorded during 24 hours on July 2; the second largest official amount of precipitation on record (1844-1981) for Iowa (Waite and Jaeger, 1981, p. 18-20, 40). This 24-hour rainfall is almost twice the 100-year recurrence interval of 6.7 inches for the Audubon area. An unofficial rainfall of 13.23 inches also was reported by Waite and Jaeger for another Audubon site for the night of July 1. The resulting flash flood was so sudden that 19 people were killed before protective measures could be taken (U.S. Army Corps of Engineers, 1959, p. 8-14). The Corps (1959) reported that total damages in the Nishnabotna River basin from the July 1-3, 1958, flood were $5.7 million. At a gaging station near the area of greatest precipitation, Davids Creek near Hamlin (06809000), a peak discharge of 22,700 ft^3/s was recorded on July 2, 1958. This peak discharge is 2.2 times larger than the Bulletin 17B, 100-year recurrence interval discharge of 10,300 ft^3/s, and it is one of the largest unit runoffs ever recorded in Iowa (873 cubic feet per second per square mile). At the gaging station, East Nishnabotna River near Atlantic (06809210), the peak discharge on July 2, 1958, is the maximum discharge for the period of record (fig. 6).

Severe flooding in the Nishnabotna River basin during September 10-15, 1972, resulted from an intense thunderstorm system over the upper part of the basin on September 10-12. At a site near Harlan, in Shelby County, 12.49 inches of rainfall was recorded on September 11, and the 3-day rainfall total was 20 inches (National Oceanic and Atmospheric Administration, September 1972, p. 136). The approximate 100-year, 3-day rainfall recurrence interval for Shelby County is 8.2 inches. Near Adair, in Adair County, 6.6 inches of rain fell in 4 hours during the evening of September 10 (U.S. Army Corps of Engineers 1974, p. 8-32). The Corps (1974) reported that total damages in the Nishnabotna River basin from the September 10-15, 1972, flood were $11.4 million, and that two deaths were caused by washed-out bridges near Brayton. The flooding occurred in the latter part of the growing season, and crop losses were excessive. The Corps (1974) also reported crop damage estimates of $5.3 million for the 108,000 acres affected by the flooding. Peak discharges from the September 1972 flood on the West Nishnabotna River at Hancock (06807410) and on the East Nishnabotna River at Red Oak (06809500) are the maximum discharges for the periods of record for these gaging stations (figs. 3 and 7).

During the night of June 14, 1982, an intense thunderstorm caused a devastating flood on Indian Creek in Mills and Montgomery Counties. Unofficial rainfalls of up to 8 inches in the headwaters of Indian Creek are reported by Heinitz (1985, p. 8), and unofficial rainfalls of up to 11 inches in the headwaters of both the West and East Nishnabotna Rivers are reported by the National Oceanic and Atmospheric Administration (June 1982, p. 26). The National Oceanic and Atmospheric Administration (June 1982) also reported that soil erosion from the storm exceeded 20 tons per acre in five southwestern Iowa counties, and that one death occurred during the night of June 14 when an Amtrak passenger train derailed at a wash out near Emerson. At the crest-stage gaging station, Indian Creek near Emerson (06807470), the peak discharge on June 15, 1982, is the maximum discharge for the period of record (fig. 4). This discharge of 15,800 ft^3/s, is 1.1 times larger than the Bulletin 17B, 100-year recurrence interval discharge.

Intense rainfall on May 26, 1987, caused flooding to occur primarily in the lower West Nishnabotna River basin. The National Oceanic and Atmospheric Administration (May 1987, p. 27) reports that up to 10 inches of rain fell between 2 a.m. and nightfall on May 26 in parts of Mills and Montgomery Counties. Damages from the May 26-28, 1987, flood were $5.5 million (Dennis Olson, Agriculture Stabilization and Conservation Service, oral commun., April 1988). The intense rainfall and flooding caused severe soil erosion, and damage to farm terraces and levees. Mills, Montgomery,

Fremont, and Page Counties were declared Presidential and State disaster areas. The May 26, 1987, peak discharge on the West Nishnabotna River at Randolph (06808500) is the maximum discharge for the period of record (fig. 5).

HYDROLOGIC DATA

Gaging-station records are the primary source of data for analyzing and understanding the flood hydrology of a river basin. Flood information is obtained from complete-record gaging stations which provide a continuous chronology of streamflow, and from partial-record, crest-stage gaging stations which provide a chronology of annual peak flows. The locations of the active and discontinued USGS gaging stations used in this report are shown on the basin map in figure 1. Specific locations, annual peak stages and discharges, and other information pertaining to these gaging stations are given in table 3 (at end of report). Supplemental flood information is also obtained from miscellaneous measurement sites which provide streamflow data at sites where gaged data are not available. The locations of the miscellaneous measurement sites used in this report are shown in figure 2. Specific locations for these sites and flood-peak discharges, computed from indirect streamflow measurements, are given in table 2. Discharge records for these gaging stations and miscellaneous measurement sites are published in the annual streamflow reports of the USGS (see references).

The computation of discharge records at a gaging station is dependent upon the development of a relation between water surface elevations (stages) and the corresponding flow rates (discharges). The high-water portion of the stage-discharge relation, or rating curve as it is sometimes called, generally remains stable if the channel downstream from the gaging site remains unchanged. Changes in the stage-discharge relation occur from time to time, either gradually or abruptly, due to changes in the river channel that result from scour, deposition, or the growth of vegetation (Rantz and others, 1982, p. 328-360).

FLOOD FREQUENCY AND MAGNITUDE

A flood event of a magnitude which is expected to be equalled or exceeded once on the average during any 100-year period (recurrence interval) has been commonly used as a standard against which flood peaks are measured. This event, commonly termed the 100-year flood, has a 1 percent chance of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year.

The methodology for determining flood-flow frequency discharges is outlined by the United States Water Resources Council (Interagency Advisory Committee on Water Data, 1981, p. 1-28). The Water Resources Council recommends using the Pearson type III distribution with log transformation of the data as a base method for determining flood-flow frequency discharges. In this report, this methodology for determining flood-flow frequency discharges is referred to as "Bulletin 17B".

Another method for determining flood-flow frequency discharges at sites in Iowa, including those not gaged, is described by Lara (1987, p. 2-19). Lara used the physiographic characteristics of Iowa as a guide in defining the boundaries of five hydrologic regions. Regional equations were developed by using the annual flood-peak discharges for all gaged stations in a hydrological, homogeneous area, thereby reducing potential errors associated with nonrepresentative, short-term stations. For this reason, regional analysis also may produce improved estimates of the flood characteristics at gaged sites. Lara also used the Pearson type III distribution with log transformation as the base method for developing the regional equations.

The relation of maximum discharges and regional, 100-year flood discharges with drainage area for active and discontinued gaging stations, and for miscellaneous measurement sites in the Nishnabotna River basin are shown in figure 9. The curves shown in figure 9 represent the 100-year,

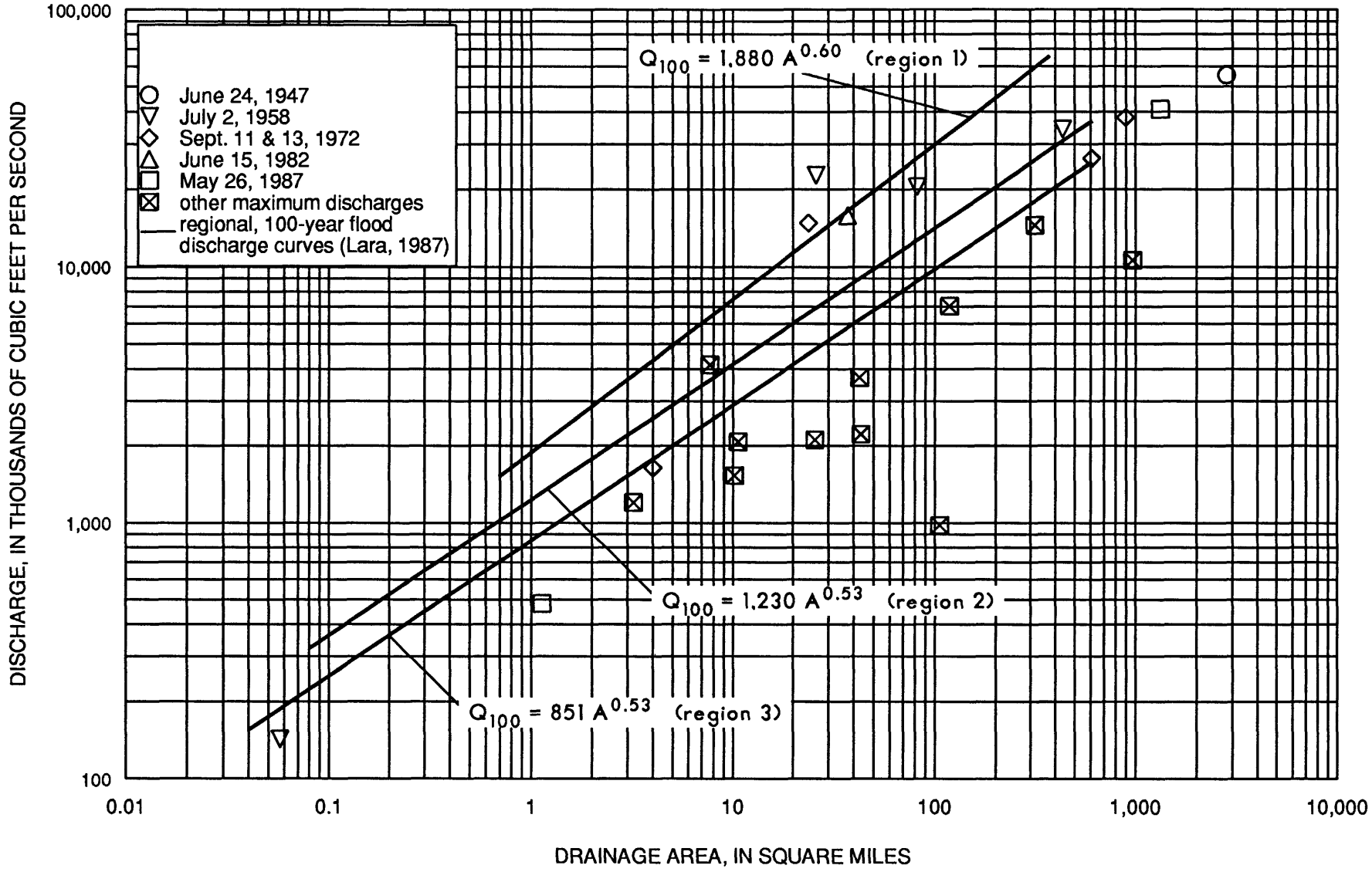

Figure 9.--Relation of maximum discharges and regional, 100-year flood discharges with drainage area for active and discontinued gaging stations, and for miscellaneous measurement sites in the Nishnabotna River basin.

flood-frequency equations developed by Lara for the three hydrologic regions delineated in figure 2. The maximum discharges shown in figure 9 represent the five floods discussed in the "Flood History" section, in addition to other flood events listed in tables 1 and 2.

The Bulletin 17B and regional flood-peak discharges for selected recurrence intervals for the gaging stations in the Nishnabotna River basin are listed in table 4. Lara (1987, p. 13-15) used separately defined flood-peak discharges for the main stem stations on the West and East Nishnabotna Rivers (discharges are based on Bulletin 17B, flood-frequency computations through the 1984 water year).

The Nishnabotna River basin above the Hamburg gaging station (06810000) has parts of its drainage area in three of the hydrologic regions defined by Lara (1987); approximately 12 percent of the drainage area is in region 1, 78.5 percent is in region 2, and 9.5 percent is in region 3 (figs. 1 and 2). Therefore, regional flood-frequency estimates for intra-basin sites in the Nishnabotna River basin may necessitate the use of more than one regional, flood-frequency equation. For stations listed in table 4 with basins situated in more than one hydrologic region, weighted averages were used based on drainage-area ratios, to compute the regional flood-peak discharges.

The relation of Bulletin 17B and region 2, 100-year flood discharges with drainage area for the majority of streams in the Nishnabotna River basin are shown in figure 10. The estimated 100-year flood peaks for the main stems of the West and East Nishnabotna Rivers, defined separately by Lara, also are shown in figure 10. Data in table 4 can be used to plot comparisons of the regional 2-, 5-, 10-, 25- and 50-year flood discharges to those defined using Bulletin 17B, as was done for the 100-year discharges shown in figure 10.

Several Bulletin 17B estimates of 100-year discharges plot significantly above or below the region 2, regression-equation curve for 100-year discharges in figure 10. These variations between Bulletin 17B and region 2 estimates of 100-year discharges probably are because of flood attenuation, length of gaging station record, or differences in basin topography.

FLOOD PROFILES

Elevation profiles for the 1972 and 1987 floods on the West and East Nishnabotna Rivers are shown in figures 11-27 (follow references). The 1972 profiles are for 107 miles on the West Nishnabotna River, 84 miles on the East Nishnabotna River, and 4 miles on the Nishnabotna River. The 1987 profiles are for 47 miles on the lower West Nishnabotna River and 4 miles on the Nishnabotna River. A 9-mile profile of the 1982 flood on Indian Creek is shown in figure 28 (follow references). The profiles were defined by field data obtained by the U.S. Geological Survey. High-water marks located both upstream and downstream from bridges were identified within a few days of passage of the flood peaks and were referenced to a common datum by leveling. Profiles between the bridges are straight-line interpolations, which only provide an approximation of water-surface elevations which occurred between the bridges.

A 1989 low-water profile also is shown in figures 11-27 to indicate the approximate range of stage that can occur within the profiled reaches. The 1989 low-water profile closely parallels a low-water profile made during a slightly larger discharge period on November 1-2, 1978. The 1978 low-water profile, which is not shown in figures 11-27, plots slightly above the 1989 low-water profile throughout most of the profiled reaches.

The June 15, 1982, flood profile for Indian Creek, shown in figure 28, extends from the U.S. Highway 34 bridge downstream to near the mouth. As shown on the profile, floodwaters within the town of Emerson were virtually pooled for about one-half mile along the upstream side of the railroad grade. A low-water profile taken on September 14, 1982, closely approximates the channel bottom configuration and can be used to estimate the depths of the water for the June 15, 1982, flood.

Table 4.--Discharge and frequency of flood flows for active and discontinued gaging stations in the Nishnabotna River basin

[17B, Bulletin 17B (Interagency Advisory Committee on Water Data, 1981); --, insufficient record to compute flood frequency using Bulletin 17B; Lara, flood-frequency equations, regions 1-3 (Lara, 1987, p. 28). For stations with basins situated in more than one hydrologic region, weighted averages were used based on drainage-area ratios. Separately defined flood-frequency discharges were used for the main stem stations on the West and East Nishnabotna Rivers.]

Station number	Station name	Method	Discharge, in cubic feet per second, for indicated recurrence interval, in years					
			2	5	10	25	50	100
06807320	W. Nishnabotna R.	17B	--	--	--	--	--	--
	at Harlan	Lara	4,860	8,640	11,700	15,500	18,300	21,600
06807410	W. Nishnabotna R.	17B	8,950	14,800	18,600	23,400	26,800	30,000
	at Hancock	Lara	9,460	15,500	19,500	24,300	27,700	30,900
06807418	Graybill Creek	17B	--	--	--	--	--	--
	near Carson	Lara	1,740	3,300	4,680	6,480	7,750	9,350
06807470	Indian Creek	[a]17B	783	2,200	3,790	6,790	9,940	14,000
	near Emerson	Lara	1,540	2,940	4,170	5,800	6,940	8,370
06807500	W. Nishnabotna R.	17B	--	--	--	--	--	--
	at White Cloud	Lara	9,410	16,600	22,900	30,500	35,400	42,300
06807720	Middle Silver Cr.	[b]17B	387	679	879	1,130	1,310	1,480
	near Avoca	Lara	381	763	1,080	1,540	1,890	2,280
06807760	Middle Silver Cr.	17B	870	1,260	1,520	1,850	2,090	2,320
	near Oakland	Lara	1,250	2,400	3,400	4,740	5,700	6,870
06807780	Middle Silver Cr.	[b]17B	1,340	1,960	2,380	2,930	3,340	3,760
	at Treynor	Lara	1,780	3,550	5,140	7,050	9,070	11,100
06808000	Mule Creek	[c]17B	762	1,840	2,730	3,980	4,950	5,930
	near Malvern	Lara	912	2,070	3,120	4,380	6,180	7,750
06808200	Spring Valley Cr.	17B	--	--	--	--	--	--
	near Tabor	Lara	745	1,700	2,570	3,640	5,080	6,370
06808500	W. Nishnabotna R.	17B	14,900	25,000	31,500	39,000	44,100	48,800
	at Randolph	Lara	15,900	23,100	27,600	32,700	36,200	39,400

Table 4.--Discharge and frequency of flood flows for active and discontinued gaging stations gaging stations in the Nishnabotna River basin --Continued

Station number	Station name	Method	Discharge, in cubic feet per second, for indicated recurrence interval, in years 2	5	10	25	50	100
06808880	Bluegrass Creek	17B	--	--	--	--	--	--
	at Audubon	Lara	891	1,720	2,430	3,400	4,100	4,950
06809000	Davids Creek	17B	892	2,140	3,400	5,590	7,710	10,300
	near Hamlin	Lara	1,040	1,960	2,680	3,680	4,440	5,300
06809210	E. Nishnabotna R.	17B	8,600	15,400	20,300	26,800	31,800	36,700
	near Atlantic	Lara	8,830	15,200	19,500	25,000	28,900	32,800
06809500	E. Nishnabotna R.	17B	9,400	16,700	21,700	28,000	32,600	37,100
	at Red Oak	Lara	9,590	16,800	21,900	28,500	33,400	38,200
06810000	Nishnabotna River	17B	15,500	23,600	28,600	34,300	38,200	41,800
	above Hamburg	Lara	15,600	23,500	28,200	33,700	37,400	40,800

[a]Flood frequency computed with 70% of annual peak discharges above base, Bulletin 17B recommends the use of 75% of annual peak discharges above base.

[b]Flood frequency computed using annual peak discharges through the 1986 water year.

[c]Flood frequency computed using 1954-69 period of record. Basin became partially regulated by construction of 24 impoundment dams during 1954-56.

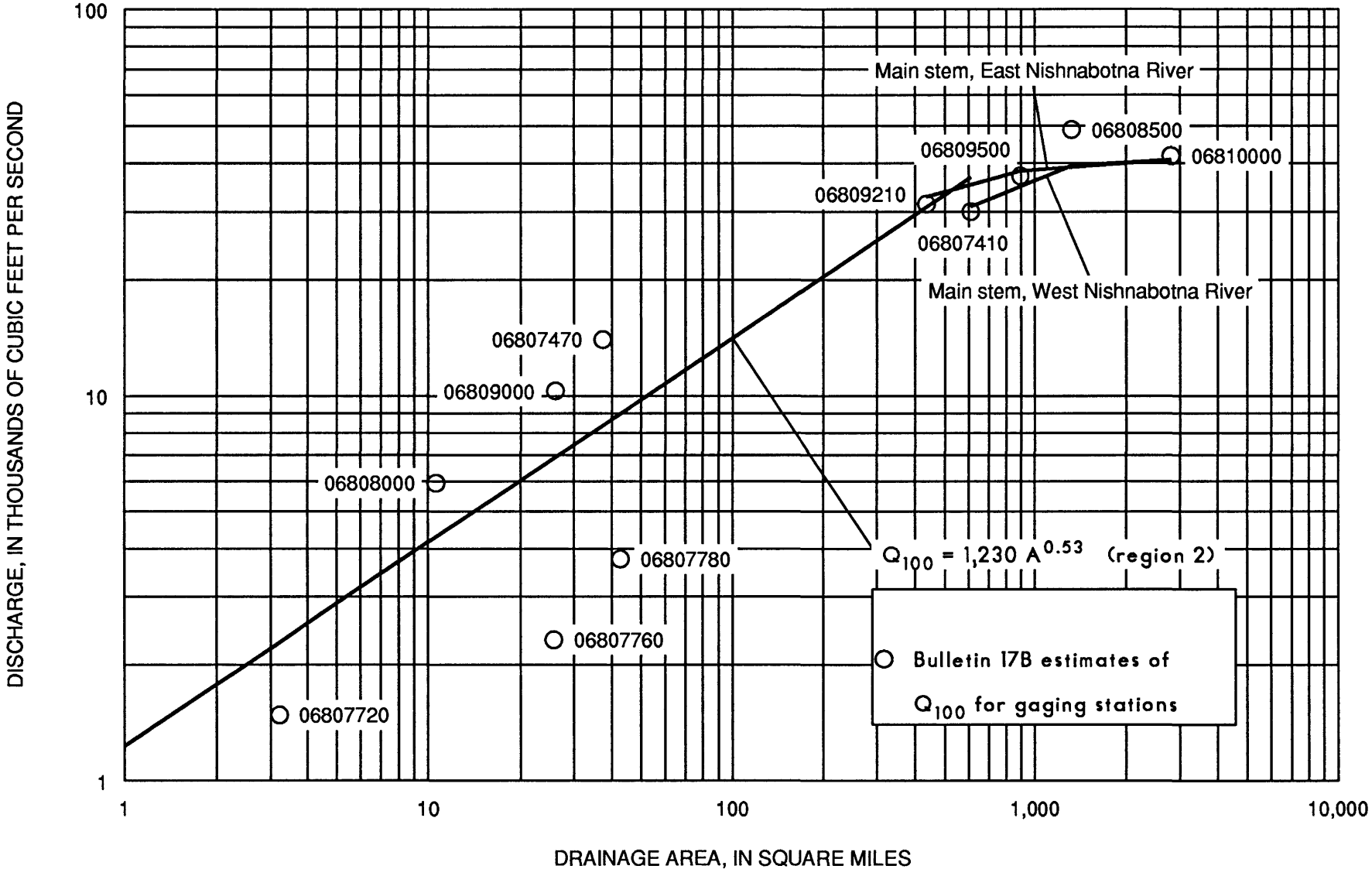

Figure 10.--Relation of Bulletin 17B and region 2, 100-year flood discharges with drainage area for streams in the Nishnabotna River basin (Lara, 1987).

Bridge deck and low-bridge chord elevations are shown in figures 11-28 to indicate the relation between the elevation of the bridges and the elevations of the profiled floods and the low-water profiles. For sloping bridges, the profiled bridge deck and low-bridge chord elevations represent the lower ends of the bridges. Selected gaging-station discharges and recurrence intervals for the floods profiled in figures 11-28 are listed in table 1.

In order to reference all the points along the profiles to a common datum, extensive leveling work was performed. At least one bench mark and one reference point were established at each bridge in the profiled reaches. Bench mark and reference point descriptions and elevations are listed in table 5 (at end of report).

River mileages, determined from the best available Geological Survey maps, are referenced to the mouth of the Nishnabotna River. Bridges, and a few other points, are designated by an index number that helps to identify their location. For example, 7241-24NW refers to a location in township 72 north, range 41 west, northwest 1/4 section 24.

DISCUSSION

The user of this report is cautioned that the stage-discharge data presented herein are representative of the physical conditions of the basin at the time of the flood events shown. Changes in the basin can alter the flood magnitude for a given frequency. Examples of these changes include, but are not limited to, extensive urbanization, implementation of agricultural conservation practices, installation of drainage systems, and construction of reservoirs. Changes in the channel conditions immediately downstream from a site can materially affect the stage-discharge relation. Examples of such changes include the construction of dams, bridges, or levees; changes in the flood-plain 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.

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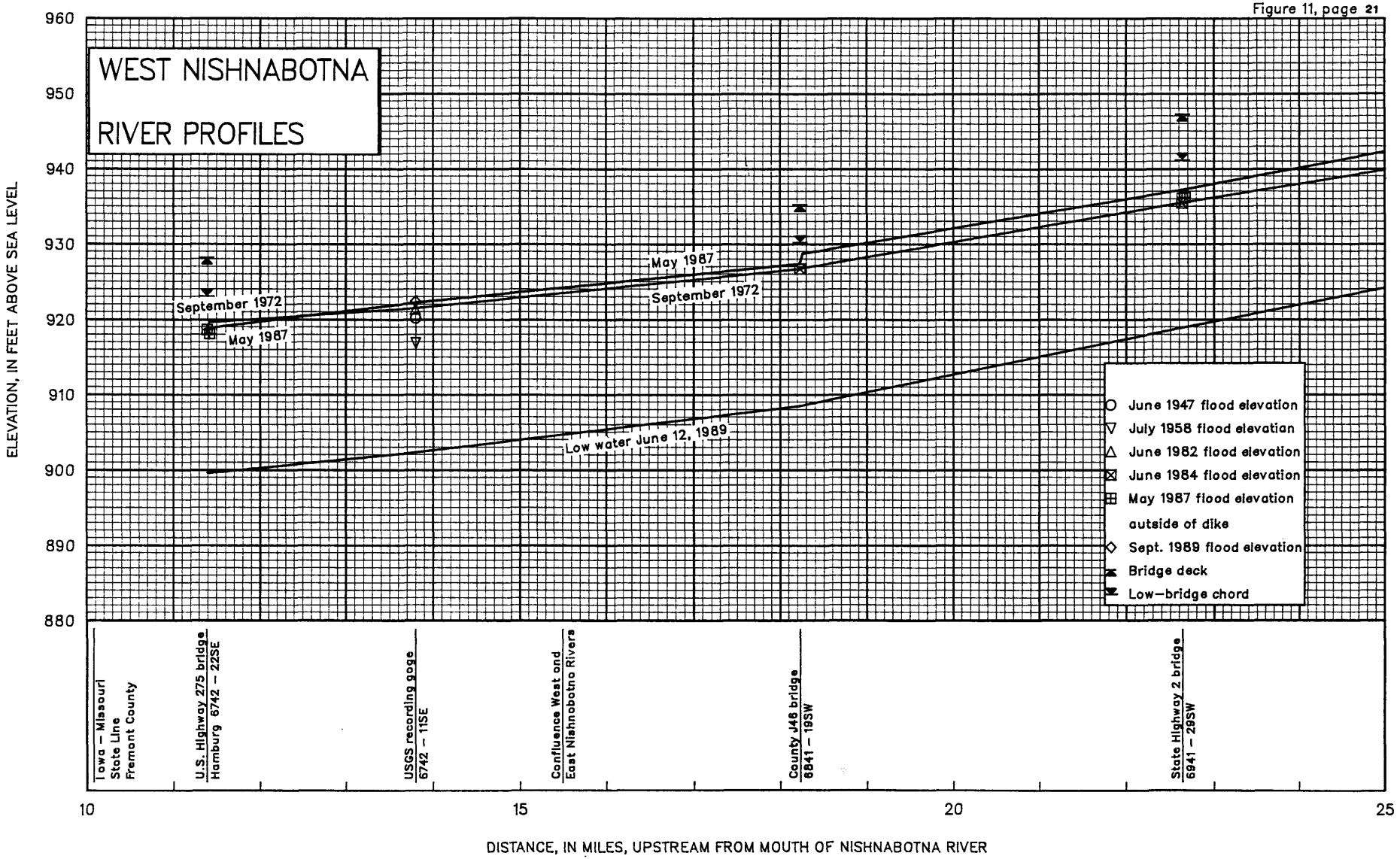


Figure 11.—Profiles of West Nishnabotna River.

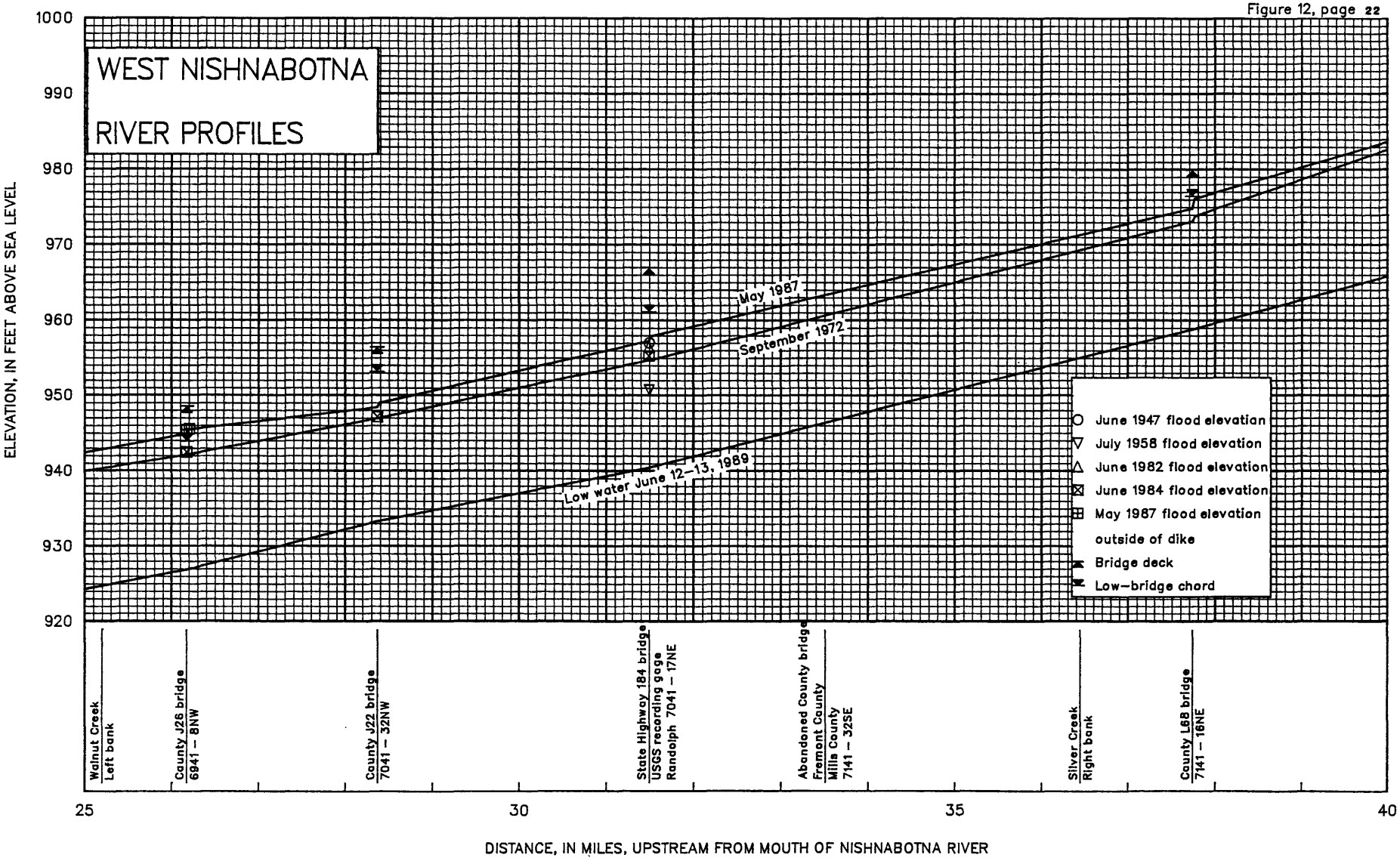


Figure 12.—Profiles of West Nishnabotna River.

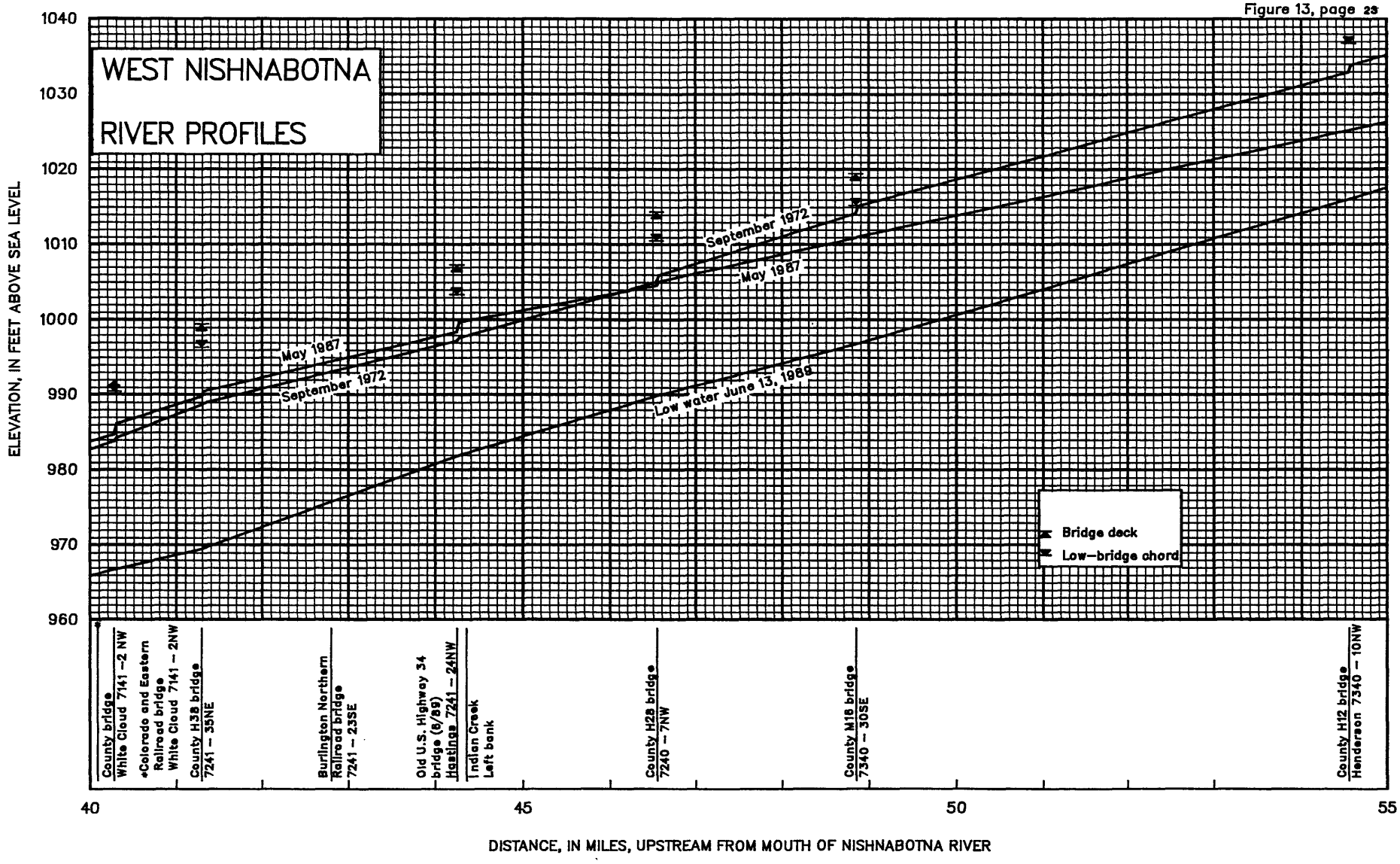


Figure 13.—Profiles of West Nishnabotna River.

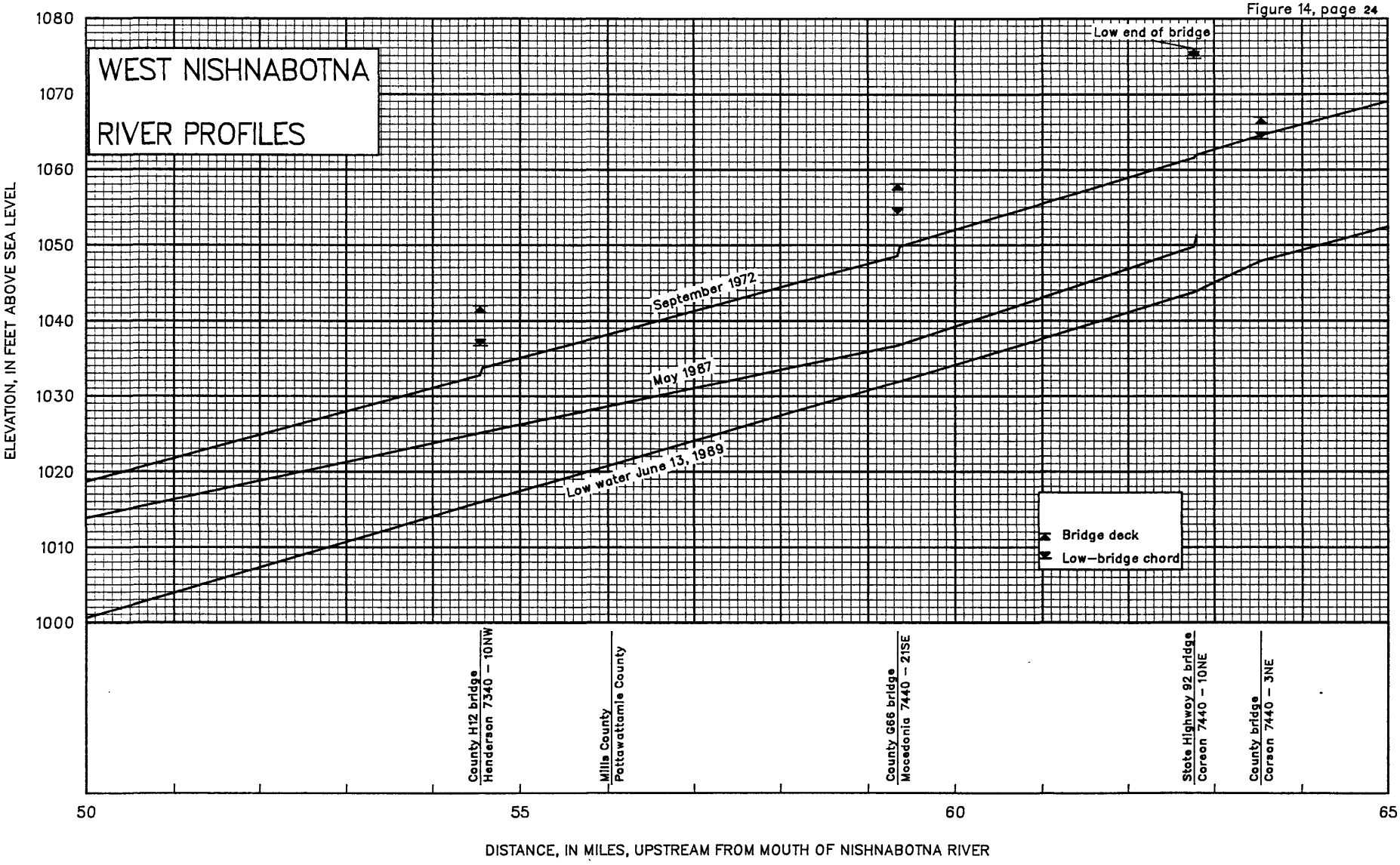


Figure 14.—Profiles of West Nishnabotna River.

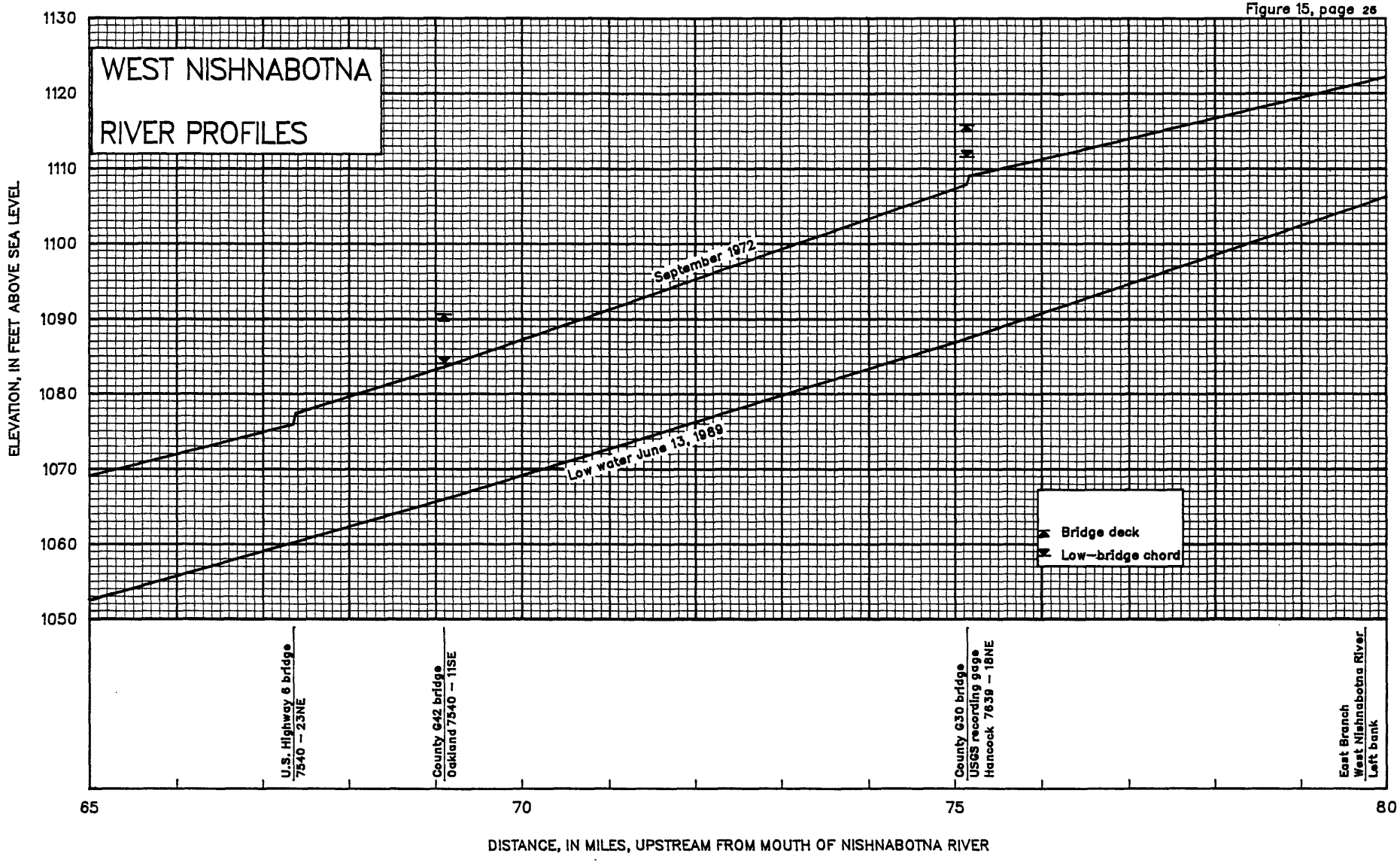


Figure 15.—Profiles of West Nishnabotna River.

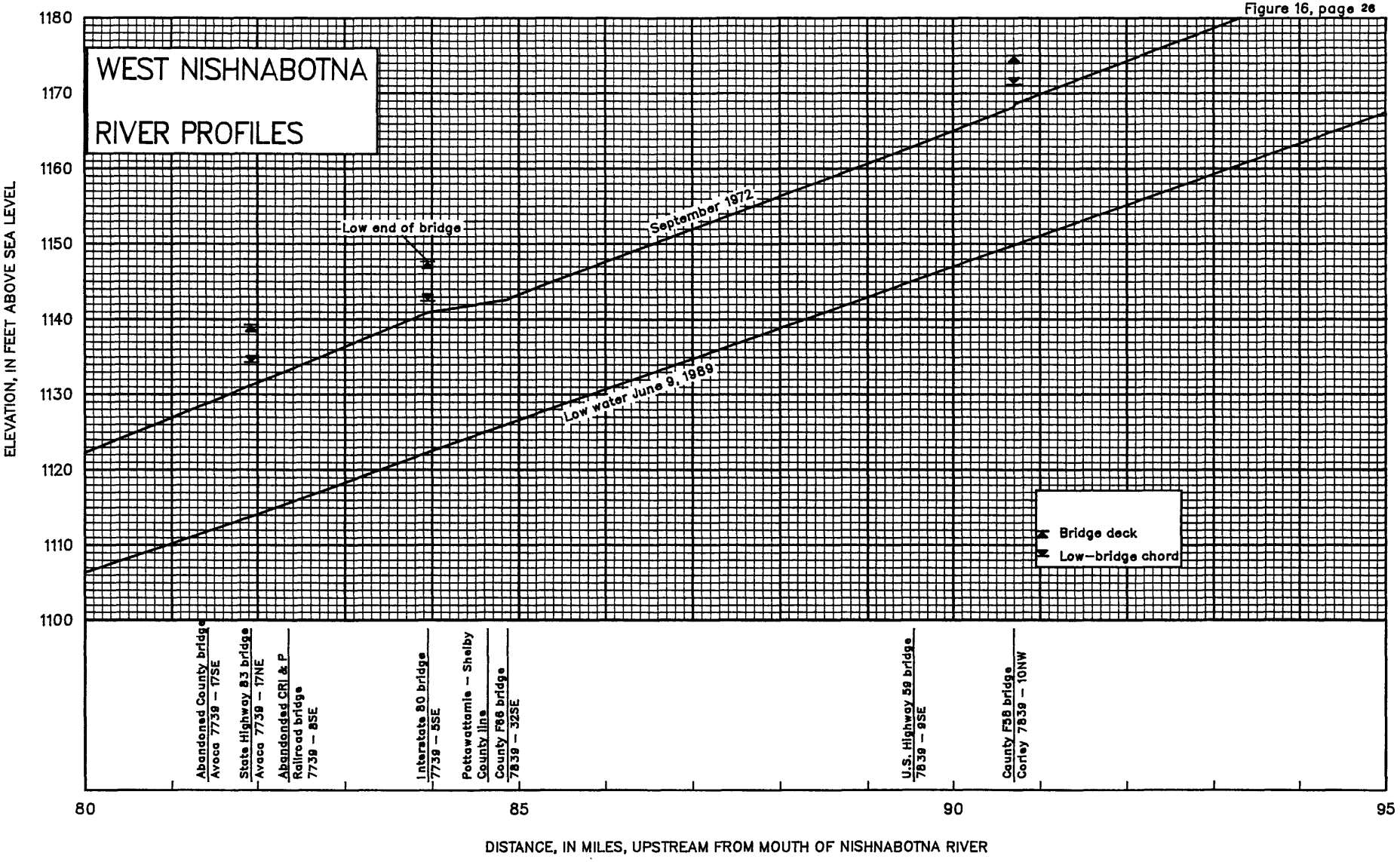


Figure 16.—Profiles of West Nishnabotna River.

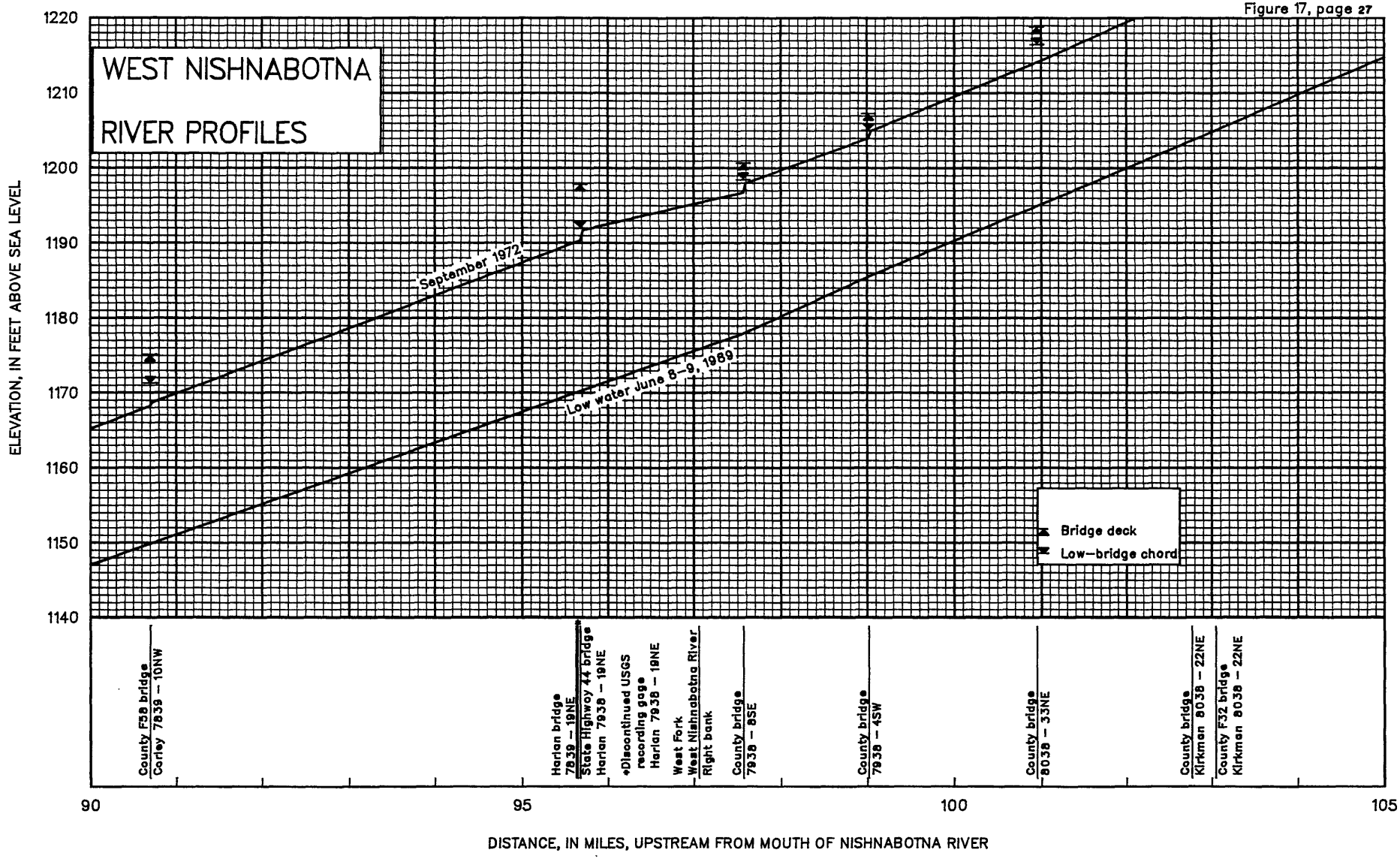


Figure 17.—Profiles of West Nishnabotna River.

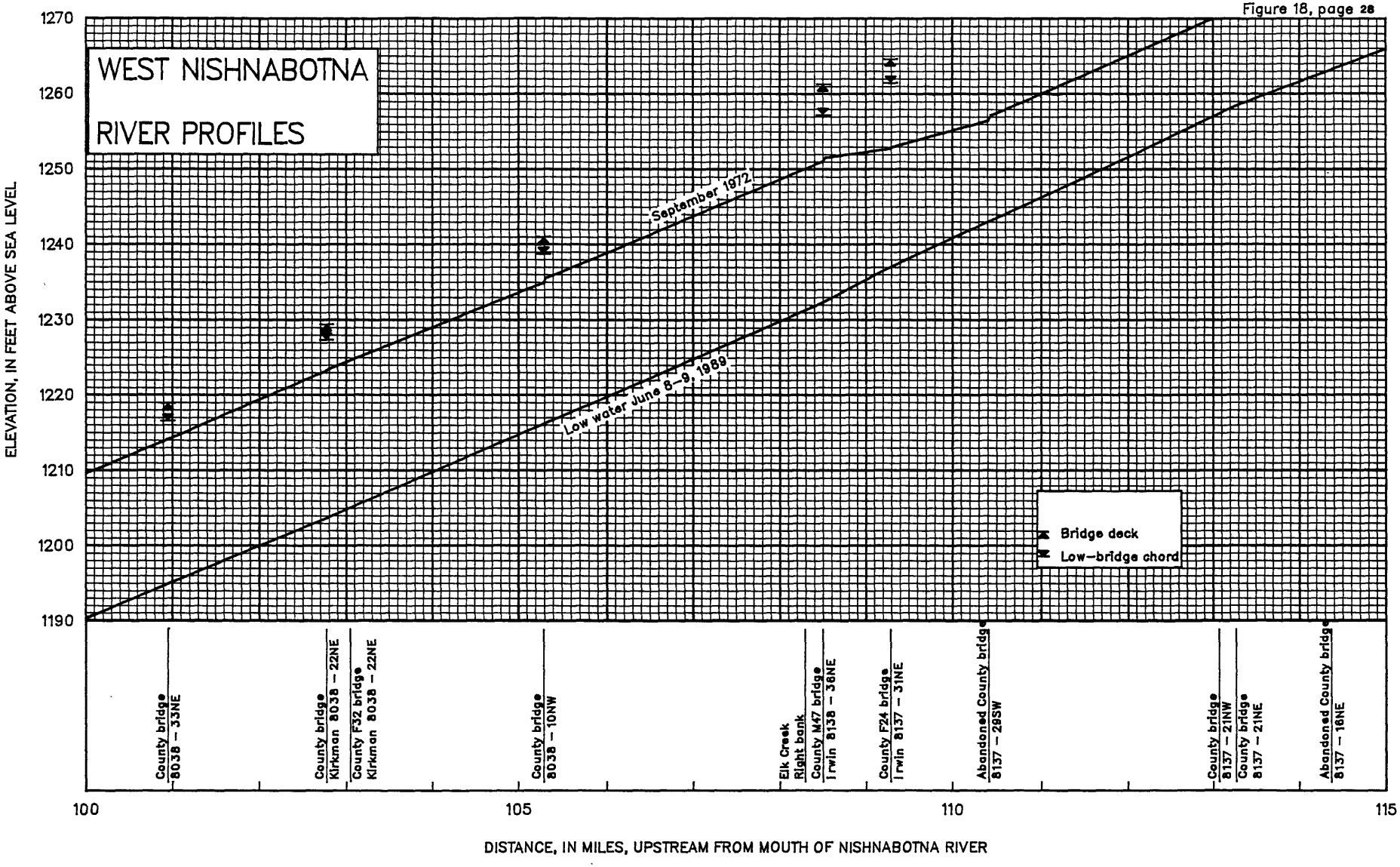


Figure 18.—Profiles of West Nishnabotna River.

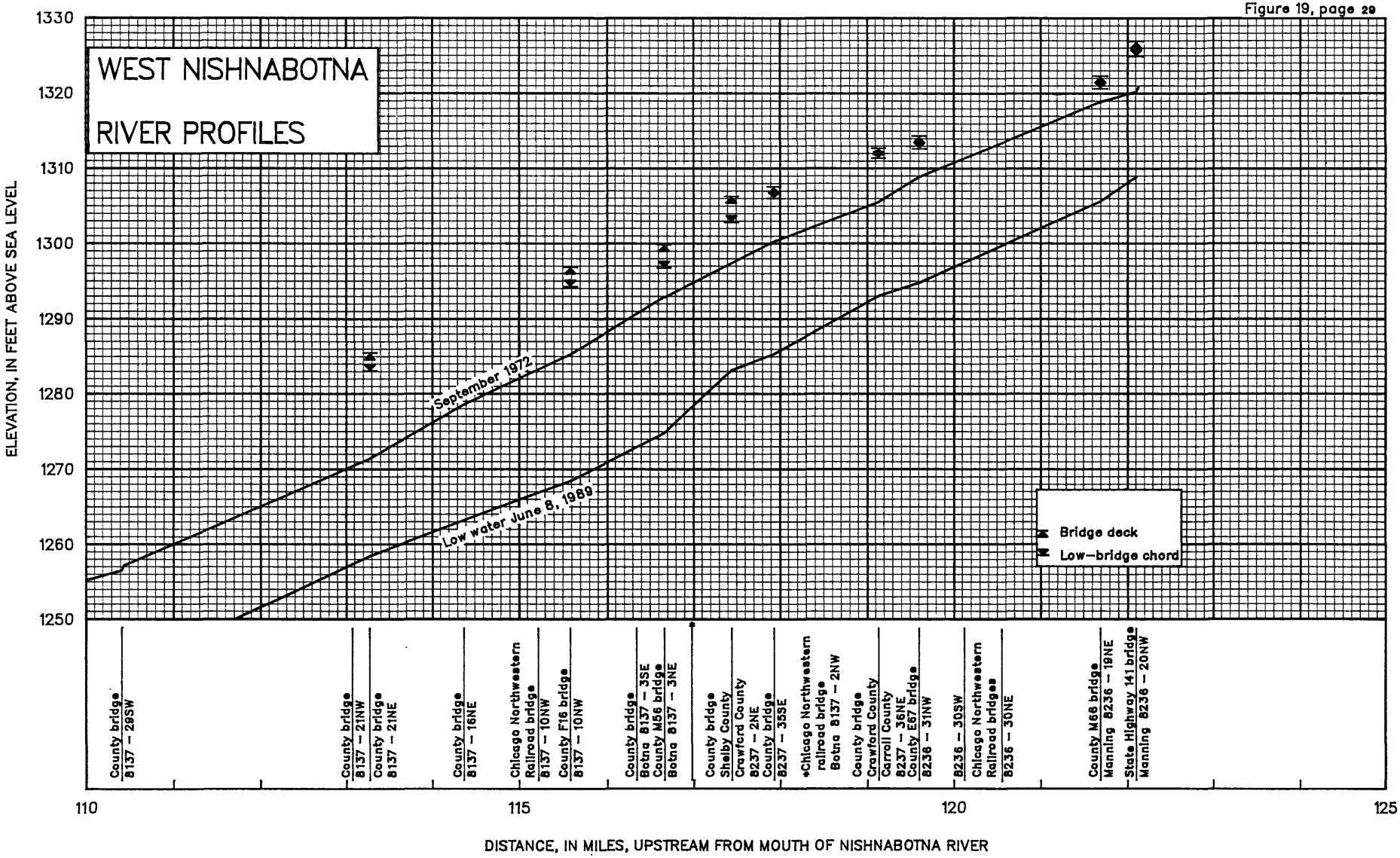


Figure 19.—Profiles of West Nishnabotna River.

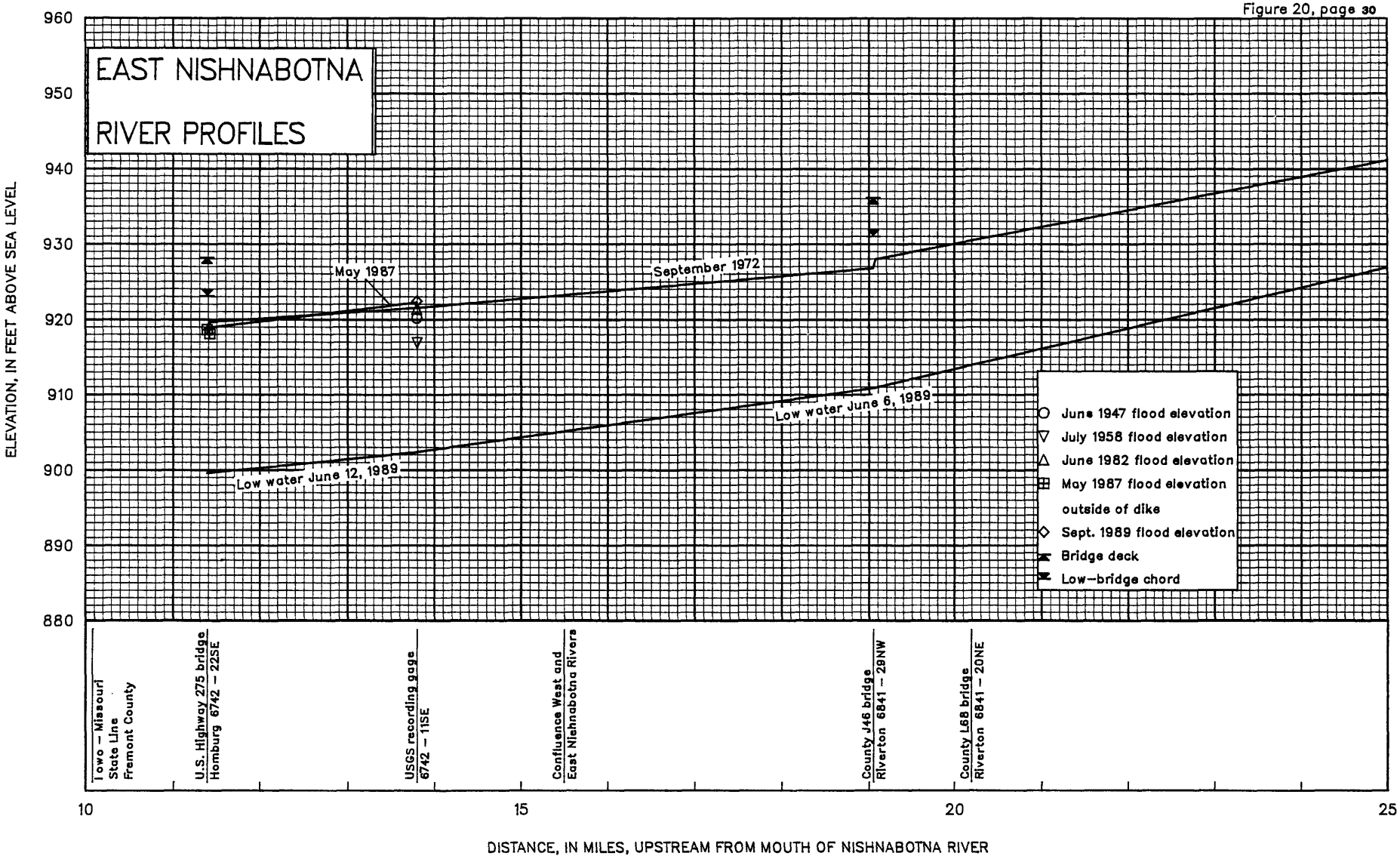


Figure 20.---Profiles of East Nishnabotna River.

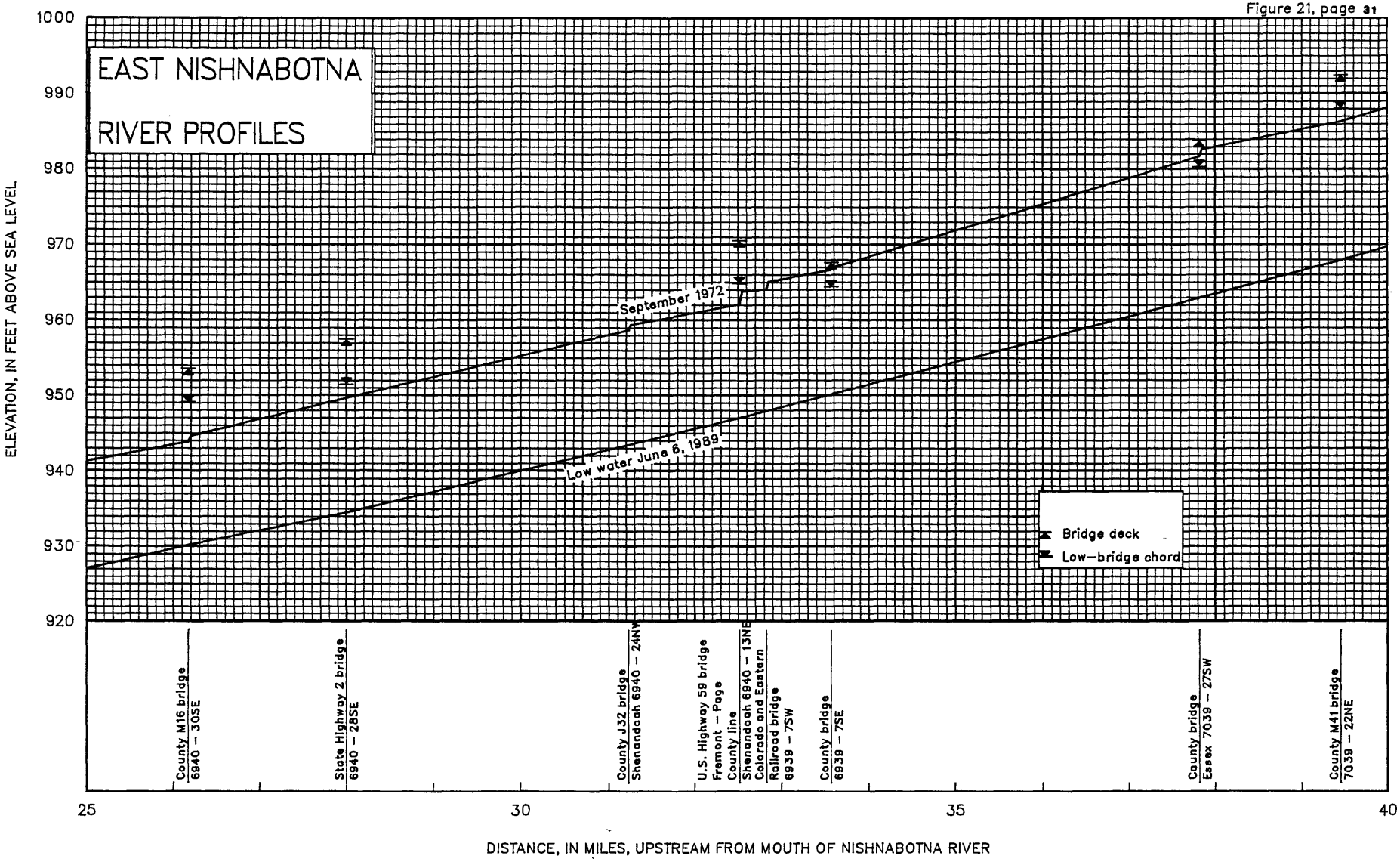
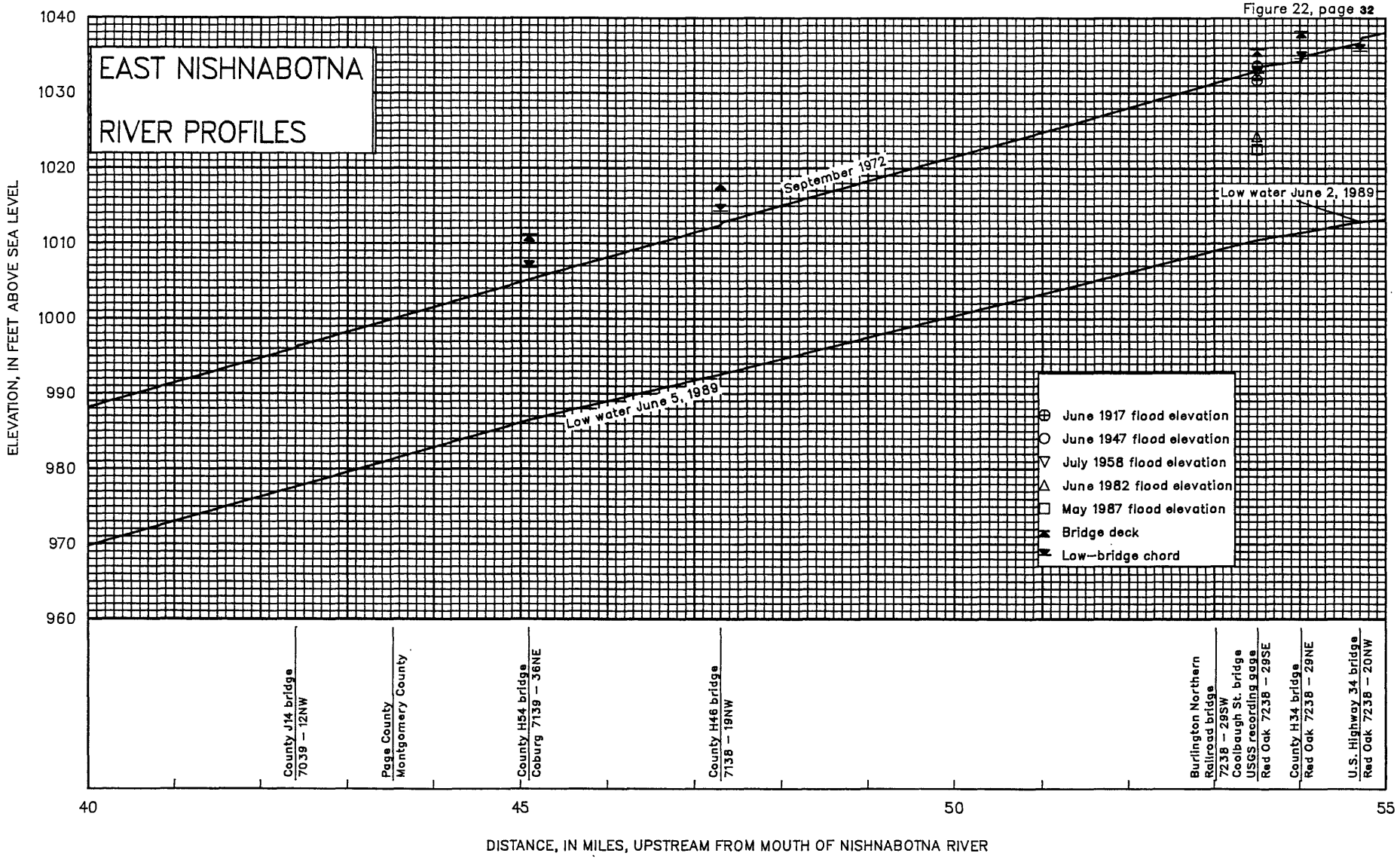


Figure 21.—Profiles of East Nishnabotna River.



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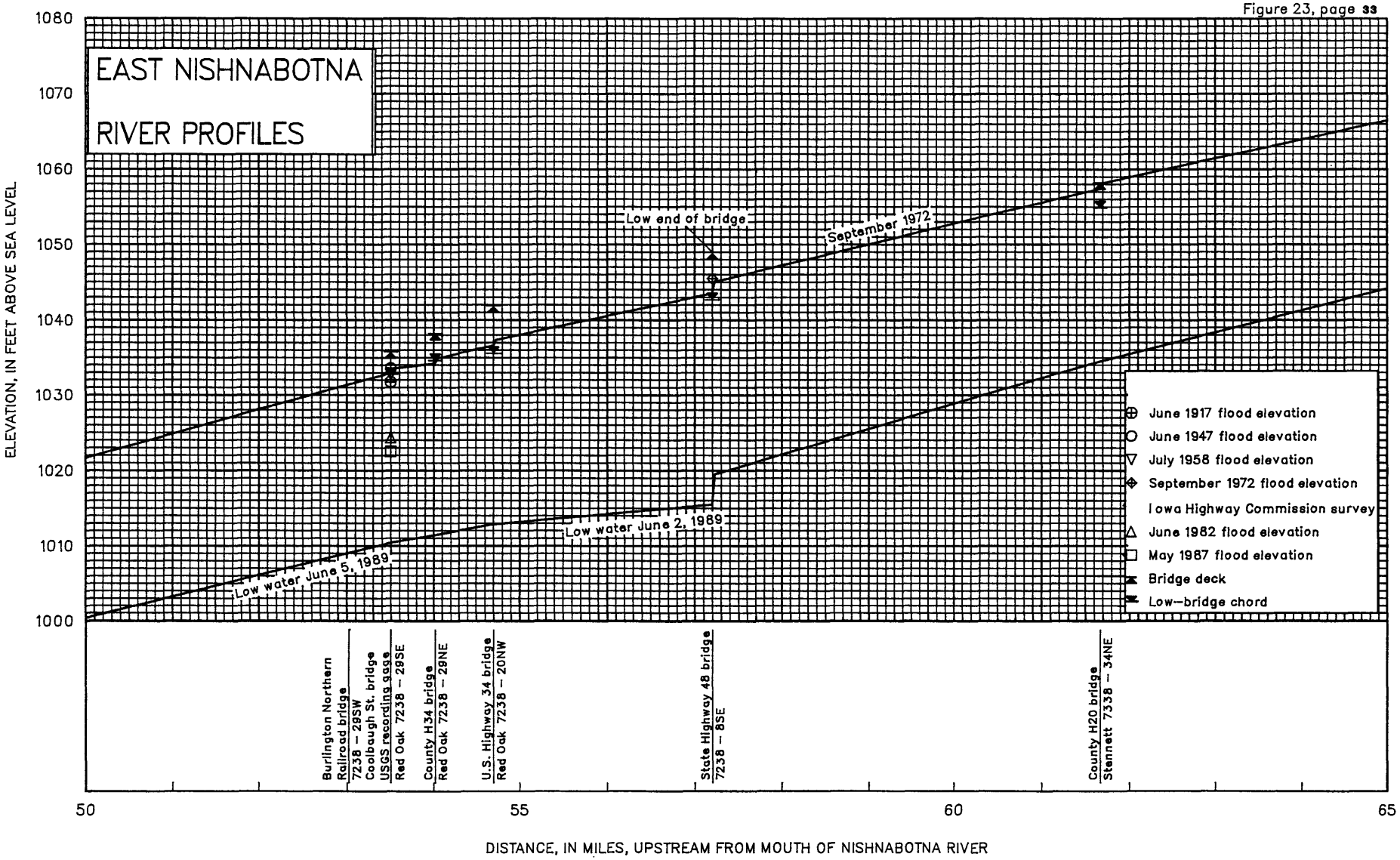

Figure 23.—Profiles of East Nishnabotna River.

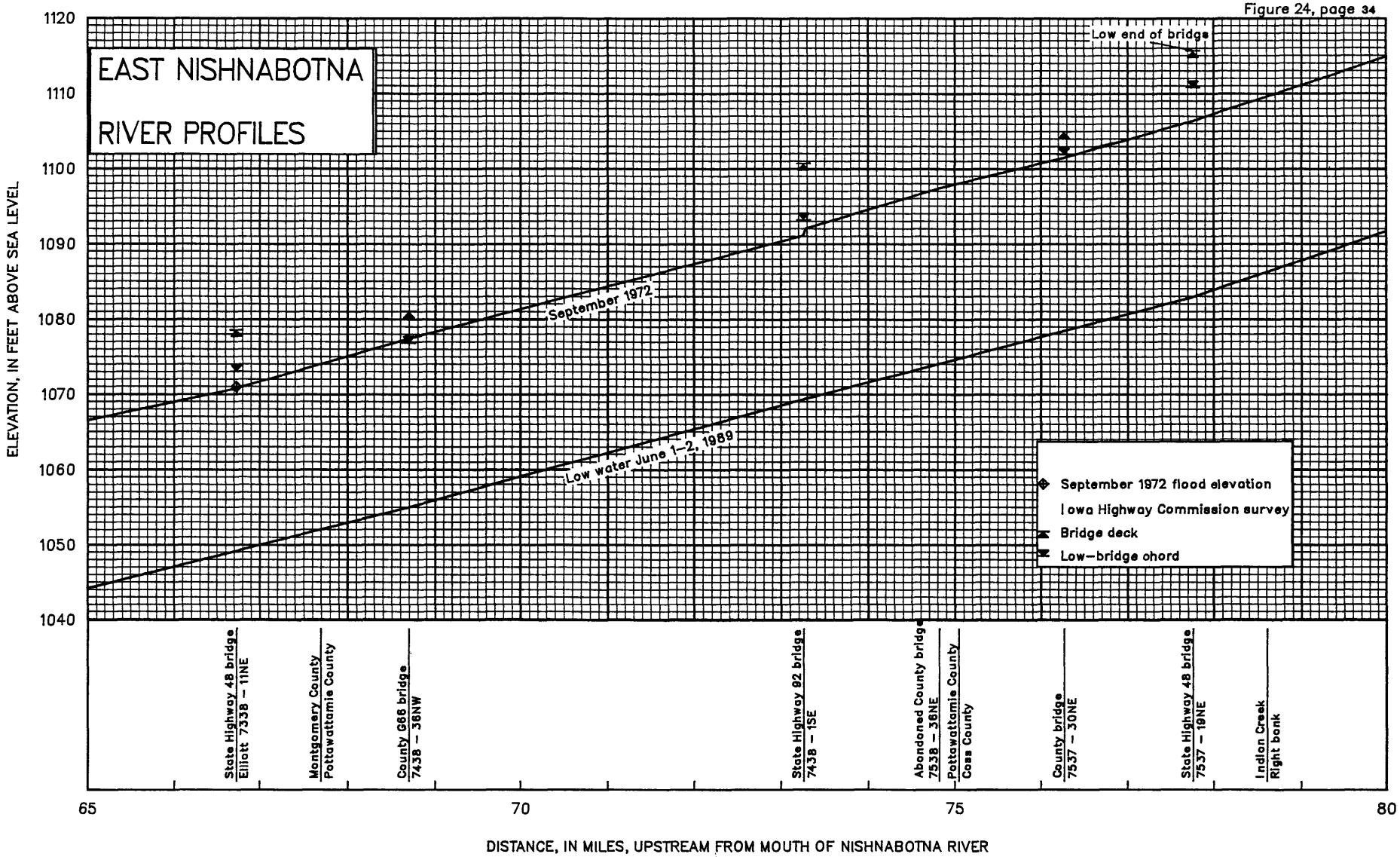

Figure 24.—Profiles of East Nishnabotna River.

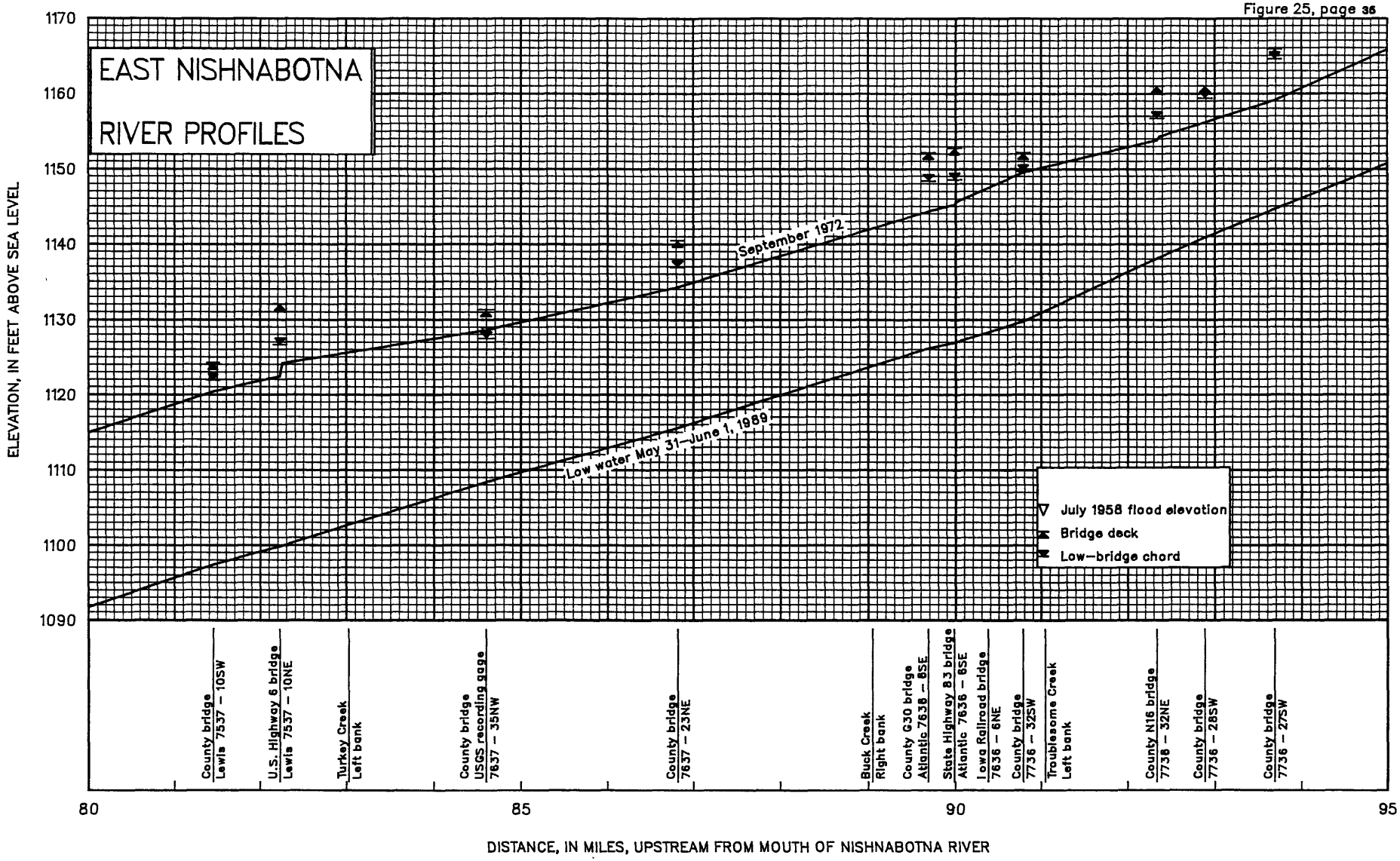

Figure 25.—Profiles of East Nishnabotna River.

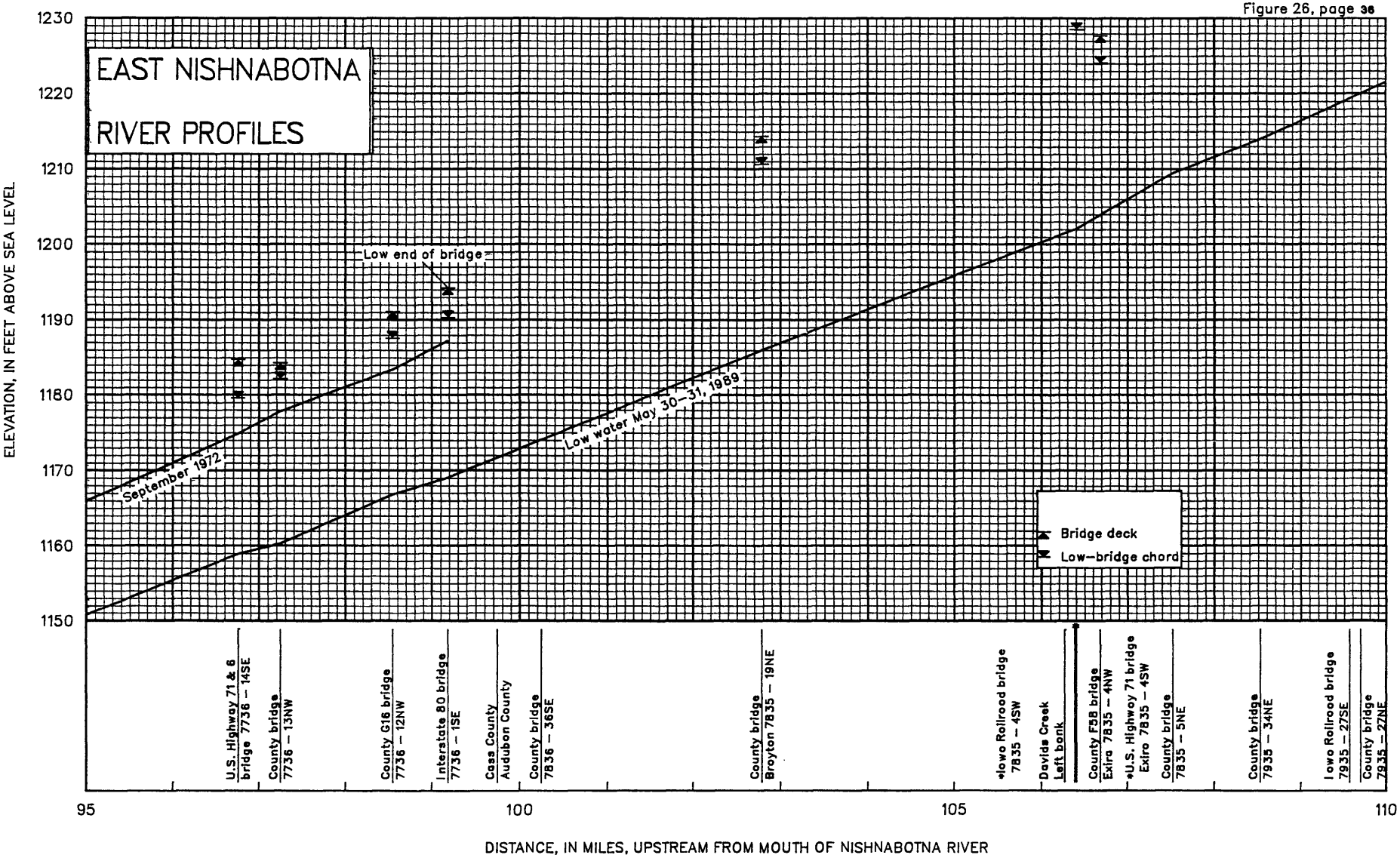

Figure 26.—Profiles of East Nishnabotna River.

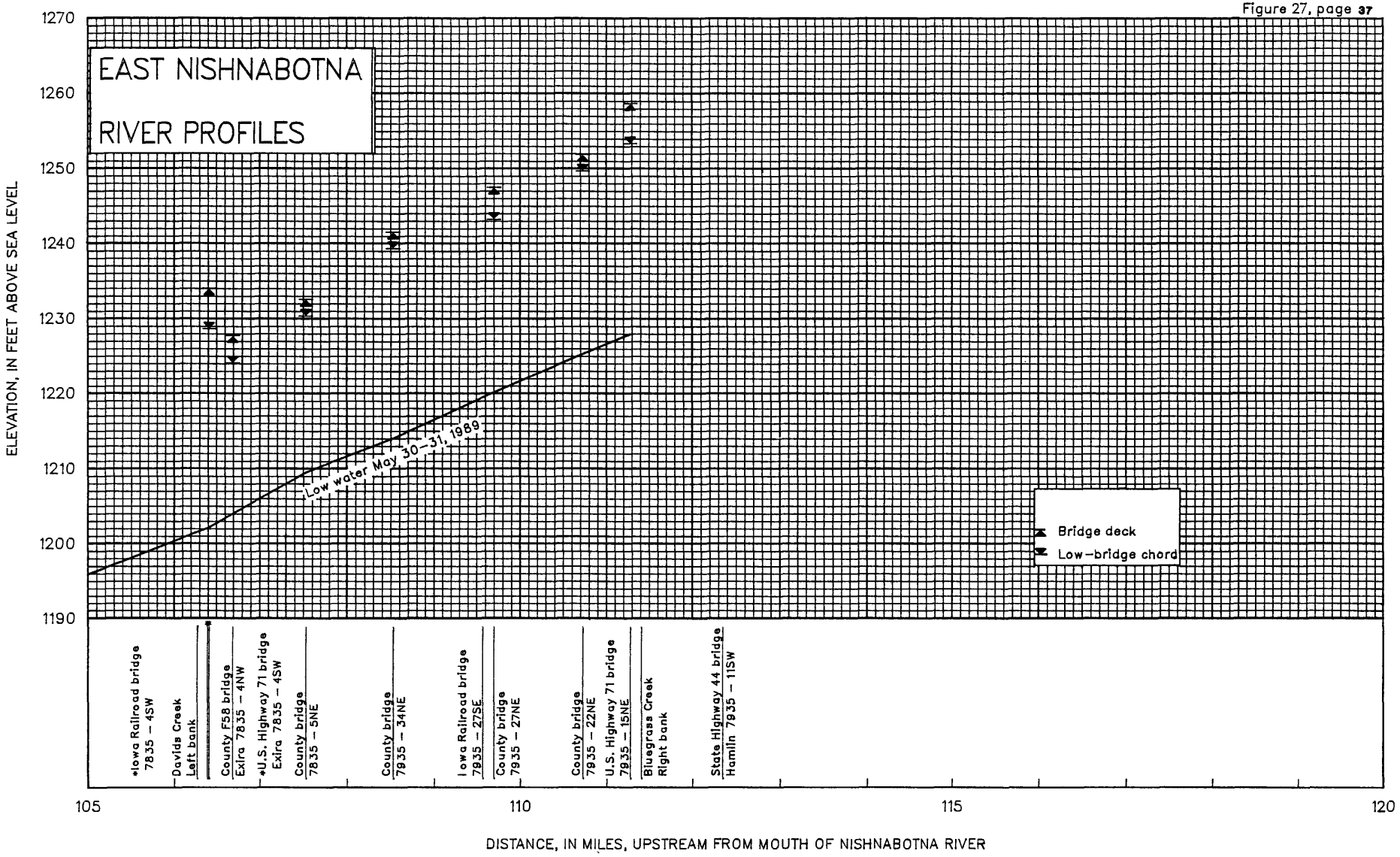

Figure 27.—Profiles of East Nishnabotna River.

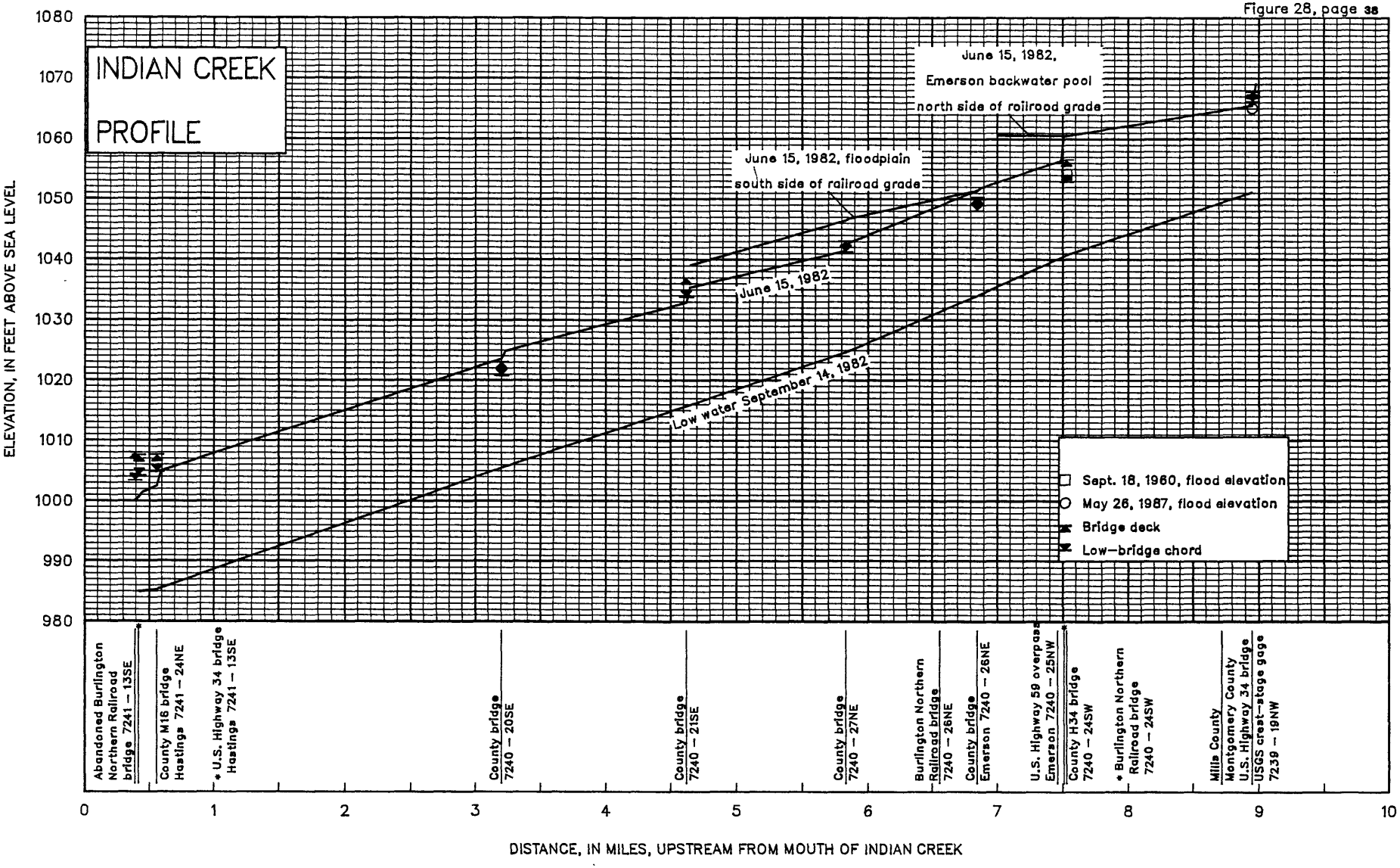

Figure 28.—Profile of Indian Creek.

Table 3.--Peak stages and discharges for gaging stations,

Nishnabotna River basin, Iowa

The peak stage and discharge data for this report were compiled through September 30, 1988, for the 16 active and discontinued gaging stations located in the Nishnabotna River basin. The flood events, designated by calendar date, are in chronological order and grouped by water year (year ending September 30). In general, independent flood peaks above a pre-selected base (partial-duration series) are listed for the continuous record-gaging stations. The magnitude of the selected base discharge, given in the "Remarks" section of the headnote, was determined so that it would be equaled or exceeded on an average of about three times per year. Two flood peaks are considered independent if a plot of the recorded stages indicates a well-defined trough between the peaks, and if the instantaneous discharge of the trough is 25 percent or more below that of the lower peak (Novak, 1985, p. 93). Only the annual flood peaks are listed for the crest-stage gaging stations.

The gaging-station records are arranged in downstream order as explained in the annual streamflow reports of the U.S. Gelogical Survey (see references). Each gaging station is identified by a permanent number that is also used in figure 1 and in tables 1 and 4. The datum of the gage, when given, is sea level, formerly called Sea Level Datum of 1929. Flood stage, as determined by the National Weather Service, is the stage at which overflow of the natural banks of the stream begins to cause damage in the reach in which the elevation is measured.

The following notations are used in the gaging station records:

1. A line in the "water year" column denotes a break or gap in the record of peaks.
2. A line beginning at the "date" column and continuing through the "discharge" column indicates a change in site and datum.
3. A line in the "date" and "discharge" columns indicates a change in site without a change in datum.
4. A line in the "gage height" column denotes a change in datum only.

The remainder of the information given is self-explanatory.

06807320 West Nishnabotna River at Harlan, Iowa
(Discontinued September 30, 1982)

Location.--Lat 41°38'41", long 95°18'50", in NW1/4 NE1/4 sec.19, T.79 N., R. 38 W, Shelby County, Hydrologic Unit 10240002, in southeast part of City of Harlan, in city owned brick pumphouse on right bank, 50 ft landward of levee, 250 ft downstream from State Highway 44, 1.4 mi downstream from mouth of West Fork, 80.1 mi upstream from confluence with East Nishnabotna River, and 95.6 mi upstream from mouth of Nishnabotna River.

Drainage area.--316 mi^2.

Gage.--Water-stage recorder. Datum of gage is 1,162.89 ft above sea level.

Stage-discharge relation.--Defined by current-meter measurements.

Flood stage.--Not determined.

Remarks.--Base for partial-duration series 1,500 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1978	Nov. 9, 1977	10.47	3,340
	Mar. 21, 1978	18.88	7,790
	May 29, 1978	12.00	2,130
	Sept.13, 1978	26.18	14,500
1979	Mar. 18, 1979	24.03	12,200
	Mar. 23, 1979	14.72	4,040
	Mar. 30, 1979	11.74	2,090
	June 19, 1979	14.66	4,000
	July 30, 1979	16.59 a	5,520
	Sept. 6, 1979	10.60	1,500
1980	June 6, 1980	17.02	5,870
	June 15, 1980	13.46	3,150
1981	Aug. 2, 1981	11.69	2,060
1982	Feb. 20, 1982	20.32	8,490
	Mar. 19, 1982	18.90	7,210
	Aug. 30, 1982	10.81	1,600

Discontinued September 30, 1982

a From high water mark.

06807410 West Nishnabotna River at Hancock, Iowa

Location.--Lat 41°23'24", long 95°22'17", in NW1/4 NE1/4 sec.18, T.76N, R.39 W., Pottawattamie County, Hydrologic Unit 10240002 on right bank at upstream side of bridge on county road G30, 0.6 mi west of Hancock school, 3.0 mi downstream from Jim Creek, 59.6 mi upstream from confluence with East Nishnabotna River, and 75.1 mi upstream from mouth of Nishnabotna River.

Drainage area.--609 mi^2.

Gage.--Water-stage encoder. Datum of gage is 1,085.83 ft above sea level. Prior to Sept. 15, 1980, on downstream end of right pier at same datum.

Stage-discharge relation.--Defined by current-meter measurements.

Flood stage.--8 feet.

Remarks.--Base for partial-duration series, 4,000 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1960	Mar. 29, 1960	13.64	9,320
	May 6, 1960	12.57	8,120
	Aug. 7, 1960	9.70	4,800
1961	Mar. 14, 1961	10.31	5,430
	June 27, 1961	10.01	4,460
	July 28, 1961	9.69	4,160
1962	Mar. 22, 1962	10.90	6,680
	May 21, 1962	12.10	7,420
	May 26, 1962	11.58	6,800
	May 29, 1962	13.50	9,240
	June 10, 1962	11.18	6,200
1963	Mar. 11, 1963	9.75	4,860
	Mar. 14, 1963	8.98	4,100
1964	Apr. 2, 1964	9.20	4,010
	May 8, 1964	9.55	5,320
	May 26, 1964	14.50	10,500
	June 22, 1964	10.92	6,090
	July 3, 1964	10.10	5,210
	July 7, 1964	9.65	4,700
	July 11, 1964	12.34	7,760

06807410 West Nishnabotna River at Hancock, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1965	Mar. 1, 1965	20.44 a	18,000 b
	Mar. 17, 1965	15.39	12,000
	Mar. 31, 1965	13.94	13,100
	Apr. 5, 1965	10.91	8,070
	May 26, 1965	11.49	8,940
	Sept. 28, 1965	8.85	5,160
1966	June 12, 1966	9.07	4,170
1967	June 7, 1967	11.05	6,260
	June 12, 1967	9.09	4,830
	June 16, 1967	14.16	10,900
	June 19, 1967	8.88	4,620
	June 24, 1967	8.71	4,450
	June 28, 1967	8.58	4,320
1968	June 25, 1968	6.41	2,380
1969	Mar. 18, 1969	15.02	12,600
	Mar. 24, 1969	9.98	5,040
	July 9, 1969	11.38	6,830
1970	Mar. 2, 1970	9.56	4,580
	May 13, 1970	9.89	4,930
1971	Feb. 19, 1971	18.56	17,700
	Mar. 14, 1971	10.98	6,730
	June 6, 1971	10.28	5,610
1972	Feb. 29, 1972	8.81	4,210
	Sept. 13, 1972	22.12	26,400
1973	Dec. 30, 1972	9.47	5,070
	Jan. 17, 1973	11.86	7,270
	Feb. 24, 1973	8.63	4,120
	Mar. 1, 1973	9.43	4,920
	May 7, 1973	12.07	7,800
	July 4, 1973	11.90	7,780
	Sept. 26, 1973	16.54	14,300
1974	Oct. 11, 1973	9.13	4,730
	May 16, 1974	9.10	4,700
	May 19, 1974	12.81	8,950

06807410 West Nishnabotna River at Hancock, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1975	Apr. 28, 1975	14.13	10,700
	June 23, 1975	10.42	6,110
	June 25, 1975	10.85	6,580
	Aug. 29, 1975	10.47	6,170
1976	June 13, 1976	12.70	8,810
1977	Sept. 1, 1977	4.70	1,110
1978	Mar. 21, 1978	13.82	10,500
	Apr. 8, 1978	8.57	4,330
	Sept.13, 1978	17.85	16,800
1979	Mar. 13, 1979	10.44	6,130
	Mar. 18, 1979	19.54	18,300
	Mar. 23, 1979	9.45	5,000
	July 30, 1979	10.73	6,210
1980	June 6, 1980	11.22	6,630
	June 15, 1980	14.01	9,880
1981	May 4, 1981	6.75	2,510
1982	Feb. 21, 1982	15.84	13,900
	Mar. 19, 1982	13.94	11,200
1983	Feb. 20, 1983	11.70	8,310
1984	Apr. 30, 1984	10.55	6,840
	June 13, 1984	9.57	5,170
	June 15, 1984	14.52	12,000
	June 16, 1984	13.28	10,300
1985	Dec. 16, 1984	8.62	4,700
	Dec. 28, 1984	9.48	5,610
	Feb. 21, 1985	14.49 a)	c
1986	Feb. 26, 1986	12.37	9,100
	Mar. 18, 1986	11.55	8,020
	May 10, 1986	15.19	13,000
	June 14, 1986	12.15	8,800
	July 9, 1986	8.11	4,140
	July 10, 1986	8.26	4,290
	July 14, 1986	8.83	4,910

06807410 West Nishnabotna River at Hancock, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1987	Oct. 11, 1986	12.39	7,510
	Aug. 26, 1987	9.97	4,870
1988	Jan. 30, 1988	10.63 a	c
	June 8, 1988	7.45	2,730

a Affected by ice. b About.
c Discharge not determined.

06807418 Graybill Creek near Carson, Iowa

Location.--Lat 41°13'57", long 95°22'51", in NW1/4 sec. 7, T.74 N., R.39 W., Pottawattamie County, at bridge on State Highway 92, 2 mi east of Carson.

Drainage area.--45.9 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Undefined due to channel degradation.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1966	June 26, 1966	81.00	b
1967	June 21, 1967	77.84	b
1968	--	a	b
1969	--	77.18	b
1970	May 18, 1970	75.40	b
1971	--	a	b
1972	--	a	b
1973	Jan. 17, 1973	75.44	b
1974	--	a	b
1975	--	a	b
1976	--	a	b
1977	--	a	b
1978	--	a	b
1979	--	a	b
1980	--	a	b
1981	--	a	b
1982	--	a	b

06807418 Graybill Creek near Carson, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1983	--	a	b
1984	--	a	b
1985	--	a	b
1986	--	a	b
1987	Aug. 8, 1987	76.12	b
1988	--	a	b

a Peak stage did not reach bottom of gage.
b Discharge not determined.

06807470 Indian Creek near Emerson, Iowa

Location.--Lat 41°01'50", long 95°22'51", in NW1/4 sec. 19, T.72 N., R.39 W., Montgomery County, at bridge on U.S. Highway 34, 1 mi east of Emerson.

Drainage area.--37.3 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Defined by current-meter measurements and an indirect measurement.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1966	June 25, 1966	87.12	630
1967	June 21, 1967	91.16	4,950
1968	--	a	<500
1969	--	a	<500
1970	Aug. 3, 1970	85.88	520
1971	--	a	<500
1972	Sept.12, 1972	87.17	630
1973	Jan. 17, 1973	87.39	660
1974	May 30, 1974	85.78	510
1975	Aug. 25, 1975	87.36	660
1976	June 14, 1976	89.52	2,000
1977	Aug. 31, 1977	88.29	820
1978	--	a	<500
1979	Mar. 18, 1979	89.35	1,600
1980	June 4, 1980	88.78	1,000
1981	--	a	<500
1982	June 15, 1982	92.63	15,800 b

06807470 Indian Creek near Emerson, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1983	--	a	<500
1984	June 15, 1984	87.87	1,310
1985	--	a	594 c
1986	April 4, 1986	86.73	1,080
1987	May 26, 1987	91.78	9,600
1988	--	a	<500 c

a Peak stage did not reach bottom of gage.
b Discharge computed from an indirect measurement.
c Reconstructed discharge based on regional analysis of streamflow and rainfall data.
< Less than.

06807500 West Nishnabotna River at White Cloud, Iowa
(Discontinued June 21, 1924)

Location.--Lat 40°57′, long 95°34′, in sec.2, T.71 N., R.41 W, Mills County, at highway bridge, 3 miles above mouth of Silver Creek, near Chicago, Burlington & Quincy Railroad and Wabash Railway crossing at White Cloud, and 4 miles southeast of Malvern.

Drainage area.--967 mi^2.

Gage.--Chain gage read twice daily.

Stage-discharge relation.--Defined by current meter measurements.

Flood stage.--Not determined.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1919	Oct. 28, 1918	--	7,500
1920	Apr. 19, 1920	18.00	9,130
1921	Sept.20, 1921	17.61	8,710
1922	July 30, 1922	19.4	10,600
1923	Aug. 11, 1923	17.6	8,710
1924	June 8, 1924	17.0	8,080

Discontinued June 21, 1924

06807720 Middle Silver Creek near Avoca, Iowa

Location.--Lat 41°28'33", long 95°28'06", near N1/4 corner sec.17, T.77 N., R.40 W., Pottawattamie County, at bridge on State Highway 83, 7 mi west of Avoca.

Drainage area.--3.21 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Defined by step-backwater computations and an indirect measurement at 642 ft^3/s.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1953	--	a	<141
1954	--	a	<141
1955	July 9, 1955	8.73	642
1956	Sept. 5, 1956	5.37	233
1957	June 16, 1957	8.51	629
1958	Aug. 13, 1958	9.36	815
1959	May 2, 1959	8.10	563
1960	May 24, 1960	7.16	429
1961	June 27, 1961	6.83	387
1962	May 20, 1962	7.00	408
1963	June 5, 1963	7.79	516
1964	June 22, 1964	6.39	335
1965	--	a	<141
1966	May 23, 1966	7.33	451
1967	June 15, 1967	9.0 b	725 b
1968	--	a	<141
1969	July 9, 1969	8.03	553

06807720 Middle Silver Creek near Avoca, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1970	--	a	<141
1971	Feb. 19, 1971	7.42 c	d
1972	--	a	<141
1973	Sept.26, 1973	10.65	1,040
1974	--	a	<141
1975	Aug. 29, 1975	9.13	730
1976	June 14, 1976	11.21	1,200
1977	Aug. 5, 1977	6.49	200
1978	Sept.13, 1978	8.53	550
1979	Mar. 18, 1979	7.52	350
1980	June 6, 1980	6.71	220
1981	May 4, 1981	8.99	680
1982	Feb. 20, 1982	9.35	750
1983	June 14, 1983	6.30	170
1984	Feb. 15, 1984	7.36 c	d
	Apr. 30, 1984	6.03	150
1985	--	a	d
1986	June 14, 1986	8.24	510
1987	--	a	d
1988	--	a	d

a Peak stage did not reach bottom of gage. b About.
c Affected by ice. d Discharge not determined.
< Less than.

06807760 Middle Silver Creek near Oakland, Iowa

Location.--Lat 41°19'28", long 95°33'19", near E1/4 corner sec.4, T.75 N., R.41 W., Pottawattamie County, at bridge on county road, and 8.5 mi northwest of Oakland.

Drainage area.--25.7 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Defined by current-meter and indirect measurements.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1953	June 10, 1953	9.53	991
1954	Aug. 22, 1954	8.27	759
1955	July 9, 1955	9.94	1,120
1956	Aug. 17, 1956	7.56	631
1957	June 16, 1957	9.81	1,040
1958	Sept. 5, 1958	12.28	1,450
1959	May 28, 1959	9.24	1,030
1960	May 25, 1960	8.15	898
1961	June 12, 1961	7.15	778
1962	July 13, 1962	5.55	586
1963	June 5, 1963	6.55	706
1964	--	a	<396
1965	June 29, 1965	8.31	917
1966	June 26, 1966	7.79	855
1967	June 15, 1967	11.26	1,300
1968	May 15, 1968	6.79	735
1969	--	7.56	700

06807760 Middle Silver Creek near Oakland, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1970	--	a	<191
1971	June 6, 1971	10.10	1,120
1972	Sept.11, 1972	8.23	790
1973	July 4, 1973	14.73	2,110
1974	May 19, 1974	5.38	360
1975	Aug. 25, 1975	13.38	1,780
1976	June 14, 1976	14.68	2,100
1977	May 21, 1977	4.59	260
1978	Sept.13, 1978	11.60	1,400
1979	Mar. 18, 1979	11.55	1,400
1980	June 6, 1980	6.64	550
1981	May 4, 1981	7.34	660
1982	Feb. 21, 1982	10.90	1,050 b
1983	June 14, 1983	9.56	758 b
1984	Apr. 30, 1984	7.39	418 b
1985	--	a	<408 b
1986	June 14, 1986	10.51	960 b
1987	Aug. 8, 1987	12.52	1,440 b
1988	--	a	<408 b

a Peak stage did not reach bottom of gage.
b Revised.
< Less than.

06807780 Middle Silver Creek at Treynor, Iowa

Location.--Lat 41°14'37", long 95°36'53", near NE corner sec.1, T.74 N., R.42 W., Pottawattamie County, at bridge on county road L55, 1 mi north of Treynor.

Drainage area.--42.7 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Defined by current-meter and indirect measurements.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1953	June 10, 1953	12.28	1,700
1954	June 21, 1954	9.80	1,180
1955	Mar. 2, 1955	10.32	1,280
1956	July 11, 1956	9.04 a	911 b
1957	June 16, 1957	10.01	1,220
1958	Sept. 5, 1958	16.01	2,600
1959	June 28, 1959	11.89	1,620
1960	Aug. 28, 1960	13.84	2,060
1961	Feb. 22, 1961	9.84	1,320
1962	July 27, 1962	9.00	1,020
1963	June 5, 1963	8.26	1,110
1964	June 22, 1964	8.82	1,320
1965	June 29, 1965	9.24	1,390
1966	June 26, 1966	15.82	2,560
1967	June 7, 1967	10.98	1,600
1968	May 15, 1968	5.41	735
1969	July 17, 1969	9.96	1,330

06807780 Middle Silver Creek at Treynor, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1970	May 12, 1970	6.13	690
1971	May 10, 1971	7.51	900
1972	Sept.11, 1972	5.59	600
1973	July 4, 1973	17.06	3,700
1974	--	c	<710
1975	Aug. 25, 1975	8.36	1,620
1976	June 14, 1976	13.92	2,850
1977	--	c	<710
1978	Sept.13, 1978	7.01	1,300
1979	Mar. 18, 1979	8.24	1,600
1980	June 6, 1980	11.37	2,300
1981	--	c	<710
1982	Feb. 21, 1982	5.46	950
1983	June 14, 1983	6.40	1,160
1984	Apr. 30, 1984	12.28	2,500
1985	--	c	<720
1986	June 14, 1986	5.58	970
1987	Aug. 8, 1987	14.06	d
1988	--	c	d

a Gage height not the maximum for the year.
b Discharge not the maximum for the year.
c Peak stage did not reach bottom of gage.
d Discharge not determined. < Less than.

06808000 Mule Creek near Malvern, Iowa
(Discontinued Sept. 30, 1969)

Location.--Lat 40°56'36", long 95°35'42", in NE1/4 NE1/4 sec.19, T.71 N., R.41 W., Mills County, on right bank 170 ft upstream from culvert on county road L63, 0.2 mi downstream from unnamed tributary, 1.8 mi upstream from mouth, and 4.3 mi south of Malvern.

Drainage area.--10.6 mi^2.

Gage.--Water-stage recorder. Datum of gage is 974.20 ft above sea level (levels by Soil Conservation Service). Prior to Oct. 1, 1964, water-stage recorder at site 180 ft downstream. Oct. 1, 1964, to Mar. 25, 1965, nonrecording gage with supplemental water-stage recorder at site 180 feet downstream. Mar. 26 to July 13, 1965, nonrecording gages at various locations. July 14, 1965 to Sept. 30, 1969, water-stage recorder at site 170 ft upstream of culvert at same datum.

Stage-discharge relation.--Defined by current-meter measurements below 510 ft^3/s and extended above on basis of slope-area measurement of peak flow.

Remarks.--Base for partial-duration series, 300 ft^3/s. Basin became partially regulated by the construction of 24 impoundment dams during 1954-56.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1954	Aug. 21, 1954	15.84	2,070 a
	Aug. 23, 1954	14.19	1,680
1955	Mar. 1, 1955	7.51	411
1956	July 11, 1956	7.55	398
	July 15, 1956	15.54	1,990
	Aug. 18, 1956	10.4	867
1957	May 29, 1957	12.58	1,310
	June 7, 1957	9.80	849
	June 15, 1957	6.30	334
	June 17, 1957	7.40	479
	July 1, 1957	8.70	678
1958	July 19, 1958	6.92	334
	July 30, 1958	12.35	1,180

06808000 Mule Creek near Malvern, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1959	May 2, 1959	6.62	332
	May 18, 1959	11.50	1,180
	May 29, 1959	8.07	549
	Sept.18, 1959	7.57	472
1960	Aug. 28, 1960	8.22	565
	Sept.24, 1960	7.30	428
1961	June 27, 1961	8.12	549
1962	May 28, 1962	10.00	886
1963	Sept.10, 1963	6.00	256
1964	May 26, 1964	10.86	1,060
	June 14, 1964	8.57	632
1965	Mar. 1, 1965	10.58	1,000
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	May 22, 1965	14.10	1,820
	----------		---
	July 19, 1965	10.25	542
	Sept. 7, 1965	8.39	303
1966	May 15, 1966	5.28	24
1967	June 5, 1967	15.80	1,400
	June 7, 1967	12.25	840
	June 11, 1967	8.72	350
1968	Aug. 16, 1968	4.92	14
1969	July 18, 1969	11.70	745
Discontinued September 30, 1969			
1987	May 26, 1987	26.06	2,060 b

a Maximum during period June to September 1954.
b Discharge computed from an indirect measurement.

06808200 Spring Valley Creek near Tabor, Iowa
(Discontinued Sept. 30, 1964)

Location.--Lat 40°54'35", long 95°36'00", in SW1/4NE1/4 sec.31, T.71 N., R.41 W., Mills County, on left bank 20 ft downstream from county road bridge, 1.5 mi upstream from mouth, and 4.0 mi northeast of Tabor.

Drainage area.--7.65 mi^2.

Gage.--Water-stage recorder and concrete control. Altitude of gage is 975 ft (from topographic map).

Stage-discharge relation.--Defined by current-meter measurements below 210 ft^3/s and above by slope-area measurement.

Remarks.--Base for partial-duration series, 250 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1956	June 11, 1956	8.59	317
	July 15, 1956	13.50	2,310
	Aug. 18, 1956	8.78	359
1957	May 29, 1957	12.07	1,480
	June 7, 1957	10.58	865
	June 17, 1957	8.90	380
	July 1, 1957	10.33	778
1958	July 19, 1958	10.85	935
	July 30, 1958	15.48	4,150
1959	May 18, 1959	12.57	1,730
	May 29, 1959	10.0 a	670 b
	Aug. 5, 1959	8.40	279
	Sept.18, 1959	8.51	298
1960	Aug. 17, 1960	9.30	473
	Aug. 28, 1960	12.28	1,570
	Sept.24, 1960	8.63	328
1961	June 27, 1961	12.13	1,480
1962	May 28, 1962	11.77	1,300
	May 31, 1962	9.36	486
	June 6, 1962	8.85 a	370 b
1963	Sept.10, 1963	12.13	1,480

06808200 Spring Valley Creek near Tabor, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1964	May 26, 1964	12.12	1,480
	June 14, 1964	9.55	525
	June 20, 1964	9.66	566
	July 11, 1964	8.55	298

Discontinued September 30, 1964

a Gage height affected by backwater.
b Discharge is an estimate.

06808500 West Nishnabotna River at Randolph, Iowa

Location.--Lat 40°52'23", long 95°34'48", in NE1/4 NE1/4 sec.17, T.70 N., R.41 W., Fremont County, Hydrologic Unit 10240002, on right bank at upstream side of bridge on State Highway 184, 0.3 mi downstream from Deer Creek, 0.5 mi west of Randolph, 16.0 mi upstream from confluence with East Nishnabotna River, and 31.5 mi upstream from mouth of Nishnabotna River.

Drainage area.--1,326 mi^2.

Gage.--Water-stage recorder. Datum of gage is 932.99 ft above sea level, unadjusted. Prior to Aug.26, 1955, nonrecording gage with supplementary water-stage recorder operating above 8.4 ft June 30, 1949, to Aug.25, 1955, at same site and datum.

Stage-discharge relation.--Defined by current-meter measurements.

Flood stage.--19 feet.

Remarks.--Base for partial-duration series, 6,500 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1947	June ??, 1947	24. a	b
1949	Mar. 5, 1949	24.6 c	16,000 a
	June 13, 1949	14.2	6,800
1950	Feb. 28, 1950	18.50	20,000
	May 9, 1950	21.93	29,600
	June 9, 1950	16.29	11,300
	June 18, 1950	15.40	9,300
	July 12, 1950	16.17	11,100
	Aug. 12, 1950	16.25	11,100
1951	Apr. 27, 1951	12.95	7,050
	May 1, 1951	21.35	28,200
	May 10, 1951	13.02	7,050
	June 2, 1951	21.66	29,100
	June 7, 1951	16.90	15,600
	July 3, 1951	21.77	29,400
	Aug. 15, 1951	13.19	7,450
	Aug. 17, 1951	12.72	6,510
	Aug. 20, 1951	15.86	13,400
1952	June 22, 1952	20.50	25,500
	June 27, 1952	18.37	19,500
	Aug. 29, 1952	18.80	20,600

06808500 West Nishnabotna River at Randolph, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1953	June 28, 1953	11.77	4,980
1954	Aug. 23, 1954	17.15	13,400
1955	Mar. 2, 1955	14.69	10,500
	July 9, 1955	16.18	13,900
1956	July 8, 1956	17.8	17,900
	July 15, 1956	14.06	9,260
1957	June 16, 1957	17.58	15,600
1958	Feb. 24, 1958	18.62 c	19,100 a
	July 3, 1958	17.70	16,500
	July 19, 1958	15.35	8,400
	July 30, 1958	17.30	14,600
	Aug. 6, 1958	16.50	11,800
	Sept. 6, 1958	18.20	17,900
1959	May 3, 1959	13.15	6,580
	May 18, 1959	14.43	8,200
	May 29, 1959	18.13	16,200
1960	Mar. 30, 1960	19.18	20,600
	May 6, 1960	14.42	7,570
	June 30, 1960	14.73	8,200
	Aug. 7, 1960	14.26	7,360
	Aug. 29, 1960	17.16	14,500
	Sept.18, 1960	14.76	8,410
1961	Mar. 13, 1961	15.56	11,700
	June 20, 1961	14.96	11,200
	June 27, 1961	14.36	7,570
1962	Mar. 22, 1962	14.94	8,830
	May 21, 1962	14.39	7,570
	May 29, 1962	21.60	26,600
	June 11, 1962	15.18	8,620
1963	Mar. 11, 1963	15.33	12,000
1964	May 26, 1964	18.76	17,400
	June 14, 1964	16.72	11,400
	June 23, 1964	16.30	10,400
	July 11, 1964	16.23	10,200

06808500 West Nishnabotna River at Randolph, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1965	Mar. 1, 1965	22.76 c	28,000 a
	Mar. 17, 1965	19.25	18,400
	Apr. 1, 1965	15.47	9,900
	Apr. 5, 1965	15.80	11,000
	May 22, 1965	15.37	9,670
	May 25, 1965	15.01	7,860
	June 29, 1965	18.35	17,900
	Sept. 7, 1965	15.33	9,580
1966	June 26, 1966	19.38	21,200
1967	June 5, 1967	19.13	20,400
	June 8, 1967	20.54	25,600
	June 10, 1967	20.91	27,000
	June 12, 1967	17.68	15,900
	June 16, 1967	18.52	18,500
	June 21, 1967	22.60	35,500
	June 25, 1967	14.66	8,120
1968	June 26, 1968	9.14	944
1969	Feb. 26, 1969	15.65	10,300
	Mar. 18, 1969	16.67	12,900
	July 9, 1969	15.68	10,400
	July 18, 1969	14.44	7,650
1970	May 14, 1970	13.31	5,560
1971	Feb. 19, 1971	19.00	20,000
	Mar. 12, 1971	14.90	8,620
	May 11, 1971	14.89	8,600
	May 18, 1971	14.32	7,400
1972	May 6, 1972	13.87	6,580
	Sept.14, 1972	21.71	18,500
1973	Dec. 29, 1972	18.55 c	12,000 a
	Jan. 17, 1973	18.75 c	13,200 a
	Feb. 24, 1973	15.39	9,720
	Mar. 1, 1973	14.35	7,460
	Mar. 14, 1973	14.30	7,360
	Apr. 16, 1973	15.27	9,440
	Apr. 30, 1973	14.02	6,830
	May 8, 1973	17.72	16,000
	July 4, 1973	-- d	10,000 a
	Sept.26, 1973	19.79	19,000

06808500 West Nishnabotna River at Randolph, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1974	Oct. 11, 1973	16.27	6,850
	May 19, 1974	16.95	7,590
1975	Apr. 28, 1975	17.78	12,000
	June 18, 1975	16.22	8,790
	June 25, 1975	15.88	8,180
	Aug. 29, 1975	16.41	7,780
1976	June 14, 1976	19.90	13,700
1977	Sept. 4, 1977	18.14	10,200
1978	Mar. 21, 1978	c	9,000 a
	July 22, 1978	19.18	12,100
	Sept.14, 1978	19.46	12,700
	Sept.20, 1978	15.96	6,850
1979	Mar. 3, 1979	c	11,000 a
	Mar. 12, 1979	16.84	8,080
	Mar. 18, 1979	21.20	17,100
	Mar. 23, 1979	16.63	7,780
	July 24, 1979	18.67	11,000
1980	June 2, 1980	15.82	6,680
	June 4, 1980	19.60	13,000
	June 7, 1980	16.14	7,100
	June 15, 1980	17.71	9,440
1981	May 4, 1981	10.89	1,970
1982	Feb. 21, 1982	18.40	10,700
	Mar. 19, 1982	17.01	8,320
	May 21, 1982	16.80	8,150
	June 15, 1982	23.51	27,600
1983	Feb. 20, 1983	16.45	7,550
	May 19, 1983	17.15	8,540
1984	Apr. 30, 1984	18.11	10,200
	May 25, 1984	16.23	7,260
	June 5, 1984	16.45	7,550
	June 13, 1984	21.55	18,000
	June 15, 1984	22.35	20,900
	June 17, 1984	18.64	11,200
1985	Feb. 21, 1985	17.57 c	5,600

06808500 West Nishnabotna River at Randolph, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1986	Feb. 27, 1986	17.01	8,320
	May 11, 1986	18.21	10,400
	May 12, 1986	16.18	7,190
	June 14, 1986	16.22	7,250
	July 10, 1986	17.97	9,920
	July 12, 1986	18.23	10,400
	Aug. 13, 1986	17.28	8,750
1987	Oct. 12, 1986	19.30	12,600
	May 26, 1987	24.50	40,800
	May 31, 1987	e	10,000
	July 9, 1987	20.07	14,100
	Aug. 8, 1987	20.43	15,100
	Aug. 25, 1987	21.38	18,300
	Aug. 26, 1987	17.97	9,850
1988	Jan. 31, 1988	15.91 c	b
	June 9, 1988	10.59	2,080

a About. b Discharge not determined. c Affected by ice.
d Gage removed for construction of new bridge.
e Peak occurred during period of surging.

06808880 Bluegrass Creek at Audubon, Iowa

Location.--Lat 41°42'46", long 94°55'43", in NW1/4 sec. 28, T.80 N., R.35 W., Audubon County, at bridge on U.S. Highway 71, near south edge of Audubon.

Drainage area.--15.4 mi^2.

Gage.--Crest-stage gage.

Stage-discharge relation.--Undefined due to channel degradation, 1967 discharge determined from an indirect measurement.

Remarks.--Only annual peaks are shown.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1966	--	a	b
1967	June 27, 1967	85.48	2,020 c
1968	--	a	b
1969	July 9, 1969	83.68	b
1970	May 13, 1970	81.85	b
1971	--	a	b
1972	Sept.11, 1972	86.05	b
1973	July 9, 1973	84.09	b
1974	--	a	b
1975	Apr. 28, 1975	84.62	b
1976	--	a	b
1977	--	a	b
1978	--	a	b
1979	Mar. 18, 1979	84.57	b
1980	--	a	b
1981	--	a	b

06808880 Bluegrass Creek at Audubon, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1982	Feb. 20, 1982	83.14	b
1983	--	a	b
1984	--	a	b
1985	--	a	b
1986	--	a	b
1987	--	a	b
1988	--	a	b

a Peak stage did not reach bottom of gage.
b Discharge not determined.
c Discharge computed from an indirect measurement.

06809000 Davids Creek near Hamlin, Iowa
(Discontinued Sept. 30, 1973)

Location.--Lat 41°40'25", long 94°48'20", in NE1/4 NE1/4 sec.9, T.79, R.34 W., Audubon County, on left bank 20 ft downstream from bridge on State Highway 64 (State Highway 44, 1990), 5.2 mi east of Hamlin, and 8 mi upstream from mouth.

Drainage area.--26.0 mi^2.

Gage.--Water-stage recorder. Datum of gage is 1,261.54 ft above sea level. Prior to Oct. 1, 1972, at datum 5.00 ft higher.

Stage-discharge relation.--Defined by current-meter measurements below 500 ft^3/s and extended above on basis of slope area measurement of peak flow.

Remarks.--Base for partial-duration series, 400 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1952	June 21, 1952	10.72	435
	June 27, 1952	12.55	760
	July 7, 1952	10.85	450
	Aug. 15, 1952	13.07	860 a
	Aug. 29, 1952	11.27	526
1953	Feb. 19, 1953	10.55	420
	June 4, 1953	11.18	510
	June 10, 1953	11.46	558
1954	Aug. 23, 1954	8.89	199
1955	Apr. 23, 1955	10.27	378
1956	June 6, 1956	11.34	406
	Aug. 16, 1956	11.31	406
	Sept. 4, 1956	12.41	574
1957	June 16, 1957	14.80	1,160
1958	July 2, 1958	19.35	22,700
	July 3, 1958	14.84	1,190
	July 19, 1958	12.26	625
	Sept. 5, 1958	11.08	425
1959	May 29, 1959	9.66	240
1960	Mar. 29, 1960	12.94 b	900 c
	Aug. 7, 1960	10.70	580

06809000 Davids Creek near Hamlin, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1961	Feb. 22, 1961	10.90	620
	Sept.30, 1961	10.32	510
1962	June 8, 1962	13.62	1,550
	June 19, 1962	10.43	529
1963	May 4, 1963	8.91	322
1964	Apr. 2, 1964	10.22	795
	Apr. 13, 1964	9.82	714
	June 20, 1964	10.59	888
	June 22, 1964	13.54	2,010
1965	Mar. 1, 1965	14.63 b	1,800 c
	Mar. 17, 1965	14.46 b	1,300 c
	Mar. 31, 1965	10.30	928
	Apr. 5, 1965	11.87	1,370
	June 22, 1965	9.51	723
1966	June 12, 1966	14.91	3,020
1967	June 7, 1967	9.54	808
	June 9, 1967	9.24	730
	June 12, 1967	10.96	1,380
1968	Jan. 26, 1968	4.18 b	d
	Apr. 23, 1968	3.28	25
1969	Mar. 17, 1969	12.17 e	1,810
	Mar. 19, 1969	6.83	487
	Mar. 24, 1969	8.19	752
	June 28, 1969	7.42	594
1970	May 14, 1970	9.27	995
1971	Feb. 18, 1971	9.28 b	700 c
	Mar. 13, 1971	7.76	734
	June 6, 1971	6.48	499
1972	Aug. 1, 1972	5.64	520
	Sept.11, 1972	6.04	584

06809000 Davids Creek near Hamlin, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1973	Jan. 17, 1973	--	400 c
	Feb. 28, 1973	11.60	809
	May 7, 1973	10.73	677
	May 27, 1973	9.26	445
	July 2, 1973	9.65	426
	July 4, 1973	11.46	700
	July 9, 1973	9.50	405
	Sept.26, 1973	9.76	441

Discontinued Sept. 30, 1973

a Maximum during period June to September 1952.
b Affected by ice. c About.
d Discharge not determined.
e Maximum gage height for water year, 12.85 ft, Mar. 17, 1969 (backwater from ice).

06809210 East Nishnabotna River near Atlantic, Iowa

Location.--Lat 41°20'46", long 95°04'36", in NW1/4 NW1/4 sec.35, T.76 N., R.37 W., Cass County, Hydrologic Unit 10240003, on left bank at downstream side of bridge on county road, 1.6 mi upstream from Turkey Creek, 5.2 mi southwest of junction of U.S. Highway 6 and State Highway 83 in Atlantic, 69.1 mi upstream from confluence with West Nishnabotna River, and 84.6 mi upstream from mouth of Nishnabotna River.

Drainage area.--436 mi^2.

Gage.--Water-stage encoder. Datum of gage is 1,105.83 above sea level. Prior to Oct. 1, 1970, at site 2.2 mi upstream at datum 5.00 ft higher.

Stage-discharge relation.--Defined by current-meter measurements.

Flood stage.--17 ft.

Remarks.--Base for partial-duration series, 3,000 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1958	July 2, 1958	22.49 a	34,200 b

1961	Feb. 22, 1961	13.08	4,120
	Mar. 14, 1961	12.85	3,800
1962	Mar. 23, 1962	12.90	6,270
	May 26, 1962	11.30	3,970
	May 29, 1962	14.34	8,310
	June 10, 1962	12.32	4,980
1963	Mar. 4, 1963	13.58 c	d
	Mar. 11, 1963	11.50	4,090
1964	Apr. 2, 1964	13.24	6,720
	Apr. 13, 1964	12.61	6,270
	May 26, 1964	14.90	8,980
	June 20, 1964	17.10	13,000
	June 22, 1964	18.16	15,200
	July 3, 1964	12.08	4,720
	July 11, 1964	13.40	6,570
1965	Mar. 1, 1965	20.43	20,500
	Mar. 17, 1965	20.10	19,400
	Mar. 31, 1965	14.24	7,810
	Apr. 5, 1965	16.80	12,300
	June 8, 1965	11.54	4,020

06809210 East Nishnabotna River near Atlantic, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1966	June 12, 1966	17.86 a	14,500
1967	June 8, 1967	13.10	5,490
	June 10, 1967	12.00	4,380
	June 12, 1967	14.37	8,100
	June 16, 1967	13.87	7,220
	June 24, 1967	11.70	4,020
	June 28, 1967	13.64	6,940
1968	June 30, 1968	7.20	560
1969	Feb. 27, 1969	14.85 c	7,000 e
	Mar. 17, 1969	17.65	14,100
	Mar. 20, 1969	11.37	4,040
	Mar. 24, 1969	12.61	5,930
	June 28, 1969	12.95	6,030
	July 9, 1969	15.46	9,980
1970	Mar. 2, 1970	16.00	11,000
	May 11, 1970	14.00	7,510
	May 14, 1970	13.90	7,300
1971	Feb. 19, 1971	17.35	15,200
	Mar. 13, 1971	10.48	4,320
	June 6, 1971	9.77	3,590
1972	Aug. 2, 1972	9.42	3,240
	Sept.12, 1972	22.81	26,700
1973	Dec. 30, 1972	--	3,800 e
	Jan. 17, 1973	12.10	6,340
	Feb. 1, 1973	9.43	3,250
	Feb. 24, 1973	9.25	3,070
	Mar. 1, 1973	9.21	3,740
	Mar. 11, 1973	9.15	3,680
	Mar. 31, 1973	10.67	4,540
	Apr. 15, 1973	10.31	4,290
	May 7, 1973	14.63	10,400
	May 28, 1973	10.20	4,160
	July 1, 1973	10.50	4,440
	July 4, 1973	12.21	6,490
	Sept.26, 1973	9.61	3,610
1974	Oct. 11, 1973	11.65	5,720
	May 19, 1974	9.30	3,270

06809210 East Nishnabotna River near Atlantic, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1975	Mar. 21, 1975	11.07	5,720
	Apr. 28, 1975	12.20	6,480
	June 18, 1975	9.85	3,790
	June 25, 1975	11.78	5,890
1976	Mar. 12, 1976	9.06	3,050
	June 14, 1976	12.34	6,680
1977	Sept. 3, 1977	10.29	4,230
1978	Mar. 20, 1978	12.25	6,440
	Sept.13, 1978	12.00	6,280
1979	Mar. 13, 1979	10.41	4,680
	Mar. 18, 1979	18.42	18,500
1980	June 6, 1980	14.25	9,500
	June 15, 1980	16.50	13,500
1981	June 15, 1981	7.21	1,650
1982	Feb. 20, 1982	12.40	6,730
	Mar. 19, 1982	11.99	10,300
	May 20, 1982	9.15	5,470
	May 26, 1982	10.99	8,620
	Aug. 30, 1982	8.75	4,860
1983	Feb. 19, 1983	9.64	3,580
	May 1, 1983	9.20	3,290
	June 28, 1983	9.13	3,160
1984	Apr. 27, 1984	9.87	4,250
	Apr. 30, 1984	15.42	12,600
	May 25, 1984	9.79	4,170
	June 16, 1984	10.95	5,430
1985	Feb. 21, 1985	10.93	5,400

06809210 East Nishnabotna River near Atlantic, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1986	Feb. 26, 1986	12.76	7,850
	May 10, 1986	12.81	7,920
	May 11, 1986	11.68	6,310
	May 15, 1986	8.74	3,160
	May 16, 1986	10.62	5,050
	June 14, 1986	8.72	3,150
	June 30, 1986	9.94	4,320
	July 9, 1986	8.65	3,090
	July 10, 1986	9.26	3,640
	July 14, 1986	11.63	6,240
	Aug. 13, 1986	12.55	7,530
	Sept.19, 1986	9.63	4,010
	Sept.29, 1986	8.70	3,130
1987	Oct. 11, 1986	13.55	9,090
	July 12, 1987	10.05	4,440
	Aug. 26, 1987	9.59	3,970
1988	Jan. 30, 1988	9.73 c	d
	June 8, 1988	6.94	2,040

a From floodmark.
b Discharge computed from an indirect measurement.
c Affected by ice.
d Discharge not determined. e About.

06809500 East Nishnabotna River at Red Oak, Iowa

Location.--Lat 41°00'31", long 95°14'29", in NW1/4 SE1/4 sec.29, T.72 N., R.38 W., Montgomery County, Hydrologic Unit 10240003, on upstream side of Coolbaugh Street and 200 ft left of left end of Coolbaugh Street bridge in Red Oak, 0.2 mi upstream from Red Oak Creek, 38.0 mi upstream from confluence with West Nishnabotna River, and 53.6 mi upstream from mouth of Nishnabotna River.

Drainage area.--894 mi^2.

Gage.--Water-stage recorder. Datum of gage is 1,005.45 ft above sea level. Prior to July 5, 1925, nonrecording gage at present site at datum 4.60 ft higher. May 29, 1936, to Nov. 13, 1952, nonrecording gage with supplementary water-stage recorder in operation above 3.2 ft gage height July 30, 1939 to Nov. 13, 1952, and Nov. 14, 1952, to June 13, 1966, water-stage recorder, all at site 0.5 mi upstream at datum 5.00 ft higher. June 14, 1966, to Sept. 30, 1969, at present site at datum 5.00 ft higher.

Stage-discharge relation.--Defined by current-meter measurements.

Flood stage.--18 ft.

Remarks.--Base for partial-duration series, 4,500 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1917	June 7, 1917	21.7 a	23,500
1918	May 29, 1918	13.6	3,740
1919	June 13, 1919	13.1	3,300
1920	Apr. 21, 1920	12.6	2,920
1921	Sept.21, 1921	12.4	2,800
1922	Sept. 2, 1922	13.6	3,740
1923	Sept.29, 1923	12.2	2,700
1924	June 9, 1924	16.5	6,800
	June 26, 1924	18.2	10,000
1925	June 25, 1925	10.00	1,850
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1936	Sept.16, 1936	14.8	3,800

06809500 East Nishnabotna River at Red Oak, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1937	Feb. 19, 1937	15.7	4,800
	Mar. 4, 1937	18.6	9,600
1938	Sept.14, 1938	14.9	3,810
1939	Aug. 12, 1939	18.2	9,070
1940	Aug. 13, 1940	15.83	5,000
1941	June 4, 1941	15.5	4,580
	June 10, 1941	15.4	4,550
1942	May 12 1942	15.9	5,100
	June 29, 1942	16.1	5,300
	July 20, 1942	18.4	8,100
1943	Feb. 4, 1943	17.9	8,610
	May 16, 1943	16.8	6,810
1944	May 22, 1944	17.7	8,200
	June 14, 1944	16.0	5,900
	Aug. 2, 1944	17.9	8,500
1945	Mar. 11, 1945	15.5	5,400
	Apr. 24, 1945	16.5	6,400
	May 15, 1945	17.6	8,000
	May 23, 1945	20.5	16,100
	May 28, 1945	15.8	8,000
	June 1, 1945	17.0	9,800
	June 7, 1945	17.2	10,100
	June 16, 1945	14.5	6,300
1946	Jan. 6, 1946	16.4 b	6,400 c
	Feb. 6, 1946	18.2	12,000
	Mar. 6, 1946	13.5	5,350
	Mar. 13, 1946	12.9	4,850
	May 3, 1946	12.6	4,600
	June 18, 1946	14.3	6,090
	Aug. 26, 1946	18.2	12,000

06809500 East Nishnabotna River at Red Oak, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1947	Oct. 18, 1946	14.3	6,800
	Apr. 11, 1947	16.1	8,900
	May 15, 1947	12.5	5,150
	June 2, 1947	19.0	13,900
	June 5, 1947	18.7	13,400
	June 13, 1947	23.2	36,200
	June 18, 1947	12.1	7,100
	June 23, 1947	19.6	15,800
1948	Feb. 28, 1948	15.8	12,400
	Mar. 19, 1948	18.9	18,400
	July 21, 1948	12.0	7,000
	July 28, 1948	10.3	5,200
1949	Mar. 5, 1949	17.7	15,800
	Mar. 22, 1949	9.8	4,720
	June 2, 1949	9.6	4,540
	July 20, 1949	9.8	4,720
1950	Feb. 9, 1950	10.5	6,550
	Feb. 28, 1950	11.8	8,580
	May 9, 1950	11.2	7,620
	June 18, 1950	11.4	7,940
1951	Mar. 29, 1951	14.31	10,700
	Apr. 25, 1951	9.55	4,850
	May 1, 1951	16.97	15,200
	June 2, 1951	14.1	10,400
	June 8, 1951	13.7	9,920
	July 3, 1951	14.9	11,600
	Aug. 20, 1951	10.9	6,190
1952	Mar. 11, 1952	10.56	5,860
	Mar. 31, 1952	11.58	7,020
	June 22, 1952	15.53	12,600
	June 27, 1952	13.54	9,500
	July 3, 1952	9.95	5,250
	July 7, 1952	11.28	6,660
	Aug. 15, 1952	10.22	5,450
	Aug. 29, 1952	12.58	8,280
1953	June 10, 1953	7.77	3,250
1954	Aug. 23, 1954	14.08	10,400

06809500 East Nishnabotna River at Red Oak, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)	
1955	Mar. 3, 1955	13.58	9,640	
	Apr. 24, 1955	10.19	5,450	
1956	Sept. 5, 1956	12.57	7,630	
1957	May 30, 1957	11.35	6,780	
	June 17, 1957	15.12	11,800	
1958	Feb. 24, 1958	12.17	b	7,710	c
	July 3, 1958	22.27	35,600	
	July 19, 1958	13.20	9,700	
	Aug. 1, 1958	10.30	5,960	
	Sept. 7, 1958	18.58	19,900	
1959	Feb. 27, 1959	9.25	b	4,800	c
	May 3, 1959	10.35	6,080	
	May 29, 1959	15.14	12,700	
1960	Mar. 30, 1960	16.40	15,100	
	May 25, 1960	9.25	5,000	
1961	Feb. 23, 1961	10.88	6,880	
	Mar. 15, 1961	12.25	8,510	
1962	Mar. 23, 1962	12.00	9,460	
	May 29, 1962	15.28	13,000	
	June 9, 1962	11.61	7,730	
1963	Mar. 11, 1963	10.90	8,920	
1964	Apr. 2, 1964	10.87	10,700	
	Apr. 13, 1964	10.38	9,700	
	May 26, 1964	14.43	11,600	
	June 20, 1964	15.00	13,200	
	June 23, 1964	15.96	14,300	
	July 3, 1964	9.33	5,000	
	July 11, 1964	12.77	9,320	
1965	Mar. 2, 1965	19.40	22,200	
	Mar. 17, 1965	17.01	16,300	
	Apr. 1, 1965	11.94	8,170	
	Apr. 5, 1965	14.96	12,400	
	June 29, 1965	11.42	7,500	

06809500 East Nishnabotna River at Red Oak, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1966	June 12, 1966	15.56	15,100
	June 26, 1966	9.24	6,040
1967	June 9, 1967	14.02	12,300
	June 12, 1967	13.71	11,900
	June 16, 1967	14.05	12,400
	June 21, 1967	11.35	8,600
	June 24, 1967	9.30	6,140
	June 28, 1967	8.90	5,700
1968	May 16, 1968	1.29	355
1969	Feb. 27, 1969	11.22	8,830
	Mar. 18, 1969	14.48	13,700
	Mar. 20, 1969	7.75	4,890
	Mar. 25, 1969	8.65	5,810
	June 29, 1969	10.40	6,730
	July 9, 1969	12.25	9,020
1970	Mar. 2, 1970	18.59	11,700
	May 12, 1970	15.84	8,790
	May 14, 1970	17.59	11,400
1971	Feb. 19, 1971	20.76	17,000
	Mar. 14, 1971	13.94	6,830
	June 6, 1971	13.92	6,810
1972	Sept.13, 1972	27.43	38,000
1973	Dec. 30, 1972	15.47	7,810
	Jan. 17, 1973	17.73	10,900
	Feb. 2, 1973	14.35	6,500
	Mar. 1, 1973	12.72	4,810
	Mar. 14, 1973	13.25	5,310
	Mar. 31, 1973	14.50	6,660
	Apr. 16, 1973	14.37	6,520
	May 8, 1973	19.20	14,500
	May 28, 1973	13.40	6,240
	July 4, 1973	15.49	8,740
	Sept.26, 1973	13.08	5,460
1974	Oct. 11, 1973	15.28	8,460
	Mar. 3, 1974	12.08	4,600

06809500 East Nishnabotna River at Red Oak, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1975	Mar. 21, 1975	15.00	7,600
	Mar. 28, 1975	12.40	4,730
	Apr. 28, 1975	15.84	8,610
	June 19, 1975	12.72	5,050
	June 25, 1975	14.19	6,630
1976	June 14, 1976	18.78	12,800
1977	Aug. 28, 1977	14.35	6,820
	Aug. 31, 1977	13.55	5,900
	Sept. 2, 1977	13.33	5,660
1978	Mar. 21, 1978	16.34	9,280
	Apr. 18, 1978	13.82	6,270
	Sept.14, 1978	15.70	8,440
1979	Mar. 13, 1979	15.34	8,010
	Mar. 19, 1979	21.20	16,900
	Mar. 23, 1979	12.78	5,110
	Mar. 29, 1979	12.17	4,500
	June 27, 1979	14.83	7,400
1980	June 4, 1980	13.43	5,750
	June 6, 1980	18.44	12,300
	June 15, 1980	19.60	14,200
1981	June 16, 1981	8.48	1,710
1982	Feb. 20, 1982	19.94 b	d
	Feb. 21, 1982	19.22	13,600
	Mar. 19, 1982	16.50	9,530
	May 26, 1982	14.74	7,290
	June 15, 1982	18.86	13,000
1983	Dec. 28, 1982	12.24	4,510
	Feb. 20, 1983	13.71	6,060
	May 2, 1983	12.91	5,190
1984	Apr. 27, 1984	15.06	7,680
	Apr. 30, 1984	20.11	15,000
	May 25, 1984	14.63	7,150
	June 8, 1984	13.08	5,370
	June 13, 1984	13.70	6,050
	June 15, 1984	18.28	12,100
	June 16, 1984	16.61	9,680

06809500 East Nishnabotna River at Red Oak, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1985	Feb. 21, 1985	14.55	7,890
1986	Feb. 27, 1986	15.71	8,050
	Apr. 4, 1986	12.65	4,770
	May 10, 1986	17.36	10,200
	May 17, 1986	--	6,700
	June 30, 1986	--	4,800
	July 10, 1986	12.92	5,030
	July 14, 1986	13.15	5,260
	Aug. 13, 1986	--	7,200
	Sept.19, 1986	12.60	4,730
1987	Oct. 12, 1986	--	d
	May 26, 1987	17.08	9,820
	July 9, 1987	14.32	6,460
	July 12, 1987	14.74	6,930
	Aug. 8, 1987	13.39	5,490
	Aug. 26, 1987	14.15	6,280
1988	Jan. 30, 1988	13.90 b	d
	June 9, 1988	7.84	1,170

a From floodmark. b Affected by ice. c About.
d Discharge not determined.

06810000 Nishnabotna River above Hamburg, Iowa

Location.--Lat 40°37'57", long 95°37'32", in SW1/4 SE1/4 sec.11, T.67 N., R.42 W., Fremont County, Hydrologic Unit 10240004, on left bank 1.7 mi downstream from confluence of East Nishnabotna and West Nishnabotna Rivers, 2 mi northeast of Hamburg, and 13.8 mi upstream from mouth.

Drainage area.--2,806 mi^2.

Gage.--Water-stage encoder. Datum of gage is 894.17 ft above sea level. Prior to Oct.1, 1923, chain gage at site 6 mi downstream at different datum. Oct.5, 1928, to Sept.6, 1929, chain gage at site 1,000 ft upstream at datum 0.42 ft higher. Sept. 7, 1929, to Feb.11, 1935, chain gage and Feb.12, 1935, to June 5, 1947, wire-weight gage, at present site and datum. June 6 to July 22, 1947, staff gage at site 1,000 ft upstream at different datum. July 23, 1947, to Nov.16, 1950, staff gage at present site and datum.

Stage-discharge relation.--Defined by current-meter measurements.

Flood stage.--16 feet.

Remarks.--Base for partial-duration series, 9,000 ft^3/s.

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1917	June 7, 1917	21. a b	c
1922	Apr. 12, 1922	16.7	11,800
1923	Mar. 27, 1923	16.00	8,800
1929	Mar. 13, 1929	22.3	21,100
	July 6, 1929	18.2	9,500
	July 15, 1929	19.10	11,100
1930	Feb. 8, 1930	13.8 d	3,020 a
1931	June 22, 1931	18.1	9,350
1932	Nov. 25, 1931	19.1	11,100
	Aug. 16, 1932	19.1	10,300
1933	Jan. 22, 1933	17.1	8,020
1934	June 9, 1934	14.6	5,620

06810000 Nishnabotna River above Hamburg, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1935	June 26, 1935	17.5	8,500
1936	Mar. 5, 1936	22.2	20,600
1937	Mar. 5, 1937	21.6	16,500
1938	Aug. 28, 1938	17.9	9,060
	Sept.14, 1938	18.2	9,650
1939	Mar. 12, 1939	23.0 d	22,100 a
	Aug. 11, 1939	17.9	9,060
1940	Aug. 8, 1940	18.4	9,800
	Aug. 12, 1940	18.9	10,700
	Aug. 14, 1940	18.2	9,500
	Aug. 17, 1940	18.4	9,800
1941	June 9, 1941	20.4	14,600
	Sept.15, 1941	19.1	11,100
1942	Oct. 22, 1941	18.8	10,500
	June 20, 1942	19.2	11,700
	June 25, 1942	19.2	11,400
1943	May 16, 1943	19.1	11,100
	June 3, 1943	18.6	10,100
	June 5, 1943	18.6	10,100
	Aug. 3, 1943	18.9	10,700
1944	May 26, 1944	17.9	9,060
	June 4, 1944	19.5	11,600
	June 9, 1944	18.8	9,200
	June 15, 1944	20.8	11,800
1945	Mar. 11, 1945	18.6 d	9,350 a
	Apr. 23, 1945	18.8	10,500
	May 15, 1945	18.4	9,800
	May 23, 1945	22.6	21,000
	June 3, 1945	18.0	9,200
1946	Feb. 6, 1946	18.9	10,700
	June 18, 1946	19.1	11,100
	Sept. 4, 1946	19.7	11,300

06810000 Nishnabotna River above Hamburg, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1947	Apr. 10, 1947	19.5	9,800
	June 2, 1947	19.80	11,200
	June 6, 1947	23.0	28,700
	June 14, 1947	25.7	52,100
	June 24, 1947	26.03 b	55,500
1948	Feb. 28, 1948	21.5	17,600
	Mar. 20, 1948	24.5	36,300
1949	Mar. 7, 1949	25.9	32,200
	June 2, 1949	19.2	12,000
	June 28, 1949	18.5	9,950
1950	Feb. 9, 1950	18.4	10,500
	May 10, 1950	22.5	19,900
	June 19, 1950	18.4	10,500
	Aug. 12, 1950	19.2	12,000
1951	Mar. 29, 1951	21.46	16,200
	May 2, 1951	24.51	23,800
	June 3, 1951	24.32	23,200
	June 8, 1951	21.0	14,500
	June 20, 1951	17.9	9,170
	July 4, 1951	21.89	16,600
1952	Mar. 13, 1952	18.2	10,700
	June 23, 1952	20.92	12,800
	June 28, 1952	20.6	12,300
	Aug. 29, 1952	20.20	11,800
1953	June 9, 1953	14.65	5,440
1954	Aug. 23, 1954	21.32	12,600
1955	Apr. 24, 1955	18.8	12,000
	July 9, 1955	18.64	10,600
1956	July 8, 1956	20.90	13,500
	Sept. 6, 1956	18.38	9,760
1957	June 7, 1957	18.90	13,400
	June 16, 1957	21.59	20,400

06810000 Nishnabotna River above Hamburg, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1958	July 6, 1958	22.75	14,600
	July 19, 1958	19.45	10,000
	July 30, 1958	20.43	11,300
	Aug. 6, 1958	20.53	11,400
	Sept. 6, 1958	20.55	10,300
1959	May 19, 1959	17.90	9,640
	May 29, 1959	21.70	15,400
1960	Mar. 31, 1960	24.56	23,900
1961	Feb. 23, 1961	18.30	9,240
	Mar. 13, 1961	21.33	14,400
	Mar. 15, 1961	20.35	12,600
1962	Mar. 23, 1962	21.60	16,200
	May 29, 1962	23.62	18,000
	June 9, 1962	19.05	9,500
1963	Mar. 12, 1963	22.02	15,600
1964	May 26, 1964	23.32	19,900
	June 20, 1964	22.02	16,200
	June 23, 1964	22.72	17,300
	July 11, 1964	21.80	15,400
1965	Mar. 2, 1965	24.83	24,700
	Mar. 17, 1965	24.20	22,600
	Apr. 1, 1965	18.90	10,100
	Apr. 5, 1965	21.45	14,800
	May 22, 1965	20.69	13,200
	June 29, 1965	22.30	17,000
	July 19, 1965	20.05	11,300
1966	June 13, 1966	18.70	9,330
	June 26, 1966	--	16,000 a
1967	June 10, 1967	24.53 e	20,000 a
	June 12, 1967	24.47 e	19,000 a
	June 16, 1967	23.40 e	12,500 a
	June 21, 1967	24.17 e	12,000 a
1968	June 27, 1968	8.85	798

06810000 Nishnabotna River above Hamburg, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1969	Mar. 18, 1969	24.19	19,700
	July 10, 1969	21.07	12,300
	July 18, 1969	23.23	17,100
1970	Mar. 3, 1970	20.05	10,300
	May 14, 1970	19.12	10,400
1971	Feb. 19, 1971	26.25 d	c
	Feb. 20, 1971	--	25,000 a
	Mar. 14, 1971	18.64	9,700
1972	Sept.15, 1972	27.42	25,200
1973	Dec. 30, 1972	22.19	16,700
	Jan. 18, 1973	24.3 d	16,000 a
	Feb. 1, 1973	19.80	11,500
	Feb. 24, 1973	19.72	10,000
	Mar. 15, 1973	18.98	9,250
	Apr. 1, 1973	20.62	11,400
	Apr. 17, 1973	20.75	11,600
	May 8, 1973	23.38	16,900
	May 28, 1973	19.92	10,300
	July 4, 1973	24.39	17,300
	Sept.27, 1973	23.45	17,900
1974	Oct. 12, 1973	23.07	16,300
1975	Mar. 21, 1975	18.99	12,600
	Apr. 28, 1975	21.63	13,300
	June 25, 1975	20.75	11,600
1976	June 14, 1976	25.70	21,400
1977	Aug. 31, 1977	23.16	12,000
	Sept. 4, 1977	23.24	12,200
1978	Mar. 21, 1978	24.98	17,700
	Apr. 17, 1978	22.98	15,000
	July 22, 1978	24.72	19,300
	Sept.15, 1978	25.17	20,500
1979	Mar 3, 1979	--	16,000
	Mar. 7, 1979	27.46 d	c
	Mar. 13, 1979	22.43	13,900
	Mar. 19, 1979	--	23,000
	July 24, 1979	22.43	13,900

06810000 Nishnabotna River above Hamburg, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1980	June 4, 1980	24.93	19,800
	June 7, 1980	--	15,000
	June 15, 1980	23.20 b	15,500
1981	July 9, 1981	13.29	3,190
1982	Feb. 22, 1982	23.17	17,000
	Apr. 16, 1982	20.63	10,800
	May 21, 1982	21.37	11,800
	June 15, 1982	27.25	29,100
	Aug. 15, 1982	20.73	10,700
1983	Feb. 15, 1983	18.98	9,350
	Feb. 20, 1983	20.88	12,700
	June 18, 1983	19.78	9,040
	June 30, 1983	20.81	10,800
1984	Mar. 26, 1984	22.29	13,600
	Apr. 27, 1984	21.13	11,400
	Apr. 30, 1984	25.65	21,800
	June 5, 1984	20.96	11,000
	June 8, 1984	20.46	10,200
	June 9, 1984	23.71	16,700
	June 13, 1984	27.08	21,900
	June 16, 1984	27.90	24,300
1985	Feb. 22, 1985	21.90 d	12,300
1986	Feb. 27, 1986	23.87	18,300
	May 11, 1986	23.87	18,300
	May 17, 1986	21.71	13,000
	June 15, 1986	19.76	9,150
	July 6, 1986	19.82	9,260
	July 10, 1986	23.18	16,500
	July 12, 1986	--	c
	July 14, 1986	--	c
	Aug. 14, 1986	19.90	9,400
	Sept.20, 1986	21.08	11,600
1987	Oct. 12, 1986	25.95	24,500
	May 27, 1987	28.14	31,400
	July 9, 1987	23.78	18,000
	July 13, 1987	21.30	12,100
	Aug. 8, 1987	22.88	15,700
	Aug. 27, 1987	25.35	22,600
	Sept.16, 1987	22.42	14,600

06810000 Nishnabotna River above Hamburg, Iowa--(Continued)

Peak stages and discharges

Water year	Date	Gage height (feet)	Discharge (ft^3/s)
1988	Jan. 31, 1988	17.93 d	4,580

a About.
b From floodmark, present site and datum.
c Discharge not determined.
d Affected by ice.
e Backwater from Missouri River.

Table 5. Temporary bench marks, Nishnabotna River basin, Iowa

The majority of the temporary bench marks listed in this tabulation are those for which elevations have been established by the Water Resources Division, Iowa District, U.S. Geological Survey. For several bridges, bench-mark elevations were obtained from the Iowa Department of Transportation or from county engineers. The work was done as part of a stream profile project cooperatively financed by the Highway Research Advisory Board, Highway Division, Iowa Department of Transportation and the U.S. Geological Survey.

Stream reaches surveyed in the Nishnabotna River basin for the establishment of bench-mark elevations include the West Nishnabotna River from near Manning, and the East Nishnabotna River from near Hamlin, to the Nishnabotna River at Hamburg; and Indian Creek from near Emerson to the mouth. Bench marks were set at most bridges and at intermediate points between bridges, generally at road intersections at 1 mile intervals.

Level lines were commenced and terminated at first or second order bench marks that were established and adjusted by the U.S. Coast and Geodetic Survey to sea level. Errors of closure found by the level work were adjusted throughout the line, to the elevations published for the higher-order bench marks. The elevations of the temporary bench marks shown herein are of third-order accuracy.

Most of the bench marks listed in this table were established in the 1970's. Since then, some bridges have been abandoned, and a number of old bridges have been repaired or replaced. As a result, many of the original bench marks have been destroyed. The status of the original bench marks at intermediate points between the bridges is not known.

Three bridges on the lower West Nishnabotna River had new bench-mark elevations established for the 1987 flood profiles. During 1989, bridge deck and low-bridge chord elevations were surveyed, and low-water elevations were measured for those bridges indicated on the West and East Nishnabotna River profiles (figs. 11-27). Due to the loss of original bench marks, several supplemental bench-mark elevations were obtained from the aforementioned agencies, and several bridges will require level-line surveys to establish sea-level elevations. Bench marks associated with either of these conditions are noted in the following descriptions. Since bench marks are destroyed during time, the user should be cautious if the given bench-mark descriptions and elevations do not exactly match those in the field.

The bench marks have been identified by an index number, which is composed of the Congressional township, range, section number and quarter-section in which they are located. The township and range numbers have been combined into a four-digit number, such as 7241 for township 72 north and range 41 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, SW, or NW. A number in parentheses, following this letter designation, indicates the numerical order among the marks located in that particular quarter. The index number describes the landline location of the mark without further reference in the body of the description.

Most of the bridges included in the following list had two original bench marks established for them. Several bridges have had additional bench marks added to them to supplement lost or destroyed marks, or to compensate for shifts in the position of the stream channel. Unless it is known that a bridge has been replaced, all known bench marks are included for a bridge. If a particular bench mark was not located during the 1989 survey work, a note to that effect is included in the description. For some bridges, landline locations may differ for the upstream or downstream, or left or right, parts of the bridge. Therefore, some bridges have bench marks with numerically separated index numbers. In such situations, a cross-reference is provided to enable the user to locate all the bench marks for a bridge.

Standard marks such as chiseled squares and crosses were used on concrete or steel. On trees or poles, a 20-penny pole spike driven through a short piece of 1/8-inch galvanized pipe and placed horizontally was used. Existing marks were used wherever available, and the agency responsible for the mark, when known, is indicated in the description. If the agency is unknown, the mark is indicated as found. Marks indicated as (Reference point) following the index number were established to permit water surface elevations to be determined by use of a tape and weight. The terms "right" and "left" in the descriptions were determined facing in the direction of the flow of the stream.

Additional information, if available, can be obtained by writing to: U.S. Geological Survey, 400 South Clinton Street, P.O. Box 1230, Iowa City, Iowa 52244.

6742-22 SE (1) - At Hamburg, on U.S. Highway 275 bridge over Nishnabotna River, at left downstream side of bridge, top of bolt head at left end of bridge, lst bolt from left. Elev. 922.21 feet.

6742-22 SE (2) - At Hamburg, on U.S. Highway 275 bridge over Nishnabota River, at right downstream end of bridge, top of first bolt head from right. Elev. 922.28 feet.

6742-22 SE (3) - (Reference point) At Hamburg, on U.S. Highway 275 bridge over Nishnabotna River, on downstream guardrail at center of bridge, near vertical truss member, top of bolt. Elev. 931.68 feet.

6742-22 SE (4) - (Reference point) At Hamburg, on U.S. Highway 275 bridge over Nishnabotna River, on downstream guardrail at center of bridge, 7 feet left of vertical truss member, a filed arrow. Elev. 931.46 feet.

6742-22 SW (1) - At Hamburg, at corner of Washington and G Streets, 40 feet west of U.S. Highway 275, southeast corner of park, inside the sidewalk line, a standard U.S. Geological Survey tablet stamped "P 9 1933". Elev. 914.253 feet.

6840-7 SW (1) - At Farragut, 90 feet west of the railroad station, 35 feet west of the centerline of main north-south street, 25 feet south of track and at west edge of sidewalk, a standard disk stamped "F 9 1933" set in top of a concrete post. Elev. 961.363 feet.

6841-19 SW (1) - About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on left upstream wingwall curb, an Iowa Highway Commission bench mark. Also see 6842-25 NE (1-6). Elev. 935.64 feet.

6841-20 NE (1) - About 0.5 mile north of Riverton, on county road L68 bridge over East Nishnabotna River, on left downstream wingwall, a chiseled cross. (Elevation to be surveyed.)

6841-20 NE (2) - (Reference point) About 0.5 mile north of Riverton, on county road L68 bridge over East Nishnabotna River, on downstream guardrail, between 23rd and 24th guardrail posts from right end of bridge, a filed arrow. (Elevation to be surveyed.)

6841-21 NW (1) - About 0.5 mile north of Riverton, on county road L68 bridge over East Nishnabotna River, on left upstream wingwall, a chiseled cross. (Elevation to be surveyed.)

6841-29 NW (1) - At Riverton, on county road J46 bridge over East Nishnabotna River, on left downstream abutment, standard disk stamped "J 9 Reset 1975". Elev. 936.509 feet.

6841-29 NW (2) - (Reference point) At Riverton, on county road J46 bridge over East Nishnabotna River, on 33rd guardrail post from left downstream end of bridge, a filed arrow. Elev. 938.71 feet.

6842-25 NE (1) - About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on downstream wingwall, at right end of bridge, a chiseled square. Also see 6841-19 SW (1).
Elev. 937.41 feet.

6842-25 NE (2) - (Reference point) About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on downstream guardrail, left of 19th guardrail post from left end of bridge, a filed arrow. Also see 6841-19 SW (1). Elev. 937.76 feet.

6842-25 NE (3) - (Reference point) About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on 19th guardrail post from left downstream end of bridge, a filed arrow. Also see 6841-19 SW (1). Elev. 937.60 feet.

6842-25 NE (4) - (Reference point) About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on 22nd guardrail post from left downstream end of bridge, a filed arrow. Also see 6841-19 SW (1). Elev. 937.61 feet.

6842-25 NE (5) - (Reference point) About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on downstream guardrail, between 19th and 20th guardrail posts from left end of bridge, a filed arrow. Also see 6841-19 SW (1). Elev. 937.78 feet.

6842-25 NE (6) - About 1 mile west of Riverton, on county road J46 bridge over West Nishnabotna River, on top of downstream wingwall at right end of bridge, a steel disk with chiseled cross. (Unable to locate 6/12/89.) Elev. 930.99 feet.

6939-7 SE (1) - About 1 mile north of Shenandoah, on county road bridge over East Nishnabotna River, on curb at left downstream end of bridge, a chisled cross. Elev. 968.29 feet.

6939-7 SE (2) - (Reference point) About 1 mile north of Shenandoah, on county road bridge over East Nishnabotna River, on 3rd guardrail post from left downstream pier, a chiseled arrow. Elev. 970.49 feet.

6939-7 SW (1) - About 1.5 miles north of Shenandoah, on railroad bridge over East Nishnabotna River, on left upstream side of bridge on 12 X 12 inch horizontal piling, a bolt head with chiseled cross.
Elev. 965.45 feet.

6939-7 SW (2) - (Reference point) About 1.5 miles north of Shenandoah, on railroad bridge over East Nishnabotna River, on downstream side of bridge at center of bridge, on top of bolt head with brace, a chiseled arrow. Elev. 968.78 feet.

6939-8 SE (1) - About 1.4 miles northeast along Burlington Northern Railroad from crossing with Colorado and Eastern Railroad in Shenandoah, 279 feet west of southwest corner of a large house which sits on a small knoll, 235 feet south of centerline of a private road crossing, 70 feet northwest of centerline of State Highway 48, 17 feet southeast of southeast rail of track, 1.4 feet south of a telephone pole and in line with row of telephone poles, a standard U.S. Geological Survey tablet stamped "Q 161 1949" set in top of a concrete post. Elev. 973.089 feet.

6940-12 NE (1) - About 1.9 miles north of Shenandoah, at intersection of U.S. Highway 59 and Colorado and Eastern Railroad, at the south abutment, in the top of the curb at the southwest corner of the U.S. Highway 59 bridge, a standard U.S. Geological Survey tablet stamped "D 98 Reset 1958". Elev. 970.240 feet.

6940-13 NE (1) - About 1.5 miles north of Shenandoah, on U.S. Highway 59 bridge over East Nishnabotna River, on curb at left downstream end of bridge, an Iowa Highway Commission bench mark. Elev. 970.68 feet.

6940-13 NE (2) - (Reference point) About 1.5 miles north of Shenandoah, on U.S. Highway 59 bridge over East Nishnabotna River, on downstream guardrail post at center of bridge, a chiseled arrow. (Unable to locate 6/6/89.) Elev. 973.34 feet.

6940-13 NE (3) - (Reference point) About 1.5 miles north of Shenandoah, on U.S. Highway 59 bridge over East Nishnabotna River, on downstream curb, 197 feet from left end of bridge, a chiseled square. Elev. 971.02 feet.

6940-13 SW (1) About 1 mile west of Shenandoah, on county road J32 bridge over East Nishnabotna River, on right upstream corner of bridge wingwall, an Iowa Highway Commission bench mark. Elevation obtained from Iowa Dept. of Transportation. Elev. 968.01 feet.

6940-14 SW (1) - About 2.2 miles west on county road J46 from intersection with State Highway 48 at west edge Shenandoah, set in top of west end of north headwall of a 4 foot concrete box culvert, a standard U.S. Geological Survey tablet stamped "J 156 1949". Elev. 1001.212 feet.

6940-24 NW (1) - About 1 mile west of Shenandoah, on county road J32 bridge over East Nishnabotna River, on abutment at left downstream end of bridge, at end of wingwall, an Iowa Highway Commission bench mark. Elevation established from 6940-13 SW (1). Elev. 968.21 feet.

6940-24 NW (2) - (Reference point) About 1 mile west of Shenandoah, on county road J32 bridge over East Nishnabotna River, on downstream concrete guardrail at center of bridge, a chiseled arrow. Elevation established from 6940-13 SW (1). Elev. 972.45 feet.

6940-24 NW (3) About 1 mile west of Shenandoah, on county road J32 bridge over East Nishnabotna River, on downstream concrete guardrail, 6.5 feet from left end of bridge guardrail, an Iowa Highway Commission bench mark. Elevation established from 6940-13 SW (1).
Elev. 971.01 feet.

6940-24 NW (4) - (Reference point) About 1 mile west of Shenandoah, on county road J32 bridge over East Nishnabotna River, on downstream guardrail, 121 feet from left end of bridge, a chiseled square. Elevation established from 6940-13 SW (1). Elev. 972.27 feet.

6940-28 SE (1) - About 2.5 miles northeast of Farragut, on State Highway 2 bridge over East Nishnabotna River, on right upstream abutment curb, an Iowa Highway Commission bench mark. Elevation obtained from Iowa Dept. of Transportation. Elev. 957.61 feet.

6940-28 SE (2) - (Reference point) About 2.5 miles northeast of Farragut, on State Highway 2 bridge over East Nishnabotna River, on downstream curb, between 6th and 7th guardrail posts from right pier, a chiseled square. Elevation established from 6940-28 SE (1).
Elev. 958.14 feet.

6940-30 SE (1) - About 1.2 miles north of Farragut, on county road M16 bridge over East Nishnabotna River, on abutment at left downstream end of bridge, an U.S. Army Corps of Engineers control plate.
Elev. 953.56 feet.

6940-30 SE (2) - (Reference point) About 1.2 miles north of Farragut, on county road M16 bridge over East Nishnabotna River, on downstream curb, at 18th guardrail post from left end of bridge, a chiseled square. Elev. 953.96 feet.

6940-31 NE (1) - About 0.8 mile north of Farragut, along county road M16, on west side of highway, west of cemetary, in telephone pole east of building, a pole spike and collar. Elev. 952.14 feet.

6941-8 NW (1) - About 4 miles northeast of Sidney, on county road J26 bridge over West Nishnabotna River, on downstream wingwall at right end of bridge, a chiseled square. Elev. 948.62 feet.

6941-8 NW (2) - (Reference point) About 4 miles northeast of Sidney, on county road J26 bridge over West Nishnabotna River, on 25th guardrail post from right downstream end of bridge, a filed arrow.
Elev. 950.97 feet.

6941-8 NW (3) - (Reference point) About 4 miles northeast of Sidney, on county road J26 bridge over West Nishnabotna River, on downstream guardrail, near 35th guardrail post from right end of bridge, a filed arrow. Elev. 950.96 feet.

6941-8 NW (4) - About 4 miles northeast of Sidney, on county road J26 bridge over West Nishnabotna River, on 1st guardrail post from right downstream end of bridge, a chiseled mark. Elev. 950.32 feet.

6941-9 NW (1) - About 4.5 miles northeast of Sidney and 1 mile west of county road L68, at southeast corner of intersection of T-road south, in north side of power pole 1 foot above ground, a pole spike and collar. Elev. 938.80 feet.

6941-10 NW (1) - From Randolph, 5.2 miles south along county road L68, 0.3 mile north of Walnut Creek, 176 feet east of county road centerline, 41 feet north of driveway centerline, a standard disk set in concrete post and stamped "S 157 1949". Elev. 941.327 feet.

6941-29 SW (1) - About 2 miles east of Sidney, on State Highway 2 bridge over West Nishnabotna River, on left downstream wingwall, an Iowa Highway Commission bench mark. Elev. 946.78 feet.

6941-30 NE (1) - About 2 miles east of Sidney, on State Highway 2 bridge over West Nishnabotna River, on end of right downstream abutment, a disk with chiseled cross. Elev. 946.62 feet.

6941-30 NE (2) - (Reference point) About 2 miles east of Sidney, on State Highway 2 bridge over West Nishnabotna River, on downstream curb, at 26th guardrail post from right end bridge, a chiseled arrow. Also a chiseled square on downstream curb at 27th guardrail post from right end bridge, at same elevation. Elev. 947.89 feet.

6941-30 NE (3) - About 2 miles east of Sidney, on State Highway 2 bridge over West Nishnabotna River, on right upstream abutment curb, an Iowa Highway Commission bench mark. Elev. 946.73 feet.

7039-1 SW (1) - About 2 miles southwest of Coburg, on county road J14 bridge over East Nishnabotna River, on left upstream abutment curb, a bolt in concrete. (Elevation to be surveyed.)

7039-12 SE (1) - About 2.9 miles southwest along railroad from station at Colburg, 31 feet west of east right-of-way fence, 18.4 feet east of east rail of track, 3.7 feet north of a telephone pole, and in line with row of telephone poles, about 2 feet lower than track, 1.2 feet south of reference post, set in top of concrete post projecting 0.3 foot above ground, a standard U.S. Geological Survey tablet stamped "P 161 1949". Elev. 997.964 feet.

7039-12 NW (1) - (Reference point) About 2 miles southwest of Coburg, on county road J14 bridge over East Nishnabotna River, on downstream guardrail, between 16th and 17th guardrail posts from right end of bridge, a filed arrow. (Elevation to be surveyed.)

7039-22 NE (1) - (Reference point) About 1 mile northeast of Essex, on county road M41 bridge over East Nishnabotna River, on downstream guardail, between 21st and 22nd guardrail posts, a chiseled arrow. Elev. 995.17 feet.

7039-23 NW (1) - About 1 mile northwest of Essex, on county road M41 bridge over East Nishnabotna River, on curb behind left upstream wingwall, a bolt head. Elev. 992.45 feet.

7039-26 NW (1) - About 0.8 mile northeast along railroad from station at Essex, on a 5 x 20 foot concrete culvert along State Highway 48, opposite a small railroad trestle, set in top of southwest end of the northwest headwall, a standard tablet stamped "M 161 1949". Elev. 998.853 feet.

7039-27 SE (1) - At Essex, northwest of railroad station, at intersection of county road M41, at southwest corner of intersection, in north side of power pole, a pole spike and collar. Elev. 993.61 feet.

7039-27 NW (1) - About 0.3 mile west of Essex, on county road bridge over East Nishnabotna River, on curb at right downstream end of bridge, an Iowa Highway Commission bench mark. Elev. 984.30 feet.

7039-27 NW (2) - (Reference point) About 0.3 mile west of Essex, on county road bridge over East Nishnabotna River, on downstream guardrail post at center of bridge, a chiseled arrow. Elev. 986.62 feet.

7039-27 NW (3) - (Reference point) About 0.3 mile west of Essex, on county road bridge over East Nishnabotna River, on downstream guardrail, between 8th and 9th guardrail posts, a filed arrow. Elev. 986.58 feet.

7041-8 SE (1) - About 0.5 mile west of Randolph, on State Highway 184 bridge over West Nishnabotna River, on upstream curb near left end of bridge, a standard U.S. Coast and Geodetic Survey brass tablet stamped "AA-158, 1973". Elev. 967.309 feet.

7041-17 NW (1) - About 0.5 mile west of Randolph, on State Highway 184 bridge over West Nishnabotna River, on downstream curb near right end of bridge, an Iowa Highway Commission bench mark. Elev. 967.24 feet.

7041-31 NW (1) - About 5.5 miles north of Sidney, at intersection of county roads at northeast corner of section 31, at southeast corner of intersection, in north side of power pole 1 foot above ground, a pole spike and collar. Elev. 1042.31 feet.

7041-32 NW (1) - About 3 miles south of Randolph, on county road J22 bridge over West Nishnabotna River, on downstream guardrail, on top of first bolt from left end of guardrail. Elev. 958.42 feet.

7041-32 NW (2) - (Reference point) About 3 miles south of Randolph, on county road J22 bridge over West Nishnabotna River, on downstream guardrail at center of bridge, 3 filed marks. Elev. 959.29 feet.

7041-32 NW (3) - About 3 miles south of Randolph, on county road J22 bridge over West Nishnabotna River, on downstream wingwall at left end bridge, a chiseled square. Elev. 956.22 feet.

7042-26 SE (1) - About 6 miles north of Sidney, near southeast corner of section 26, 34 feet north and 236 feet west of T-road north, 11 feet east of field entrance, 1 foot south of fence line, standard disk stamped "95 RC 1955 1106". Elev. 1106.103 feet.

7138-18 SE (1) - About 1.9 miles northeast along the Burlington and Northern Railroad from station at Coburg, at a road crossing, 855 feet north of railroad trestle, 129 feet south of centerline of east-west road, 10.7 feet west of west rail, 2.0 feet lower than railroad, set in top of center of west headwall of a 9 x 3 foot concrete culvert, a standard U.S. Geological Survey tablet stamped "G 161 1949". Elev. 1011.442 feet.

7138-19 NW (1) - About 1.5 miles north of Coburg, on county road H46 bridge over East Nishnabotna River, on top of first bolt on guardrail from left downstream end of bridge, a chiseled cross on bolt. Elev. 1020.64 feet.

7138-19 NW (2) - (Reference point) About 1.5 miles north of Coburg, on county road H46 bridge over East Nishnabotna River, on downstream guardrail, centered between piers, a chiseled arrow. Elev. 1020.89 feet.

7138-30 SW (1) - At Coburg, 153 feet northeast of station at Coburg, 49 feet north of centerline of road, 33 feet east of east rail of main track, 9.3 feet northwest of a telephone pole, 1.0 foot west of reference post, set in top of a concrete post projecting 0.3 foot above ground, a standard U.S. Geological Survey tablet stamped "M 98 1935". Elev. 1003.600 feet.

7139-36 NE (1) - About 0.5 mile west of Coburg, on county road H54 bridge over East Nishnabotna River, on left downstream abutment, a chiseled square. Elev. 1009.58 feet.

7139-36 NE (2) - (Reference point) About 0.5 mile west of Coburg, on county road H54 bridge over East Nishnabotna River, on 2nd guardrail post right of left downstream pier, a chiseled arrow. Elev. 1013.53 feet.

7141-2 NW (1) - About 3 miles northwest of Strahan, on county road bridge over West Nishnabotna River, on downstream end of left pier, on top of left downstream corner of I-beam. Also see 7241-35 SW (1). Elev. 989.60 feet.

7141-2 NW (2) - (Reference point) About 3 miles northwest of Strahan, on county road bridge over West Nishnabotna River, on downstream guardrail at center of bridge, on horizontal bolt, a chiseled arrow. Also see 7241-35 SW (1). Elev. 995.30 feet.

7141-2 NW (3) - About 3 miles southeast of Malvern, on railroad bridge over West Nishnabotna River, on top of left downstream abutment, a chiseled square. Elev. 987.10 feet.

7141-2 NW (4) - (Reference point) About 3 miles southeast of Malvern, on railroad bridge over West Nishnabotna River, at downstream side of bridge at center of bridge, on top of bolt head at vertical upright, a chiseled cross. Elev. 991.84 feet.

7141-4 NE (1) - From Malvern, 2.2 miles southeast along railroad track from station, at a road crossing, 51 feet west of centerline of road, 42 feet south of centerline of track, 7 feet southeast of a pole, 4 feet north of a fence, and about 2.5 feet lower than the track, a standard disk stamped "S 97 1935" set in top of a concrete post. Elev. 1001.373 feet.

7141-16 NE (1) - About 3.5 miles south of Malvern, on county road L68 bridge over West Nishnabotna River, on top of left downstream pier, a chiseled square. Elev. 974.83 feet.

7141-16 NE (2) - (Reference point) About 3.5 miles south of Malvern, on county road L68 bridge over West Nishnabotna River, on downstream guardrail, between 2nd and 3rd vertical truss member from left end of bridge, a filed arrow. Elev. 982.81 feet.

7141-22 NW (1) - About 3 miles west of Strahan, 42 feet north of intersection of county roads L68 and H46, at 10 X 12 foot concrete culvert, on top of south end of east culvert headwall, a standard disk stamped "FF 158 1949". Elev. 973.597 feet.

7238-8 SE (1) - (Reference point) About 1.5 miles north of Red Oak, on State Highway 48 bridge over East Nishnabotna River, on downstream curb, at 2nd guardrail post from right pier, a chiseled square. Elev. 1051.83 feet.

7238-9 SW (1) - About 1.5 miles north of Red Oak, on State Highway 48 bridge over East Nishnabotna River, on left upstream abutment, an Iowa Highway Commission bench mark. Elev. 1049.50 feet.

7238-9 SW (2) - About 1.5 miles north of Red Oak, on State Highway 48 bridge over East Nishnabotna River, on upstream curb at left end of bridge, an Iowa Highway Commission bench mark. (Unable to locate 6/2/89.) Elev. 1054.88 feet.

7238-16 NW (1) - About 1.3 miles north along State Highway 48 from U.S. Highway 34 at Red Oak, at railroad signal, on top of threaded bolt on northwest corner of railroad signal base, a chiseled cross. Elev. 1053.54 feet.

7238-20 NE (1) - At Red Oak, 0.4 mile west of intersection of U.S.Highways 34 and 48, 10 feet west of railroad track, at railroad crossing signal south of U.S. Highway 34, on top of threaded bolt on northeast corner of railroad signal base, a chiseled cross. Elev. 1036.63 feet.

7238-20 SE (1) - At Red Oak, on county road H34 bridge over East Nishnabotna River, on upstream end of right pier, a brass disk. Also see 7238-29 SE (1). Elev. 1033.60 feet.

7238-20 NW (1) - About 1 mile northwest of Red Oak, on U.S. Highway 34 bridge over East Nishnabotna River, on left downstream abutment, an Iowa Highway Commission bench mark. Elev. 1041.91 feet.

7238-20 NW (2) - (Reference point) About 1 mile northwest of Red Oak, on U.S. Highway 34 bridge over East Nishnabotna River, on downstream curb at left pier, a chiseled square. Elev. 1042.60 feet.

7238-29 SE (1) - (Reference point) At Red Oak, on county road H34 bridge over East Nishnabotna River, on downstream guardrail, near 2nd vertical truss member from right end of bridge, a filed arrow. Also see 7238-20 SE (1). Elev. 1041.68 feet.

7238-29 SE (2) - At west edge of Red Oak, on Coolbaugh Street bridge over East Nishnabotna River, on left upstream concrete abutment, a standard U.S. Army Corps of Engineers disk. Elev. 1032.74 feet.

7239-19 NW (1) - About 1 mile northeast of Emerson, on U.S. Highway 34 bridge over Indian Creek, on right downstream wingwall, an Iowa Highway Commission bench mark. Elev. 1068.08 feet.

7239-19 NW (2) - (Reference point) About 1 mile northeast of Emerson, on U.S. Highway 34 bridge over Indian Creek, on downstream curb, 70 feet from left abutment, a 3/8 inch bolt. Elev. 1068.67 feet.

7240-5 SW (1) - About 2.5 miles north of Hastings, on county road M16 about 0.2 mile north of county road H26, about 0.1 mile north of farmhouse, 35 feet east of centerline of road, 28 feet north of centerline of field entrance road, 1 foot west of east right of way fence, 1.3 feet south of a reference post, a standard disk stamped "Z 147 1949" set in top of a concrete post. Elev. 1032.688 feet.

7240-7 NW (1) - About 2 miles north of Hastings, on county road H26 bridge over West Nishnabotna River, near left downstream corner of right downstream pier, a chiseled square. Elev. 1011.33 feet.

7240-7 NW (2) - (Reference point) About 2 miles north of Hastings, county road H26 bridge over West Nishnabotna River, on downstream guardrail, at 2nd vertical truss member from right end of bridge, a filed arrow. Elev. 1016.99 feet.

7240-19 NW (1) - At Hastings, on county road M16 bridge over Indian Creek, about 250 feet south of U.S. Highway 34, on right upstream abutment about 0.5 foot above road level, a standard disk stamped "W 147 1949". Elev. 1008.236 feet.

7240-20 SE (1) - (Reference Point) About 3 miles west of Emerson, on county road bridge over Indian Creek, on 8th guardail post from right downstream abutment, 3 chisel marks. Elev. 1026.05 feet.

7240-21 SE (1) - About 2 miles west of Emerson, on county road M21 bridge over Indian Creek, on end of left downstream wingwall, top of nut. Elev. 1040.89 feet.

7240-21 SE (2) - (Reference point) About 2 miles west of Emerson, on county road M21 bridge over Indian Creek, on downstream guardrail, 40 feet from right abutment, a chiseled ledge. Elev. 1040.40 feet.

7240-21 SW (1) - About 3 miles west of Emerson, on county road bridge over Indian Creek, on top of right upstream wingpost, a painted square. Elev. 1026.63 feet.

7240-23 SE (1) - At west edge of Emerson, at northwest corner of Harris and Morton Streets, on fire hydrant, top of nut. Elev. 1073.35 feet.

7240-24 SW (1) - At Emerson, at northeast corner of Howland and Morton Streets, on fire hydrant, "O" in "IOWA". Elev. 1055.92 feet.

7240-24 SW (2) - (Reference point) Near east edge of Emerson, on county road H34 bridge over Indian Creek, on center of downstream guardrail, a chiseled arrow. Elev. 1060.00 feet.

7240-24 SW (3) - Near east edge of Emerson, on county road H34 bridge over Indian Creek, on left downstream abutment, a chiseled square. Elev. 1057.10 feet.

7240-24 NW (1) - About 0.5 mile northeast of Emerson and about 0.5 mile downstream from U.S. Highway 34, on unimproved county road culvert over Indian Creek, on top of culvert. Elev. 1064.34 feet.

7240-26 NE (1) - Near southwest corner of Emerson, on county road bridge over Indian Creek, on right downstream curb, a chiseled cross. Elev. 1050.75 feet.

7240-26 NE (2) - (Reference point) Near southwest corner of Emerson, on county road bridge over Indian Creek, on center downstream guardrail post, 3 chisel marks. Elev. 1052.81 feet.

7240-26 NW (1) - About 1 mile west of Emerson, on county road concrete culvert over Indian Creek, on downstream headwall, a painted square. Elev. 1050.02 feet.

7240-26 NW (2) - About 1 mile west of Emerson, on county road bridge over Indian Creek, on right upstream abutment pile cap, a railroad spike. Elev. 1041.07 feet.

7240-27 NE (1) - (Reference point) About 1 mile west of Emerson, on county road bridge over Indian Creek, on 3rd angle iron support from right downstream abutment, 3 chisel marks. Elev. 1046.33 feet.

7240-30 SW (1) - About 1.5 miles south of Hastings, at intersection of county roads M16 and H38, in northeast corner of intersection, 78 feet east of centerline of county road M16, 30 feet north of centerline of county road H38, 44 feet east of a power pole, 1 foot south of the north right-of-way fence, 1.4 feet west of a witness post, a standard disk stamped "U 147 1949" set in top of a concrete post. Elev. 1077.724 feet.

7241-13 SE (1) - (Reference point) Near northwest corner of Hastings, on U.S. Highway 34 bridge over Indian Creek, on center of downstream guardrail, 3 chisel marks. Elev. 1010.50 feet.

7241-23 SE (1) - About 1.5 miles west of Hastings, on railroad bridge over West Nishnabotna River, on left downstream wingwall, a chiseled square. Elev. 1002.92 feet.

7241-23 SE (2) - (Reference point) About 1.5 miles west of Hastings, on railroad bridge over West Nishnabotna River, at center of downstream side of bridge, on top of a bolt head across from a guardrail post, a chiseled arrow. Elev. 1007.50 feet.

7241-24 NE (1) - Near north edge of Hastings, on U.S. Highway 34 bridge over Indian Creek, on left upstream wingwall, a chiseled cross. Elev. 1008.08 feet.

7241-24 NE (2) - (Reference point) Near north edge of Hastings, on county road M16 bridge over Indian Creek, on downstream guardrail, about 25 feet from right pier, a chiseled arrow. Elev. 1011.25 feet.

7241-24 NW (1) - About 0.5 mile west of Hastings, on U.S. Highway 34 bridge over West Nishnabotna River, on right upstream wingwall guardrail, an Iowa Highway Commission bench mark (7/90). Elev. 1009.57 feet.

7241-24 NW (2) - (Reference point) About 0.5 mile west of Hastings, on U.S. Highway 34 bridge over West Nishnabotna River, on center of downstream guardrail, a chiseled square (7/90). Elev. 1009.93 feet.

7241-24 NW (3) - About 0.5 mile west of Hastings, on U.S. Highway 34 bridge over West Nishnabotna River, on left downstream wingwall guardrail, an Iowa Highway Commission bench mark (7/90). Elev. 1009.84 feet.

7241-35 NE (1) - About 2 miles southwest of Hastings, on county road H38 bridge over West Nishnabotna River, on end of left downstream abutment, a chiseled square. Elev. 996.02 feet.

7241-35 NE (2) - (Reference point) About 2 miles southwest of Hastings, on county road H38 bridge over West Nishnabotna River, on downstream guardrail, at 1st vertical truss member from left end of bridge, a filed arrow. Elev. 1002.18 feet.

7241-35 SW (1) - About 3 miles northwest of Strahan, on county road bridge over West Nishnabotna River, on upstream guardrail at right end of bridge, on first bolt head from end of guardrail, a chiseled cross. Also see 7141-2 NW (1-2). Elev. 995.47 feet.

7338-1 SE (1) - At Elliott, southeast of railroad, 42 feet south of south curb of street and 36 feet west of east rail of main track, a standard U.S. Geological Survey tablet stamped "Y 98 1935" set in a concrete post. Elev. 1075.415 feet.

7338-2 SE (1) - About 0.5 mile west of Elliott, on State Highway 48 bridge over East Nishnabotna River, on right upstream abutment, an Iowa Highway Commission bench mark. Elev. 1081.33 feet.

7338-11 NE (1) -(Reference point) About 0.5 mile west of Elliott, on State Highway 48 bridge over East Nishnabotna River, on downstream curb at center guardrail post, a chiseled square. Elev. 1079.21 feet.

7338-12 NW (1) - South of Elliott, at intersection of State Highway 48 and county road M55, southwest of intersection, in tallest of 2 telephone poles, in north side of pole, a pole spike and collar. Elev. 1070.52 feet.

7338-14 SE (1) - About 2 miles north of Stennett, on railroad bridge over creek, over right upstream pile cap, a 1.5 inch drift pin. Elev. 1059.12 feet.

7338-14 SE (2) - About 2 miles north of Stennett, at a private-road crossing, 48 feet southeast of centerline of railroad track, 21 feet northeast of centerline of private road, 57 feet southwest of a pole, 5 feet northwest of right-of-way fence, a standard disk stamped "W 98 1935" set in top of a concrete post. Elev. 1059.827 feet.

7338-23 SW (1) - About 1 mile north of Stennett, on dead-end road, in pole west of railroad, nail and disk in pole 1 foot above ground. Elev. 1060.51 feet.

7338-34 NW (1) - About 0.5 mile southwest of Stennett, on county road H20 bridge over East Nishnabotna River, on curb at left downstream end of bridge, a chiseled cross. Elev. 1058.64 feet.

7338-34 NW (2) - (Reference point) About 0.5 mile southwest of Stennett, on county road H20 bridge over East Nishnabotna River, on downstream guardrail, centered between 2 left piers, a chiseled arrow. Elev. 1060.97 feet.

7338-34 NW (3) - About 0.5 mile southwest of Stennett, on county road H20 bridge over East Nishnabotna River, on downstream wingwall curb, at left end of bridge, a chiseled square. Elev. 1058.60 feet.

7340-3 SW (1) - About 1 mile northwest of Henderson, on county road H12 bridge over West Nishnabotna River, at left end of upstream guardrail, a chiseled square in concrete. Also see 7340-10 NW (1-4). Elev. 1045.38 feet.

7340-3 NW (1) - About 1.2 miles north of Henderson, on county road M21 bridge over small creek, on left downstream side, a chiseled square. Elev. 1044.78 feet.

7340-10 NW (1) - About 1 mile northwest of Henderson, on county road H12 bridge over West Nishnabotna River, at right end of downstream guardrail, a chiseled square in concrete. Also see 7340-3 SW (1). Elev. 1043.65 feet.

7340-10 NW (2) - (Reference point) About 1 mile northwest of Henderson, on county road H12 bridge over West Nishnabotna River, on downstream guardrail, 137 feet east of 7340-10 NW (1), a filed arrow. Also see 7340-3 SW (1). Elev. 1044.33 feet.

7340-10 NW (3)- About 1 mile northwest of Henderson, on county road H12 bridge over West Nishnabotna River, at left end of downstream guardrail, a chiseled square in concrete. Also see 7340-3 SW (1).
Elev. 1045.42 feet.

7340-10 NW (4) - About 1 mile northwest of Henderson, on county road H12 bridge over West Nishnabotna River, on concrete centerline of bridge deck, 143 feet east of 7340-10 NW (1), a chiseled cross. Also see 7340-3 SW (1). Elev. 1041.90 feet.

7340-30 SE (1) - About 4 miles north of Hastings, on county road M16 bridge over West Nishnabotna River, on downstream end of right pier, a standard tablet stamped "C 148 1949". Elev. 1014.047 feet.

7340-30 SE (2) - (Reference point) About 4 miles north of Hastings, on county road M16 bridge over West Nishnabotna River, on downstream guardrail, at 5th vertical truss member from left end of bridge, a filed arrow. Elev. 1022.64 feet.

7437-6 SE (1) - At Griswold, at the public school, 102 feet west of main entrance, 1 foot southwest of flag pole, a standard U.S. Geological Survey tablet stamped "Griswold 1934". Elev 1103.147 feet.

7438-1 SE (1) - About 1 mile west of Griswold, on State Highway 92 bridge over East Nishnabotna River, on right downstream abutment, an Iowa Highway Commission bench mark. (Unable to locate 6/1/89.)
Elev. 1100.77 feet.

7438-1 SE (2) - (Reference point) About 1 mile west of Griswold, on State Highway 92 bridge over East Nishnabotna River, on 10th guardrail post from right downstream end of bridge, a chiseled arrow.
Elev. 1103.42 feet.

7438-1 SE (3) - About 1 mile west of Griswold, on State Highway 92 bridge over East Nishnabotna River, on right downstream wingwall, a chiseled cross. (Elevation to be surveyed.)

7438-36 NE (1) - About 1.7 miles north of Elliott, along Chicago, Burlington and Quincy Railroad, southwest of county road G66 crossing, 34.5 feet south of centerline of county road G66 and 35.5 feet west of centerline of tracks, a standard U.S. Geological Survey tablet stamped "Z 98 1935" set in a concrete post. Elev. 1086.195 feet.

7438-36 NW (1) - About 1.5 miles north of Elliott, on county road G66 bridge over East Nishnabotna River, on right downstream wingwall, top of bolt head. Elev. 1081.38 feet.

7438-36 NW (2) - (Reference point) About 1.5 miles north of Elliott, on county road G66 bridge over East Nishnabotna River, on downstream guardrail, between 24th and 25th guardrail posts from right end of bridge, a chiseled arrow. (Unable to locate 6/2/89.)
Elev. 1083.62 feet.

7438-36 NW (3) - (Reference point) About 1.5 miles north of Elliott, on county road G66 bridge over East Nishnabotna River, on downstream curb, between 14th and 15th guardrail posts from left end of bridge, a chiseled square. Elev. 1081.77 feet.

7440-3 NE (1) - At northwest edge of Carson, on county road bridge over West Nishnabotna River, on right downstream pier, a chiseled square. Elev. 1063.66 feet.

7440-3 NE (2) - (Reference point) At northwest edge of Carson, on county road bridge over West Nishnabotna River, on 3rd vertical truss member from right downstream end of bridge, a filed mark. Elev. 1070.28 feet.

7440-10 NE (1) - At Carson, at intersection of State Highway 92 and Commercial Street, southwest of intersection, 57 feet south of centerline of State Highway 92, 47 feet east of east rail of the railroad tracks, 1 foot northwest of a driven railroad rail projecting 0.6 foot above ground, a standard disk stamped "H 149 reset 1955" set in top of a concrete post. Elev. 1067.428 feet.

7440-10 NE (2) - At Carson, on State Highway 92 bridge over West Nishnabotna River, on left downstream abutment, a steel pin. Elev. 1076.38 feet.

7440-10 NE (3) - (Reference point) At Carson, on State Highway 92 bridge over West Nishnabotna River, on downstream curb, at 20th guardrail post from left end of bridge, a chiseled square. Elev. 1081.19 feet.

7440-21 SE (1) - About 1 mile west of Macedonia, on county road G66 bridge over West Nishnabotna River, on top of left downstream wingwall, a chiseled square. Elev. 1057.70 feet.

7440-21 SE (2) - (Reference point) About 1 mile west of Macedonia, on county road G66 bridge over West Nishnabotna River, on 22nd guardrail post from left downstream end of bridge, a filed arrow. Elev. 1060.34 feet.

7440-22 SE (1) - At Macedonia, at intersection of county roads M21 and G66, 29 feet east and 55 feet south of intersection, at base of power pole, a pole spike and collar. Elev. 1105.57 feet.

7440-27 SE (1) - About 1 mile south of Macedonia, on county road M21 culvert over drainage ditch, in center of east headwall, an Iowa Highway Commission bench mark. Elev. 1043.55 feet.

7537-3 SE (1) - About 0.5 mile north of Lewis, on U.S. Highway 6 bridge over East Nishnabotna River, on right upstream wingwall, an Iowa Highway Commission bench mark. Also see 7537-10 NE (1). Elev. 1132.95 feet.

7537-4 SW (1) - About 2 miles west of Lewis, along U.S. Highway 6, 297 feet north and 34 feet east of intersection with north-south county road, north of a telephone pole, 2 feet north of a witness post, a standard U.S. Geological Survey tablet stamped "3 PJH 1968".
Elev. 1209.445 feet.

7537-9 NW (1) - About 2 miles northwest of Lewis, on U.S. Highway 6 bridge over small creek, on left upstream abutment, a chiseled square.
Elev. 1146.22 feet.

7537-10 NE (1) - (Reference point) About 0.5 mile north of Lewis, on U.S. Highway 6 bridge over East Nishnabotna River, on downstream curb, near 20th guardrail post from right end of bridge, a chiseled square. Also see 7537-3 SE (1). Elev. 1132.66 feet.

7537-10 SW (1) - About 0.2 mile west of Lewis, on county road bridge over East Nishnabotna River, on I-beam at right downstream end of truss, a chiseled arrow. Elev. 1122.78 feet.

7537-10 SW (2) - (Reference point) About 0.2 mile west of Lewis, on county road bridge over East Nishnabotna River, on downstream guardrail, centered between 3rd and 4th vertical truss members from right end of bridge, a chiseled arrow. Elev. 1127.78 feet.

7537-18 SE (1) - About 3.5 miles north of Griswold, on State Highway 48 bridge over East Nishnabotna River, on top of right downstream abutment, a chiseled square. Elev. 1116.39 feet.

7537-19 NE (1) - (Reference point) About 3.5 miles north of Griswold, on State Highway 48 bridge over East Nishnabotna River, on downstream curb, at center guardrail post, a chiseled square.
Elev. 1122.01 feet.

7537-20 SW (1) - About 2.5 miles north of Griswold, along State Highway 48, 27 feet north and 45 feet west of T-road east, on top of north end of a 1.5 foot corrugated pipe culvert, a punched hole "UE 4 PJH A".
Elev. 1124.71 feet.

7537-29 SW (1) - About 1.5 miles north of Griswold, on State Highway 48, 78 feet north, 70.5 feet east and 4.3 feet below crossroads, about 4 feet southeast of power pole, a standard U.S. Geological Survey tablet stamped "5 PJH 1968". Elev. 1110.912 feet.

7537-30 NE (1) - About 2.5 miles north of Griswold, on county road bridge over East Nishnabotna River, above first pier from right downstream side of bridge, top of right downstream bolt. Elev. 1104.43 feet.

7537-30 NE (2) - (Reference point) About 2.5 miles north of Griswold, on county road bridge over East Nishnabotna River, on downstream guardrail, centered between 4th and 5th vertical truss members from right end of bridge, a chiseled arrow. Elev. 1108.35 feet.

7537-30 NE (3) - About 2.5 miles north of Griswold, on county road bridge over East Nishnabotna River, above first pier from right downstream side of bridge, top of left downstream bolt, a filed cross. Elev. 1104.43 feet.

7537-30 NE (4) - (Reference point) About 2.5 miles north of Griswold, on county road bridge over East Nishnabotna River, on downstream guardrail, between 1st and 2nd vertical truss members from left end of bridge, a filed arrow. Elev. 1108.26 feet.

7537-35 SW (1) - About 1.5 miles northwest of Lewis, at intersection of U.S. Highway 6 and north-south county road, at northeast corner of intersection, in south side of telephone pole, a pole spike and collar. Elev. 1198.36 feet.

7540-11 SE (1) - At Oakland, on county road G42 bridge over West Nishnabotna River, on left downstream wingwall, a chiseled square. Elev. 1089.72 feet.

7540-11 SE (2) - (Reference point) At Oakland, on county road G42 bridge over West Nishnabotna River, on 25th guardrail post from left downstream end of bridge, a filed arrow. Elev. 1092.98 feet.

7540-11 SE (3) - (Reference point) At Oakland, on county road G42 bridge over West Nishnabotna River, on 13th guardrail post from left downstream end of bridge, a filed arrow. Elev. 1092.55 feet.

7540-12 SW (1) - At Oakland, on U.S. Highway 59 at the old Citizens State Bank building, in the east face at the southeast corner of the building, a standard tablet stamped "P 147 1949". Elev. 1102.619 feet.

7540-14 SE (1) - About 0.5 mile south of Oakland, on U.S. Highways 6 and 59, 0.2 mile north of junction of U.S. Highways 6 and 59, about 150 feet south of a large red stone farmhouse on west side of highway, 42 feet west of centerline of highway, 19 feet northeast of centerline of a gate, 3 feet west of a corner fence post, 3 feet east of a telephone pole, 1.6 feet south of a fence, a standard tablet stamped "R 149 1949" set in top of a concrete post. Elev. 1093.059 feet.

7540-14 SE (2) - About 1 mile south of Oakland, on U.S. Highway 6 bridge over West Nishnabotna River, on upstream side of right upstream wingwall, top of large nut. Elevation established from 7540-23 NE (1). Elev. 1086.78 feet.

7540-23 NE (1) - About 1 mile south of Oakland, on U.S. Highway 6 bridge over West Nishnabotna River, on top of corner of right downstream wingpost, an Iowa Highway Commission bench mark. Elevation obtained from Iowa Dept. of Transportation. Elev. 1087.52 feet.

7540-23 NE (2) - (Reference point) About 1 mile south of Oakland, on U.S. Highway 6 bridge over West Nishnabotna River, on downstream concrete guardrail, 148 feet from left end of bridge, a chiseled square. Elevation established from 7540-23 NE (1). Elev. 1088.01 feet.

7636-6 SE (1) - At Atlantic, on State Highway 83 bridge over East Nishnabotna River, on curb at right upstream end of bridge, a standard U.S. Geological Survey tablet stamped "X 162 1950". (Unable to locate 6/1/89.) Elev. 1152.98 feet.

7636-6 SE (2) At Atlantic, on State Highway 83 bridge over East Nishnabotna River, on top of wingwall, at right downstream end of bridge, a standard National Geodetic Survey brass tablet. Elevation obtained from Iowa Dept. of Transportation. Elev. 1155.112 feet.

7636-6 SE (3) - (Reference point) At Atlantic, on State Highway 83 bridge over East Nishnabotna River, on 15th guardrail post from right downstream end of bridge, a filed arrow. Elevation established from 7636-6 SE (2). Elev. 1155.17 feet.

7636-6 SE (4) - At Atlantic, on State Highway 83 bridge over East Nishnabotna River, on curb at left upstream end of bridge, an Iowa Highway Commission bench mark. Elev. 1152.91 feet.

7636-6 SE (5) - At west edge of Atlantic, on 6th Street bridge over East Nishnabotna River, on top of left upstream wingpost, a chiseled square. Elev. 1154.18 feet.

7636-6 SE (6) - (Reference point) At west edge of Atlantic, on 6th Street bridge over East Nishnabotna River, on downstream guardrail, near 21st guardrail post from left end of bridge, a filed arrow. Elev. 1154.39 feet.

7637-14 SE (1) - About 3 miles southwest of Atlantic, on county road bridge over East Nishnabotna River, on upstream curb, at right end of bridge, a chiseled square. Elev. 1140.00 feet.

7637-23 NE (1) - About 3 miles southwest of Atlantic, on county road bridge over East Nishnabotna River, on downstream curb, at right end of bridge, a chiseled square. Elev. 1140.02 feet.

7637-23 NE (2) - About 3 miles southwest of Atlantic, on county road bridge over East Nishnabotna River, on downstream curb, between 2nd and 3rd vertical truss members from right end of bridge, a chiseled square. Elev. 1141.13 feet.

7637-26 SW (1) About 2.5 miles north of Lewis, on county road bridge over East Nishnabotna River, on inside of left upstream bridge abutment, a chiseled square. Elev. 1131.76 feet.

7637-26 SW (2) About 2.5 miles north of Lewis, on county road bridge over East Nishnabotna River, on left upstream corner of right upstream bridge abutment, a chiseled square. Elev. 1134.12 feet.

7639-18 NE (1) - About 0.5 mile west of Hancock, on county road G30 bridge over West Nishnabotna River, on downstream curb at right end of bridge, a chiseled square. Elev. 1115.76 feet.

7639-18 NE (2) - About 0.5 mile west of Hancock, on county road G30 bridge over West Nishnabotna River, on downstream curb at left end of bridge, painted "UE 1116.2" from Avoca Quad.84, line 7 in 1962, a chiseled square. Elev. 1115.92 feet.

7639-18 SE (1) - About 0.8 mile south of the Hancock school in Hancock along U.S. Highway 59, 137 feet south of the south edge of railroad bridge, 15 feet northeast of centerline of a field road entrance, 1.5 feet northwest of southeast right of way fence, a standard tablet stampled "J 147 1949" set in top of a concrete post.
Elev. 1108.397 feet.

7639-18 SW (1) - About 1 mile southwest of Hancock, on railroad bridge over West Nishnabotna River, on left upstream wingpost, a chiseled square.
Elev. 1127.34 feet.

7639-18 SW (2) - (Reference point) About 1 mile southwest of Hancock, on railroad bridge over West Nishnabotna River, at center of bridge on downstream side, on top of a bolt head which is on top of a steel crossbar support, a chiseled arrow. Elev. 1129.07 feet.

7736-1 SE (1) - About 0.8 mile east of intersection of Interstate 80 and U.S. Highway 71, on downstream Interstate 80 bridge over East Nishnabotna River, on downstream abutment at right end of bridge, an Iowa Highway Commission bench mark. Elev. 1194.95 feet.

7736-1 SE (2) - (Reference point) About 0.8 mile east of intersection of Interstate 80 and U.S. Highway 71, on downstream Interstate 80 bridge over East Nishnabotna River, on downstream curb, near 19th guardrail post from right end of bridge, a chiseled square.
Elev. 1195.24 feet.

7736-12 NW (1) - About 0.5 mile downstream of Interstate 80, on county road G16 bridge over East Nishnabotna River, on downstream curb at right end of bridge, top of bolt. (Unable to locate 5/31/89.)
Elev. 1191.47 feet.

7736-12 NW (2) - (Reference point) About 0.5 mile downstream of Interstate 80, on county road G16 bridge over East Nishnabotna River, on 14th guardrail post from right downstream end of bridge, a filed arrow.
Elev. 1193.98 feet.

7736-12 NW (3) - About 0.5 mile downstream of Interstate 80, on county road G16 bridge over East Nishnabotna River, on downstream guardrail, at right of 3rd guardrail post from right end of bridge, top of guardrail. Elev. 1193.62 feet.

7736-12 NW (4) - About 0.5 mile downstream of Interstate 80, on county road G16 bridge over East Nishnabotna River, behind wingwall at right downstream end of bridge, a chiseled square.
(Elevation to be surveyed.)

7736-13 SW (1) - About 2.3 miles south of Interstate 80, on U.S. Highway 71 bridge over East Nishnabotna River, on right upstream abutment, a chiseled cross. Elev. 1184.92 feet.

7736-13 NW (1) - About 2 miles south of Interstate 80, on county road bridge over East Nishnabotna River, on right downstream bridge seat, a chiseled cross on bolt. Elev. 1182.09 feet.

7736-13 NW (2) - (Reference point) About 2 miles south of Interstate 80, on county road bridge over East Nishnabotna River, on 3rd vertical truss member from right downstream end of bridge, a chiseled notch at guardrail height. (Unable to locate 5/31/89.) Elev. 1188.02 feet.

7736-13 NW (3)- About 2 miles south of Interstate 80, on county road bridge over East Nishnabotna River, under bridge, in pile at end of right truss, a nail and disk. Elev. 1177.83 feet.

7736-13 NW (4) - About 2 miles south of Interstate 80, on county road bridge over East Nishnabotna River, on 3rd guardrail post from left downstream end of bridge, a filed arrow. Elev. 1187.79 feet.

7736-14 SE (1) - (Reference point) About 2.3 miles south of Interstate 80, on U.S. Highway 71 bridge over East Nishnabotna River, on downstream curb, at 19th guardrail post from right end of bridge, a chiseled arrow. Elev. 1185.08 feet.

7736-27 SW (1) - About 1.5 miles northeast of Atlantic, on county road bridge over East Nishnabotna River, at left end of downstream side of bridge truss, a chiseled cross on bolt. Elev. 1164.62 feet.

7736-27 SW (2) - (Reference point) About 1.5 miles northeast of Atlantic, at county road bridge over East Nishnabotna River, on center vertical truss member on downstream side of bridge, a filed mark. Elev. 1169.68 feet.

7736-27 SW (3) - (Reference point) About 1.5 miles northeast of Atlantic, on county road bridge over East Nishnabotna River, on downstream low-steel, at 5th vertical truss member from left end of bridge, a filed arrow. Elev. 1164.70 feet.

7736-28 SW (1) - About 1.5 miles north of Atlantic, on county road over East Nishnabotna River, on bridge truss seat at left downstream end of bridge, a chiseled cross on bolt. Elev. 1158.92 feet.

7736-28 SW (2) - (Reference point) About 1.5 miles north of Alantic, on county road over East Nishnabotna River, on downstream side of bridge, on left leg of middle cross member of bridge truss, a filed mark at guardrail height. Elev. 1164.17 feet.

7736-32 NE (1)- (Reference point) About 1.2 miles north of Atlantic, on county road N16 bridge over East Nishnabotna River, on downstream guardrail post at center of bridge, a chiseled arrow. Elev. 1163.41 feet.

7736-32 SW (1) - About 0.5 mile northwest of Atlantic, on county road bridge over East Nishnabotna River, on bridge seat at left downstream end of bridge truss, a filed cross on bolt. Elev. 1149.76 feet.

7736-32 SW (2) - (Reference point) About 0.5 mile northwest of Atlantic, on county road bridge over East Nishnabotna River, on downstream guardrail, between center vertical truss members, a chiseled arrow. Elev. 1155.42 feet.

7736-33 NW (1) - About 1.2 miles north of Atlantic, on county road N16 bridge over East Nishnabotna River, on top of left upstream wingwall, a chiseled square. Elev. 1161.05 feet.

7739-5 SE (1) - About 1.5 miles north of Avoca, on downstream Interstate 80 bridge over West Nishnabotna River, on right downstream wingwall behind wingpost, an Iowa Highway Commission bench mark. Elev. 1147.87 feet.

7739-5 SE (2) - (Reference point) About 1.5 miles north of Avoca, on downstream Interstate 80 bridge over West Nishnabotna River, on downstream curb, between 16th and 17th guardrail posts from right end of bridge, a chiseled square. Elev. 1148.89 feet.

7739-5 NW (1) - About 2 miles northwest of Avoca, at a concrete culvert under railroad, about 300 feet north of center of Interstate 80 overpass, 39 feet south of centerline of east-west gravel road, 16 feet south of center of railroad bridge 88, on east end of culvert headwall, a standard disk stamped "T 146 RESET 1964". Elev. 1158.296 feet.

7739-16 NW (1) - At Avoca, about 0.2 mile west along railroad from station in Avoca, at a road crossing, 148 feet south of south rail of main track, 52 feet east of centerline of Pine Street, 65 feet southeast of a railroad crossing sign post, 1.1 feet north of a fence, 1.2 feet east of a reference post, a standard tablet stamped "R 146 1949" set in top of a concrete post. Elev. 1137.681 feet.

7739-17 NE (1) - About 1 mile west of Avoca, on State Highway 83 bridge over West Nishnabotna River, on right downstream wingpost, an Iowa Highway Commission bench mark. Elev. 1142.02 feet.

7739-17 NE (2) - (Reference point) About 1 mile west of Avoca, on State Highway 83 bridge over West Nishnabotna River, on 14th guardrail post from right downstream end of bridge, a chiseled arrow. Elev. 1140.07 feet.

7739-17 SE (1) - About 1 mile west of Avoca, on Union Street bridge over West Nishnabotna River, at left downstream corner of bridge, top of bolt painted "UE". (Bridge abandoned 6/13/89.) Elev. 1131.20 feet.

7739-17 SE (2) - (Reference point) About 1 mile west of Avoca, on Union Street bridge over West Nishnabotna River, on downstream side of bridge, on 3rd vertical truss member from left end of bridge, a filed notch. (Bridge abandoned 6/13/89.) Elev. 1135.68 feet.

7835-SW (1) - At Exira, on U.S. Highway 71 bridge over East Nishnabotna River, on left downstream wingwall curb, a standard National Geodetic Survey brass tablet. Elevation obtained from Iowa Dept. of Transportation. Elev. 1233.506 feet.

7835-4 SW (2) - (Reference point) At Exira, on U.S. Highway 71 bridge over East Nishnabotna River, on downstream concrete guardrail, 159 feet from brass tablet on left downstream end of bridge, a chiseled square. Elevation established from 7835-4 SW (1). Elev. 1236.40 feet.

7835-4 NW (1) - At Exira, on county road F58 bridge over East Nishnabotna River, on downstream abutment at right end of bridge, a chiseled square. Elev. 1228.13 feet.

7835-4 NW (2) - (Reference point) At Exira, on county road F58 bridge over East Nishnabotna River, on 13th guardrail post from right downstream end of bridge, a filed arrow. Elev. 1230.07 feet.

7835-19 NE (1) - About 0.5 mile east of Brayton, on county road bridge over East Nishnabotna River, on downstream wingwall at right end of bridge, a chiseled square. (Unable to locate 5/31/89.) Elev. 1214.69 feet.

7835-19 NE (2) - (Reference point) About 0.5 mile east of Brayton, on county road bridge over East Nishnabotna River, on 17th guardrail post from right downstream end of bridge, a filed arrow. Elev. 1216.77 feet.

7835-19 NE (3) - (Reference point) About 0.5 mile east of Brayton, on county road bridge over East Nishnabotna River, on 20th guardrail post from right downstream end of bridge, a filed cross. (Elevation to be surveyed.)

7835-19 NE (4) - About 0.5 mile east of Brayton, on county road bridge over East Nishnabotna River, on right downstream wingwall, a chiseled cross. (Elevation to be surveyed.)

7835-19 NE (5) - About 0.5 mile east of Brayton, on county road bridge over East Nishnabotna River, at extreme end of right downstream wingwall, a deeply chiseled cross. (Elevation to be surveyed.)

7835-19 SW (1) - About 0.4 mile south along railroad from intersection with East Main Street in Brayton, on railroad bridge marked 451.7, at upstream side of bridge at right abutment, a pole spike and collar in top beam. Elev. 1206.90 feet.

7835-29 NW (1) - About 1 mile southeast of Brayton, near north sixteenth corner between sections 29 and 30, 32 feet north and 510 feet east of T-road east, 172 feet east of fence, 2 feet west of power pole, a standard disk stamped "11 LB 1956" set in a concrete post. Elev. 1356.660 feet.

7836-24 SE (1) - About 0.2 mile south of Brayton, on railroad bridge over creek, at upstream side of bridge on right abutment, a pole spike and collar. Elev. 1204.66 feet.

7836-25 SW (1) - About 1.8 mile south along railroad from intersection with East Main Street in Brayton, on railroad bridge marked 450.3, at upstream side of bridge at right abutment, a pole spike and collar in top beam. Elev. 1195.77 feet.

7836-36 SE (1) - About 2 miles south of Brayton and 1 mile north of Interstate 80, on county road bridge over East Nishnabotna River, on end of left downstream wingwall, a chiseled square. (Elevation to be surveyed.)

7836-36 SE (2) - (Reference point) About 2 miles south of Brayton and 1 mile north of Interstate 80, on county road bridge over East Nishnabotna River, on 17th guardrail post from right downstream end of bridge, a filed arrow. (Elevation to be surveyed.)

7836-36 SW (1) - Near county line about 2.5 miles south of Brayton, at pipeline crossing over East Nishnabotna River, most westerly pipeline support, filed cross on center I-beam. Elev. 1193.57 feet.

7839-4 SE (1) - At the Harlan Municipal airport, about 4 miles south of Harlan, 2.1 feet north of northwest corner of main hanger and office, 3 feet northeast of the northeast corner of concrete sidewalk on west side of hangar, a standard tablet stamped "L 150 1949" set in a concrete post. Elev. 1192.895 feet.

7839-9 SE (1) - About 5 miles south of Harlan, on U.S. Highway 59 bridge over West Nishnabotna River, on right downstream wingpost, a chiseled square. Elev. 1175.06 feet.

7839-9 SE (2) - (Reference point) About 5 miles south of Harlan, on U.S. Highway 59 bridge over West Nishnabotna River, on 30th guardrail post from right downstream end of bridge, a chiseled arrow. Elev. 1172.74 feet.

7839-9 SE (3) - About 5 miles south of Harlan, on U.S. Highway 59 bridge over West Nishnabotna River, on upstream curb at left end of bridge, a chiseled cross. Elevation obtained from Iowa Dept. of Transportation. Elev. 1172.67 feet.

7839-10 NW (1) - At Corley, on county road F58 bridge over West Nishnabotna River, on right downstream wingpost, a chiseled square. (Unable to locate 6/9/89.) Elev. 1177.74 feet.

7839-10 NW (2) - (Reference point) At Corley, on county road F58 bridge over West Nishnabotna River, on 15th guardrail post from right downstream end of bridge, a filed arrow. Elev. 1177.94 feet.

7839-10 NW (3) - At Corley, on county road F58 bridge over West Nishnabotna River, on downstream curb, behind wingwall at right end of bridge, a chiseled square. (Elevation to be surveyed.)

7839-28 SW (1) - About 3 miles north of Avoca along U.S. Highway 59, at a road crossing, 89 feet north of center of farm driveway, 80 feet west of center of U.S. Highway 59, 1 foot north of a witness post, a standard tablet stamped "83-19 RESET 1970" set in a concrete post. Elev. 1161.886 feet.

7839-32 SE (1) - About 2 miles north of Avoca, on county road F66 bridge over West Nishnabotna River, on downstream concrete guardrail, at right end of bridge, a chiseled square. Elevation established from 7839-32 SE (3). Elev. 1153.50 feet.

7839-32 SE (2) - (Reference point) About 2 miles north of Avoca, on county road F66 bridge over West Nishnabotna River, on downstream concrete guardrail, 151 feet from right end of bridge, a chiseled square. Elevation established from 7839-32 SE (3). Elev. 1152.70 feet.

7839-32 SE (3) - About 2 miles north of Avoca, at a grain bin about 600 feet east of county road F66 bridge over West Nishnabotna River, on southeast corner of cement platform, a chiseled cross. Elevation obtained from Shelby County Engineer. Elev. 1143.01 feet.

7839-33 NW (1) - About 2 miles north of Avoca, at northwest corner of intersection of U.S. Highway 59 and county road F66, on north side of pole 2 feet above ground, a nail and disk. Elev. 1146.31 feet.

7935-15 SE (1) - About 0.5 mile south of Hamlin, on U.S. Highway 71 bridge over East Nishnabotna River, on upstream abutment at left end of bridge, a chiseled square. (Unable to locate 5/30/89.) Elev. 1258.47 feet.

7935-15 SE (2) - (Reference point) About 0.5 mile south of Hamlin, on U.S. Highway 71 bridge over East Nishnabotna River, on downstream curb, at 13th guardrail post from left end of bridge, a chiseled arrow. Elev. 1258.57 feet.

7935-15 SE (3) - About 0.5 mile south of Hamlin, on U.S. Highway 71 bridge over East Nishnabotna River, on upstream abutment at left end of bridge, a chiseled cross. (Elevation to be surveyed.)

7935-15 SE (4) - (Reference point) About 0.5 mile south of Hamlin, on U.S. Highway 71 bridge over East Nishnabotna River, on downstream curb, at 16th guardrail post from left end of bridge, a chiseled cross. (Elevation to be surveyed.)

7935-22 NE (1) - About 1.5 miles south of Hamlin, on county road bridge over East Nishnabotna River, on right end of truss on downstream side of bridge, a filed cross. (Unable to locate 5/30/89.) Elev. 1251.48 feet.

7935-22 NE (2) - (Reference point) About 1.5 miles south of Hamlin, on county road bridge over East Nishnabotna River, on downstream guardrail, between 2nd and 3rd vertical truss members from right end of bridge, a filed arrow. Elev. 1255.14 feet.

7935-22 NE (3) - About 1.5 miles south of Hamlin, on county road bridge over East Nishnabotna River, on right end of bridge truss 0.9 feet below downstream bridge deck, a filed arrow.
(Elevation to be surveyed.)

7935-27 NE (1) - About 2.5 miles north of Exira, on county road bridge over East Nishnabotna River, on top of downstream wingwall at left end of bridge, a chiseled square. Elevation established from 7935-27 NE (3). Elev. 1249.77 feet.

7935-27 NE (2) - (Reference point) About 2.5 miles north of Exira, on county road bridge over East Nishnabotna River, at center of downstream concrete guardrail, a chiseled cross. Elevation established from 7935-27 NE (3). Elev. 1249.90 feet.

7935-27 NE (3) - About 2.5 miles north of Exira, about 100 feet east of county road bridge over East Nishnabotna River, a spike in corner post of fence. Elevation obtained from Audubon County Engineer.
Elev. 1246.52 feet.

7935-34 NE (1) - About 1.5 miles north of Exira, on county road bridge over East Nishnabotna River, at right end of truss on downstream side of bridge, a filed cross on bolt. Elev. 1241.16 feet.

7935-34 NE (2) - (Reference point) About 1.5 miles north of Exira, on county road bridge over East Nishnabotna River, on downstream guardrail at center of bridge, a filed arrow. Elev. 1244.78 feet.

7935-35 SW (1) - About 0.5 mile north of Exira, on county road bridge over East Nishnabotna River, at right end of truss on downstream side of bridge, on top of landward bolt, a filed cross. Elev. 1232.17 feet.

7935-35 SW (2) - (Reference point) About 0.5 mile north of Exira, on county road bridge over East Nishnabotna River, on downstream guardrail, between 1st and 2nd vertical truss members from right end of bridge, a filed arrow. Elev. 1235.90 feet.

7938-4 SE (1) - About 2 miles northeast of Harlan, on county road bridge over West Nishnabotna River, on left upstream bridge seat, on 1 inch bolt head, a chiseled cross. Elev. 1204.41 feet.

7938-4 SE (2) - (Reference point) About 2 miles northeast of Harlan, on county road bridge over West Nishnabotna River, on downstream guardrail, at 3rd vertical truss member from left end of bridge, a filed arrow. Elev. 1210.70 feet.

7938-8 SE (1) - About 1 mile northeast of Harlan, on county road bridge over West Nishnabotna River, on left downstream most landward bolt head, a chiseled cross. Elev. 1200.16 feet.

7938-8 SE (2) - (Reference point) About 1 mile northeast of Harlan, on county road bridge over West Nishnabotna River, on downstream guardrail, at 4th vertical truss member from left end of bridge, a filed arrow. Elev. 1204.07 feet.

7938-8 SW (1) - At northeast edge of Harlan, on bridge over West Fork West Nishnabotna River, on top of right downstream railing, near bridge span, a chiseled cross. Elev. 1202.72 feet.

7938-19 NE (1) - At Harlan, about 1 mile east along State Highway 44 from junction with U.S. Highway 59, on a steel power line tower, on northwest concrete base, a standard disk stamped "V 150 1949". Elev. 1191.458 feet.

7938-19 NE (2) - At Harlan, on State Highway 44 bridge over West Nishnabotna River, on right upstream concrete abutment, an Iowa Highway Commission bench mark. Elevation obtained from Iowa Dept. of Transportation. Elev. 1200.07 feet.

7938-19 NE (3) - (Reference point) At Harlan, on State Highway 44 bridge over West Nishnabotna River, on downstream concrete guardrail, near light base bolts, a chiseled square. Elevation established from 7938-19 NE (2). Elev. 1200.13 feet.

8038-3 SW (1) - About 2 miles north of Kirkman, on county road bridge over West Nishnabotna River, at left upstream corner of bridge, at upstream landward corner, on top of 0.5 inch bolt at left end of truss, a filed cross. Elev. 1240.59 feet.

8038-10 NW (1) - (Reference point) About 2 miles north of Kirkman, on county road bridge over West Nishnabotna River, on 2nd vertical truss member from right downstream end of bridge, a filed mark. Elev. 1244.60 feet.

8038-22 NE (1) - About 0.3 mile northeast of Kirkman, on county road F32 bridge over West Nishnabotna River, on right downstream wingwall, a chiseled square. (Elevation to be surveyed.)

8038-22 NE (2) - (Reference point) About 0.3 mile northeast of Kirkman, on county road F32 bridge over West Nishnabotna River, on right half of downstream concrete guardrail, a chiseled square. (Elevation to be surveyed.)

8038-22 NE (3) - At east edge of Kirkman ,on county road bridge over West Nishnabotna River, at left downstream end of truss, on top of pile cap, a chiseled cross on top of 1 inch bolt head. (Unable to locate 6/8/89.) Elev. 1226.48 feet.

8038-22 NE (4) - (Reference point) At east edge of Kirkman, on county road bridge over West Nishnabotna River, on 2nd vertical truss member from right downstream end of bridge, a filed mark. Elev. 1233.01 feet.

8038-33 NE (1) - About 1.5 miles south of Kirkman, on county road bridge over West Nishnabotna River, on downstream landward corner of left downstream steel pile cap, a chiseled square. Elev. 1216.40 feet.

8038-33 NE (2) - (Reference point) About 1.5 miles south of Kirkman, on county road bridge over West Nishnabotna River, on 4th vertical truss member from left downstream end of bridge, a filed mark. Elev. 1222.30 feet.

8038-33 NE (3) - (Reference point) About 1.5 miles south of Kirkman, on county road bridge over West Nishnabotna River, on downstream guardrail, between 2nd and 3rd vertical truss members from left end of bridge, a filed arrow. Elev. 1222.20 feet.

8137-2 NE (1) - (Reference point) About 7 miles northeast of Irwin, at county-line road bridge over West Nishnabotna River, on 2nd vertical truss member from left downstream end of bridge, a filed mark. Also see 8237-35 SE (1). Elev. 1309.40 feet.

8137-2 SW (1) - About 0.5 mile south of Botna, 0.4 mile south of a church at Botna, 33 feet east of centerline of county road, 81 feet northeast of the third power line pole north of intersection, 3 feet north of third telephone pole north of intersection, 0.8 feet west of a fence, 1.3 feet south of a reference post, a standard tablet stamped "Q 151 1949" set in top of a concrete post. Elev. 1344.558 feet.

8137-3 NE (1) - About 6 miles northeast of Irwin, on county road M56 bridge over West Nishnabotna River, on curb at right downstream end of bridge, a chiseled square. Elev. 1300.50 feet.

8137-3 NE (2) - (Reference point) About 6 miles northeast of Irwin, on county road M56 bridge over West Nishnabotna River, on 13th guardrail post from right downstream end of bridge, a filed arrow. Elev. 1302.34 feet.

8137-3 NE (3) - (Reference point) About 6 miles northeast of Irwin, on county road M56 bridge over West Nishnabotna River, on 8th guardrail post from left downstream end of bridge, a filed arrow. Elev. 1302.32 feet.

8137-3 SW (1) - About 1 mile southwest of Botna, on coutny road F16 bridge over West Nishnabotna River, on steel pile cap at left upstream end of bridge, a chiseled cross on a rivet. (Unable to locate 6/8/89.) Elev. 1294.60 feet.

8137-4 SE (1) - About 1 mile west of Botna, at southeast corner of section 4, near northeast corner of a schoolyard, 204 feet north of centerline of county road F16, 62 feet west of centerline of north-south county road, 30 feet west of a corner fence post, 1.2 feet south of a fence, a standard tablet stamped "P 151 1949" set in a concrete post. Elev. 1339.961 feet.

8137-10 NW (1) - (Reference point) About 1 mile southwest of Botna, on county road F16 bridge over West Nishnabotna River, on downstream side of bridge, on 2nd vertical truss member from left downstream end of bridge, on right side of truss member, a filed notch.
Elev. 1300.29 feet.

8137-16 NE (1) - About 4 miles northeast of Irwin, on county road bridge over West Nishnabotna River, on top of steel pile cap at right downstream end of truss, a chiseled square. (Bridge abandoned 6/8/89.)
Elev. 1286.12 feet.

8137-16 NE (2) - (Reference point) About 4 miles northeast of Irwin, on county road bridge over West Nishnabotna River, on center downstream bridge truss member, on right side of truss member, a filed mark. (Bridge abandoned 6/8/89.) Elev. 1290.58 feet.

8137-21 NE (1) - About 3 miles northeast of Irwin, on county road bridge over West Nishnabotna River, on downstream side of bridge, 3 feet left of right end of center span, on horizontal I-beam support, a chiseled cross. Elev. 1284.82 feet.

8137-21 NE (2) - (Reference point) About 3 miles northeast of Irwin, on county road bridge over West Nishnabotna River, on downstream guardrail, 4 inches left of 5th guardrail post from right end of bridge, a filed arrow. Elev. 1289.44 feet.

8137-21 NE (3) - (Reference point) About 3 miles northeast of Irwin, on county road bridge over West Nishnabotna River, on 3rd guardrail post from left downstream end of bridge, a chiseled arrow.
Elev. 1289.38 feet.

8137-29 SW (1) - (Reference point) About 1 mile northeast of Irwin, on county road bridge over West Nishnabotna River, on 2nd bridge truss member from left downstream end of bridge, a filed notch. (Bridge abandoned 6/8/89.) Elev. 1270.71 feet.

8137-29 NW (1) - About 1 mile northeast of Irwin, on county road bridge over West Nishnabotna River, on pile cap at left upstream end of bridge, a chiseled cross on rivet. (Bridge abandoned 6/8/89.)
Elev. 1266.45 feet.

8137-31 NE (1) - At east edge of Irwin, on county road F24 bridge over West Nishnabotna River, on curb at right downstream abutment, a 2 inch brass cap. Elev. 1264.92 feet.

8137-31 NE (2) - (Reference point) At east edge of Irwin, on county road F24 bridge over West Nishnabotna River, on 2nd guardrail post from right of left downstream pier, a filed arrow. (Unable to locate 6/8/89.) Elev. 1266.89 feet.

8137-31 NE (3) - (Reference point) At east edge of Irwin, on county road F24 bridge over West Nishnabotna River, on 3rd guardrail post from left downstream pier, a filed arrow. Elev. 1267.00 feet.

8138-25 SE (1) - At Irwin, at northwest corner of intersection of county road M47 and county road F24, 52 feet north of centerline of county road F24, 43 feet west of centerline of county road M47, 10.4 feet west of west edge sidewalk, 3.1 feet southwest of corner fence post, 1.6 feet south of a fence, a standard tablet stamped "L 151 1949" set in a concrete post. Elev. 1263.793 feet.

8138-36 SE (1) - At south edge of Irwin, on county road M47 bridge over West Nishnabotna River, on curb of right downstream abutment, a standard tablet stamped USC&GS. Elev. 1262.02 feet.

8138-36 SE (2) -(Reference point) At south edge of Irwin, on county road M47 bridge over West Nishnabotna River, on downstream guardrail at center of bridge, a filed arrow. Elev. 1263.79 feet.

8236-19 NE (1) - About 0.5 mile south of Manning, on county road M66 bridge over West Nishnabotna River, on top of right downstream wingpost, a chiseled square. Elev. 1324.97 feet.

8236-19 NE (2) - (Reference point) About 0.5 mile south of Manning, on county road M66 bridge over West Nishnabotna River, on 6th guardrail post from left downstream end of bridge, a chiseled arrow. Elev. 1325.10 feet.

8236-20 SW (1) - At the Manning airport about 1 mile southwest of Manning, 79 feet north of the northeast corner of the south hanger, 6.8 feet east of the southeast corner of the main office, 9.0 feet south of the southeast corner of a gas pump, 0.5 foot east of the southeast corner of a concrete slab, a standard tablet stamped "W 151 1949" set in top of a concrete post. Elev. 1315.48 feet.

8236-20 NW (1) - At Manning, on State Highway 141 bridge over West Nishnabotna River, on right downstream wingwall, an Iowa Highway Commission bench mark. Elev. 1326.33 feet.

8236-20 NW (2) - (Reference point) At Manning, on State Highway 141 bridge over West Nishnabotna River, on downstream curb, at 7th guardrail post from right end of bridge, a chiseled arrow. (Unable to locate 6/8/89.) Elev. 1326.98 feet.

8236-20 NW(3) - (Reference point) At Manning, on State Highway 141 bridge over West Nishnabotna River, on downstream curb, near 7th guardrail post from right end of bridge, a chiseled square. Elev. 1326.96 feet.

8236-31 NW (1) - About 2 miles southwest of Manning, on east-west county road bridge over West Nishnabotna River, on top of left downstream wingpost, a chiseled square. Elev. 1316.80 feet.

8236-31 NW (2) - (Reference point) About 2 miles southwest of Manning, on east-west county road bridge over West Nishnabotna River, on 7th guardrail post from right downstream side of bridge, a filed arrow. Elev. 1316.74 feet.

8237-35 SE (1) - About 7 miles northeast of Irwin, at county-line road bridge over West Nishnabotna River, on right upstream bridge seat, a chiseled cross on rivet. Also see 8137-2 NE (1).
Elev. 1305.60 feet.

8237-35 SE (2) - About 7.5 miles northeast of Irwin, on north-south county road M64 bridge over West Nishnabotna River, on top of right downstream wingpost, a chiseled square. Elev. 1310.19 feet.

8237-35 SE (3) - (Reference point) About 7.5 miles northeast of Irwin, on north-south county road M64 bridge over West Nishnabotna River, on 9th guardrail post from right downstream end of bridge, a filed arrow.
Elev. 1310.10 feet.

8237-36 NE (1) - About 3 miles southeast of Aspinwall, on county-line road bridge over West Nishnabotna River, on top of right downstream wingpost, a chiseled square. Elev. 1315.17 feet.

8237-36 NE (2) - (Reference point) About 3 miles southeast of Aspinwall, on county-line road bridge over West Nishnabotna River, on downstream guardrail, at left of 9th guardrail post from right end of bridge, a filed arrow. Elev. 1315.06 feet.