FLOODS IN EASTERN NEBRASKA AND SOUTHEASTERN SOUTH DAKOTA, JUNE 1984

By G. B. Engel and R. D. Benson

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CONVERSION FACTORS

The inch-pound system of units is used in this report. Conversion factors are given below for readers who prefer metric units.

Multiply	By	To Obtain
acre	0.4047	hectare
foot (ft)	0.3048	meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
inch (in)	25.4	millimeter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.589	square kilometer

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ABSTRACT

Thunderstorms during June 1984 produced significant rainfall and subsequent runoff that caused substantial flooding in eastern Nebraska and southeastern South Dakota. The storms occurred in rapid succession over the area, and the rain fell on ground that was near saturation from greater-than-normal precipitation during April and May. Flooding occurred in the Loup River, Blue River, Platte River, Elkhorn River, and Weeping Water Creek basins in Nebraska and the James River, Vermillion River, and Big Sioux River basins in South Dakota. Record and near-record peak discharges occurred on many streams. The floodflows from tributary streams caused the highest stages and the most widespread flooding along the Missouri River from Sioux City, Iowa, to Rulo, Nebr., since April 1952.

Considerable erosion of topsoil occurred, and damage to roads, bridges, crops, and personal property was extensive. Disaster areas were declared in both Nebraska and South Dakota.

INTRODUCTION

In late May and early June 1984, a weather pattern developed in the continental United States that produced 3 weeks of violent storms over the central and upper Midwest. A strong ridge of high pressure on the east coast caused warm, moist air to flow north from the Gulf of Mexico into the area. A rapid succession of frontal zones brought colder air from the northwest into the area. Numerous tornadoes and intense thunderstorms were spawned when the warm moist air met the colder air from the northwest. The thunderstorms produced large amounts of rainfall over parts of a six-State area of northeastern Kansas, northwestern Missouri, western Iowa, southwestern Minnesota, southeastern South Dakota, and eastern Nebraska. These storms occurred in rapid succession, and the ground became saturated, leading to significant runoff. Flooding occurred over a large area (fig. 1), and record and near-record streamflows occurred at numerous gaging sites. Federal disaster areas were declared in Nebraska and South Dakota as a result of extensive property and crop damages.

Streamflow data in this report were collected as part of cooperative programs between the U.S. Geological Survey and various other Federal, State, and local agencies. Annual and monthly reports of the National Oceanic and Atmospheric Administration (NOAA) were used extensively for the description of the storms and rainfall amounts.

ANTECEDENT CONDITIONS AND JUNE RAINFALL

During the period October 1983 through March 1984, precipitation was greater than normal over most of eastern Nebraska and southeastern South Dakota. During April 1984, rainfall occurred almost daily over the area. Most National Oceanic and Atmospheric Administration reporting stations recorded over 200 percent of normal precipitation and several recorded new maximum rainfall amounts for the month of April. During May 1984, many reporting stations had greater-than-normal monthly precipitation, with most of the rainfall occurring during the last half of the month. The accumulated precipitation, prior to the intense thunderstorms in June, made the spring of 1984 one of the wettest on record in the area.

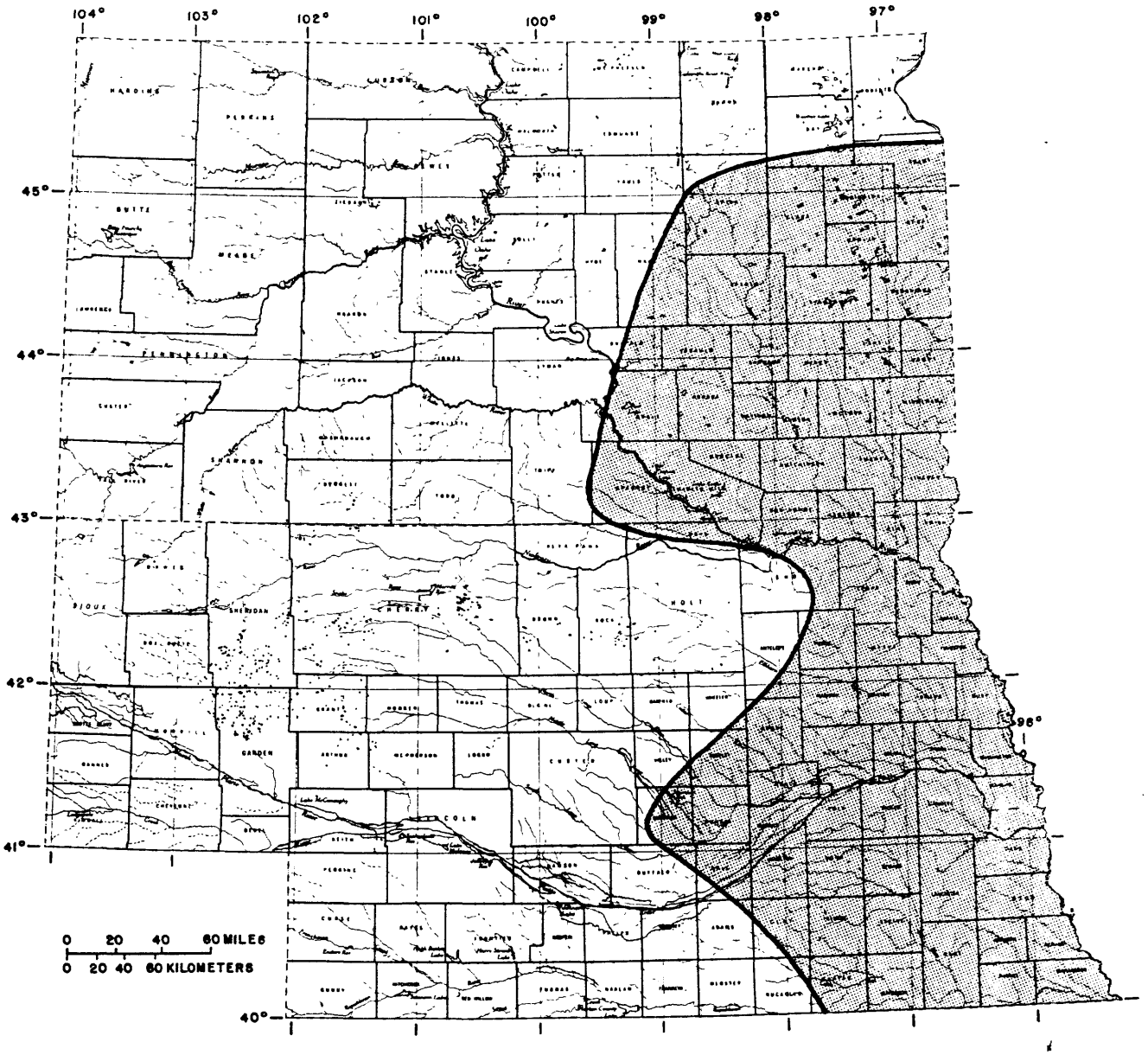

Figure 1.--Approximate area shaded in eastern Nebraska and southeastern South Dakota affected by significant flooding during June 1984.

Rain fell over much of the area during the first week of June, with amounts up to 4 inches in some areas. The intense thunderstorms began during the second week in June, and many reporting stations again recorded over 200 percent of normal monthly precipitation. Some locations had a total June rainfall of 8 inches, and a few had rainfall in excess of 12 inches.

Table 1 shows average precipitation during April, May, and June 1984 and the percentage of normal for the 1984 rainfall for these months for the six National Oceanic and Atmospheric Administration reporting divisions (fig. 2) that encompass most of the flooded area. Figure 3 shows accumulated precipitation from October 1983 to June 1984 and normal precipitation at three reporting sites (fig. 2) in areas of greatest flooding.

Table 1.--Average precipitation, in inches, and percentage of normal for April, May, and June 1984
[NOAA, National Oceanic and Atmospheric Administration]

NOAA Reporting Division	April		May		June	
	Average precip-itation	Percent-age of normal	Average precip-itation	Percent-age of normal	Average precip-itation	Percent age of normal
NEBRASKA						
Southeast	6.85	248	4.59	11[illegible]	7.22	165
Central	7.51	314	4.08	11[illegible]	5.49	142
East Central	6.82	245	5.72	141	6.96	163
Northeast	8.12	330	4.79	123	7.17	172
SOUTH DAKOTA						
Southeast	6.66	286	3.70	112	8.78	232
East Central	3.50	164	2.59	87	7.95	214

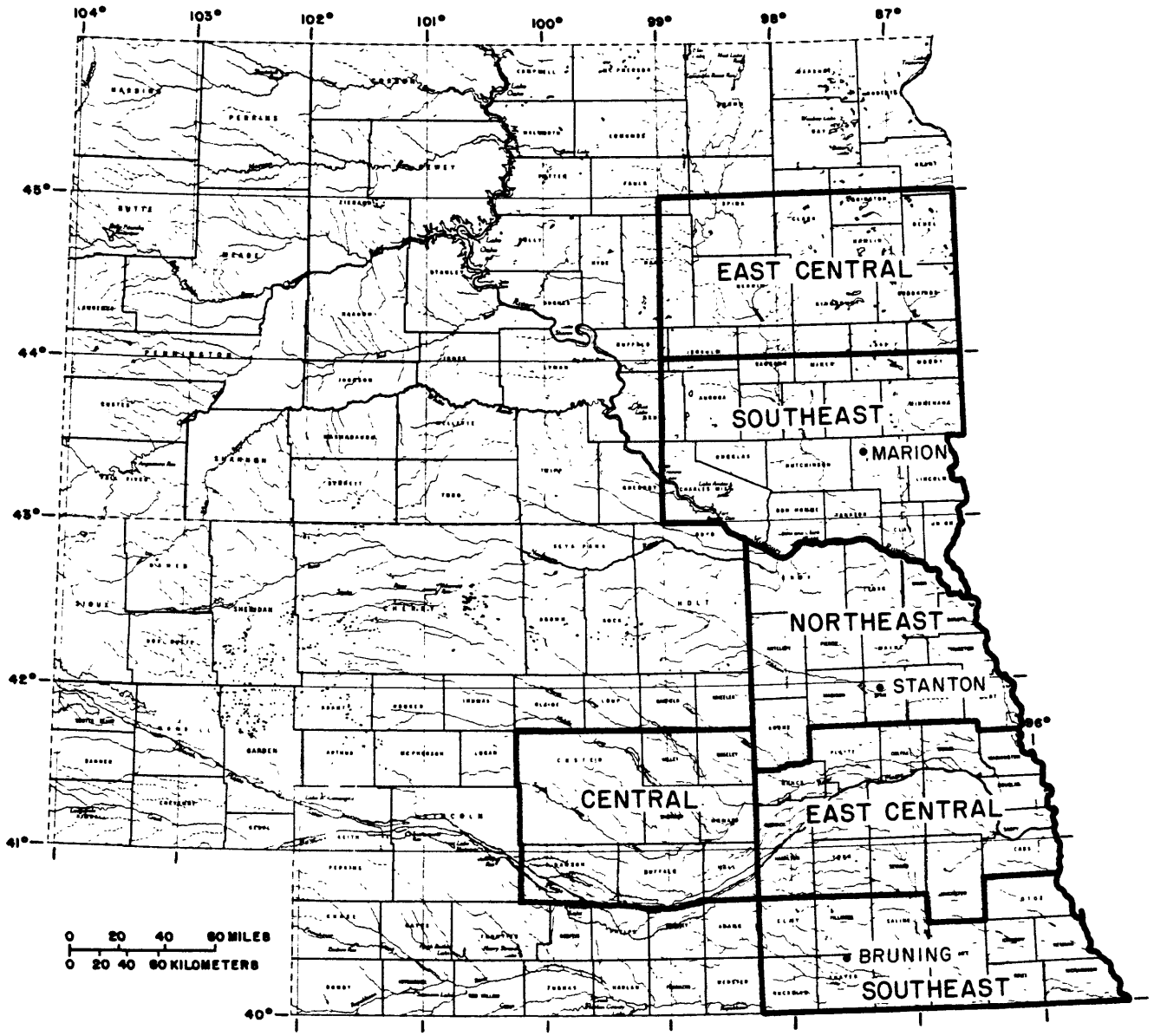

Figure 2.--National Oceanic and Atmospheric Administration reporting divisions in eastern Nebraska and southeastern South Dakota encompassing the area of June 1984 flooding and selected precipitation recording sites.

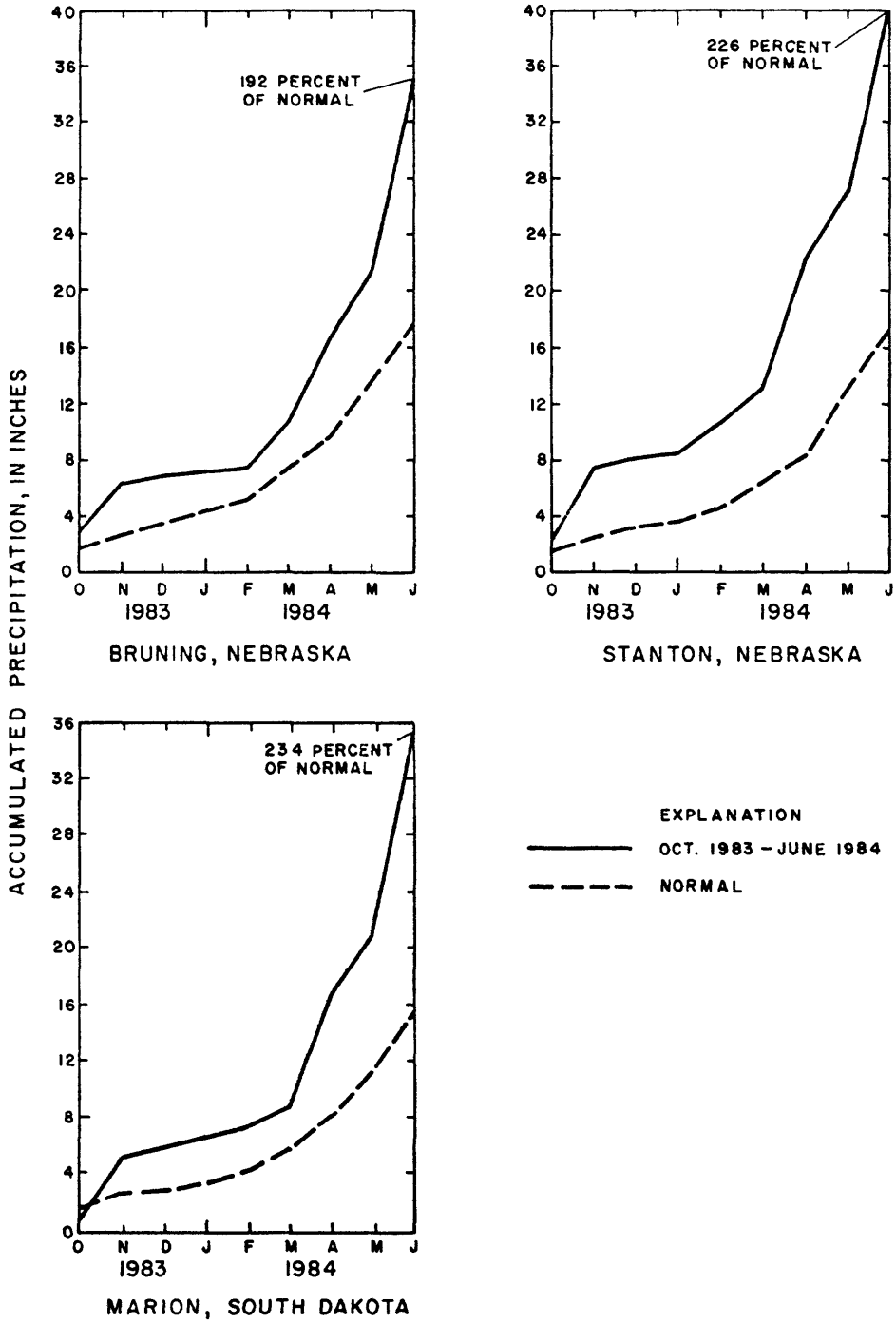

Figure 3.--Accumulated precipitation and normal precipitation for October 1983 to June 1984 for three reporting sites in eastern Nebraska and southeastern South Dakota.

DESCRIPTION OF STORMS AND RESULTANT FLOODING

The intense thunderstorms of June 1984 occurred in quick succession over the area. The ground was saturated, due to prior greater-than-normal rainfall, and many rivers had risen significantly prior to the intense storms. The storms and flooding are described in the sequence in which they occurred.

Nebraska

Loup River Basin and Platte River

The first of the intense storms occurred the evening of June 11 and the morning of June 12, 1984, in northern Hall and Buffalo Counties, and in Sherman and Howard Counties in central Nebraska. Five-inch rains were common, and 8 inches fell near Cairo and Dannebrog. Flash flooding from small streams occurred in the communities of Cairo, Dannebrog, and Ravenna. (See fig. 4 for county, city, river, and gaging-station locations.) Erosion of topsoil was extensive, and washouts occurred on many county roads and to the approaches of several county bridges.

Runoff in the smaller streams entered the larger rivers and produced large flows in the South Loup, Middle Loup, and Loup Rivers. The peak flow of 29,100 cubic feet per second (ft^3/s) at Middle Loup River at St. Paul (station 06785000) was the second largest in 62 years of record. Downstream on June 13, the peak flow of 44,700 ft^3/s at the Loup River near Genoa (station 06793000) was the fourth largest in 45 years of record. The peak flow of 65,200 ft^3/s on June 13 at Platte River at North Bend (station 06796000), downstream from the confluence of the Platte and Loup Rivers, was the fifth largest in 36 years of record.

Blue River Basin

The next major storm occurred from the afternoon of June 12 to the morning of June 13 in an area from west of Fairbury, through Lincoln, to just south of Omaha. The greatest damage in the Blue River basin occurred in Fillmore, Saline, Thayer, and Jefferson Counties. Eight-inch rainfalls were common; the town of Ohiowa in southeastern Fillmore County reported 11 inches of rain overnight after having received 9 inches in the previous 7 days (Nebraska Civil Defense Agency, 1985). Large losses of topsoil occurred and numerous bridges and county roads were damaged by washouts. Homes were flooded in a number of communities.

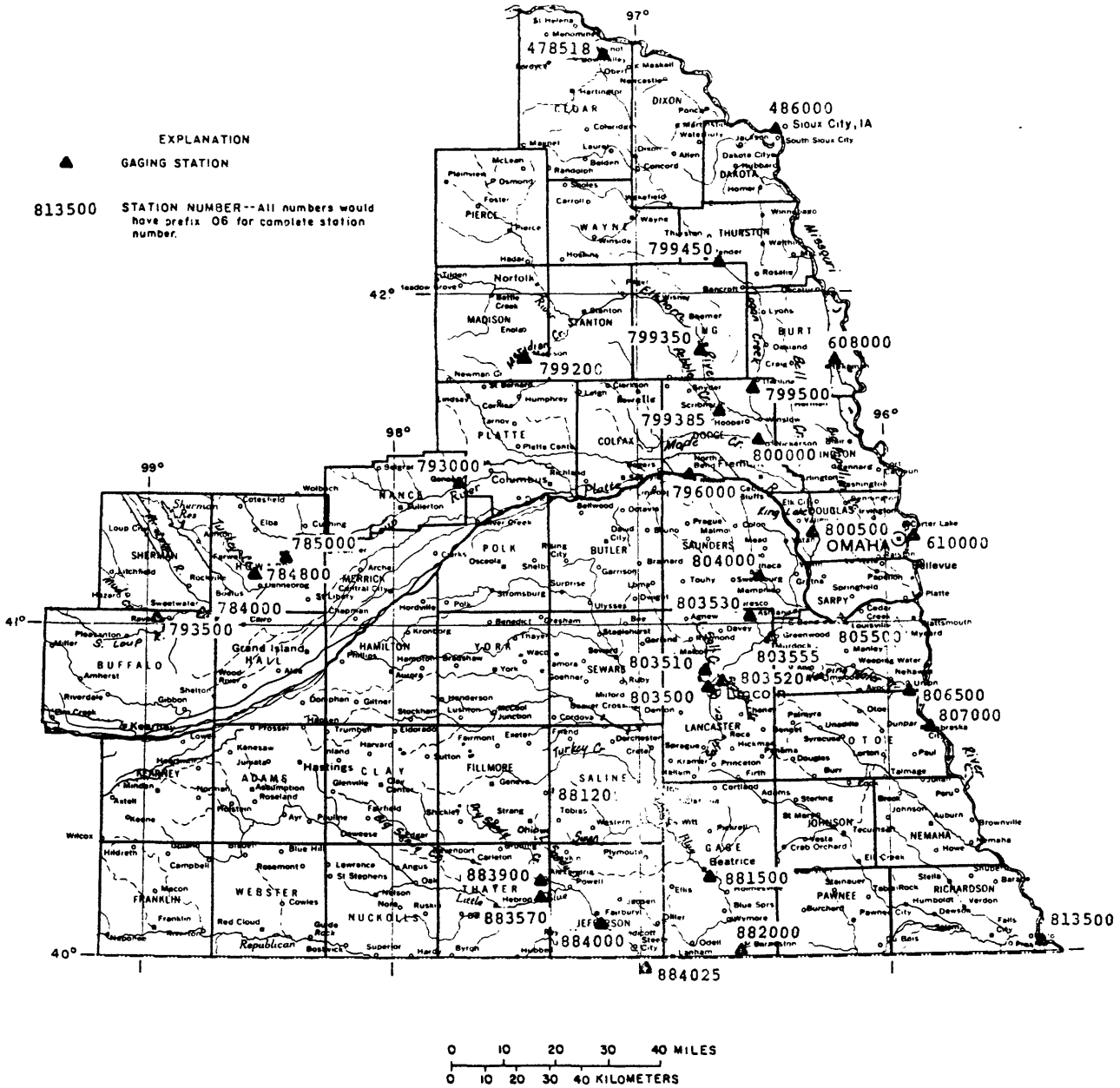

Figure 4.--Location of selected gaging stations in eastern Nebraska.

Extensive flooding occurred along Turkey and Swan Creeks in the Big Blue River basin, and along Dry Sandy, Little Sandy, and Big Sandy Creeks in the Little Blue River basin. The June 13 peak discharge for Turkey Creek near Wilber (station 06881200) was 33,000 ft^3/s, which was more than four times the previous peak flow of record. The daily discharge hydrograph for June at this station is shown in figure 5.

The town of DeWitt, in Saline County, is situated near the confluence of Turkey and Swan Creeks. Floodwaters from these creeks inundated the entire community; the main street had water 2-3 feet deep, and some areas of town had water up to 5 feet deep (Nebraska Civil Defense Agency, 1985). The entire population of 700 was evacuated for three days.

Tributary floodflows entering the Big Blue River caused extensive flooding downstream. The June 14 peak discharge at Big Blue River at Beatrice (station 06881500) was 55,100 ft^3/s, the greatest on record (1902-84). Approximately 30 homes were flooded. Further downstream, the peak discharge at Big Blue River near Barneston (station 06882000) was 55,800 ft^3/s, and this was the second largest in 53 years of record.

In the Little Blue River basin, the peak discharge for Big Sandy Creek at Alexandria (station 06883940) was 21,900 ft^3/s, the maximum for the 5 years of record at this site. On the Little Blue River, gaging stations at Fairbury (station 06884000) and Hollenberg, Kans. (station 06884025), had peak discharges of 41,900 ft^3/s and 36,600 ft^3/s, respectively, that were maximums for the period of record.

Lower Platte River and Weeping Water Creek Basins

On June 12-13, the same storms that affected the Blue River basin also affected Lancaster, Otoe, and Cass Counties. Rains of 3-4 inches were common over the area, and 8 inches fell in parts of Cass County. Many streets and basements were flooded in Lincoln, and tributaries to Salt Creek had very high flows. Maximum peak discharges for 16 years of record occurred at Little Salt Creek at Lincoln (station 06803510; 7,500 ft^3/s) and Stevens Creek near Lincoln (station 06803520; 4,620 ft^3/s). On June 12, two persons were drowned when their car was swept off U.S. Highway 34 east of Lincoln by floodwaters from Stevens Creek.

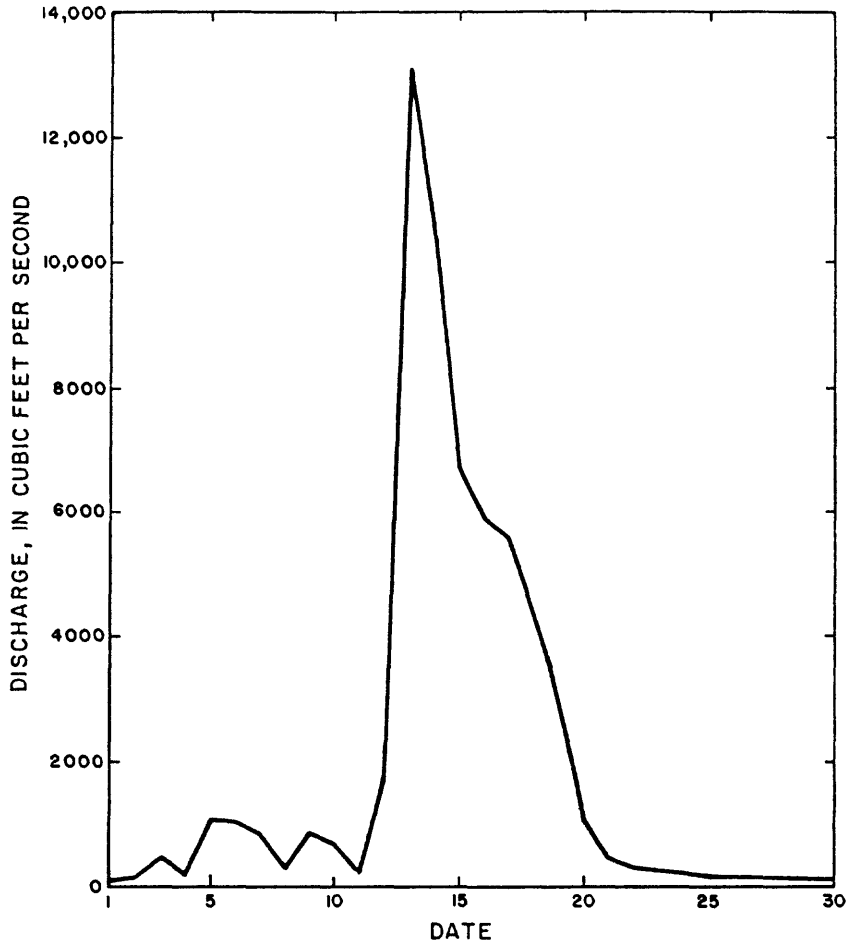

Figure 5.--Daily discharge for station 06881200, Turkey Creek near Wilber, NE, June 1984.

Flows were confined within the levees along the main stem of Salt Creek through Lincoln, but as flow entered Salt Creek from Little Salt Creek, Stevens Creek, Rock Creek, and other tributaries downstream from Lincoln, extremely high stages occurred. The June 13 peak discharge of 46,800 ft^3/s at Salt Creek at Greenwood (station 06803555) was the maximum for 33 years of record. Flooding occurred at Ashland near the mouth of Salt Creek. Floodwaters entered about 40 homes and 5 businesses, and the bridge on U.S. Highway 6 over Salt Creek collapsed. According to local residents, the flooding on the downstream reach of Salt Creek was the worst since 1908 (Nebraska Civil Defense Agency, 1985).

The large flows from Salt Creek, combined with moderately large flows from the Elkhorn and Platte Rivers, produced record stages near the mouth of the Platte River. The June 14 peak discharge of 144,000 ft^3/s at Platte River at Louisville (station 06805500) was the maximum for 32 years of record. The Nebraska National Guard Camp near Ashland, small summer-cabin communities along the river, and many isolated cabins near the river were flooded. The daily discharge hydrograph for June for Platte River at Louisville is shown in figure 6.

About 7 inches of rain were recorded on June 12 at the town of Weeping Water in Cass County near the headwaters of Weeping Water Creek, a tributary to the Missouri River. Urban damage occurred in Weeping Water as well as in the downstream towns of Nehawka and Union. Rail lines throughout Cass County were washed out or were under water. Washouts occurred at 30 to 40 bridges and many county roads sustained damage. The peak discharge on June 13 at Weeping Water Creek at Union (station 06806500) of 53,500 ft^3/s was second only to that of the May 1950 flood.

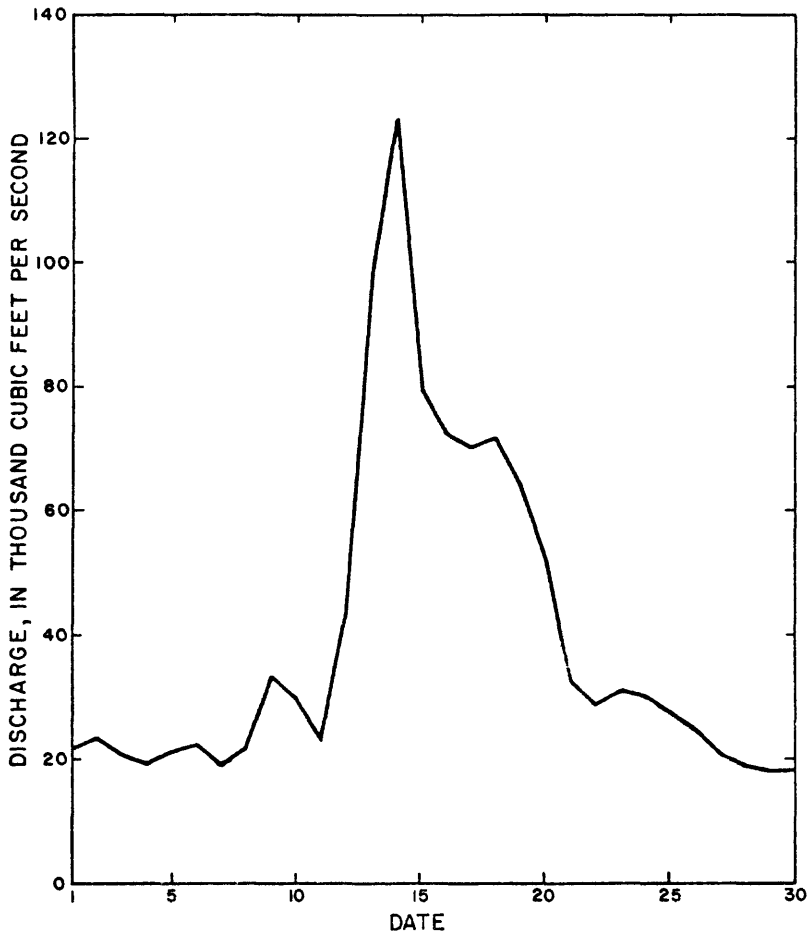

Figure 6.--Daily discharge for station 06805500, Platte River at Louisville, NE, June 1984.

Elkhorn River Basin and Missouri River Tributaries

Thunderstorms occurred again on June 14-15, 1984, this time mainly in northeastern Nebraska. During the evening of June 14, as much as 6 inches of rainfall was measured in Burt, Dodge, and Washington Counties. Urban flooding occurred along Bell Creek in Arlington and Big Papillion Creek in Omaha.

During the morning of June 15 and again that evening, thunderstorms produced up to 6 inches of rain over the lower Elkhorn River basin. Counties affected were Burt, Colfax, Cuming, Dodge, Stanton, Thurston, and Washington. Soils were extremely wet throughout the area, runoff was excessive, and flood crests were quickly produced. Tributary streams to the Elkhorn River (Union Creek, Pebble Creek, Logan Creek, and Maple Creek) had flood crests that contributed to very high stages on the Elkhorn River. Urban flooding occurred in the communities of Howells, Crowell, Scribner, Hooper, Winslow, Arlington, and King Lake. Many county roads and bridges sustained damage (Nebraska Civil Defense Agency, 1985).

The Elkhorn River at Waterloo (station 06800500) peaked on June 18, after a week of high stages. The discharge of 43,100 ft^3/s was the fourth largest in 66 years of peak-flow record. The daily discharge for June at this station is shown in figure 7. Secondary flood peaks on the Platte River and the Missouri River downstream from the mouth of the Platte, resulting from the Elkhorn River flows, were not as great as the peaks that had occurred 4 days earlier, but they contributed to sustained flooding along the lower Platte River (see fig. 6) and the Missouri River.

South Dakota

During the period June 11-26, the Vermillion, Big Sioux, and James River basins in southeastern South Dakota experienced widespread and damaging flooding. (See fig. 8 for county, city, river, and gaging-station locations.) June 1984 was the wettest June on record in the area. As each successive storm occurred, more ground became saturated. Each storm produced flash flooding on the smaller streams, followed by flooding on the larger rivers.

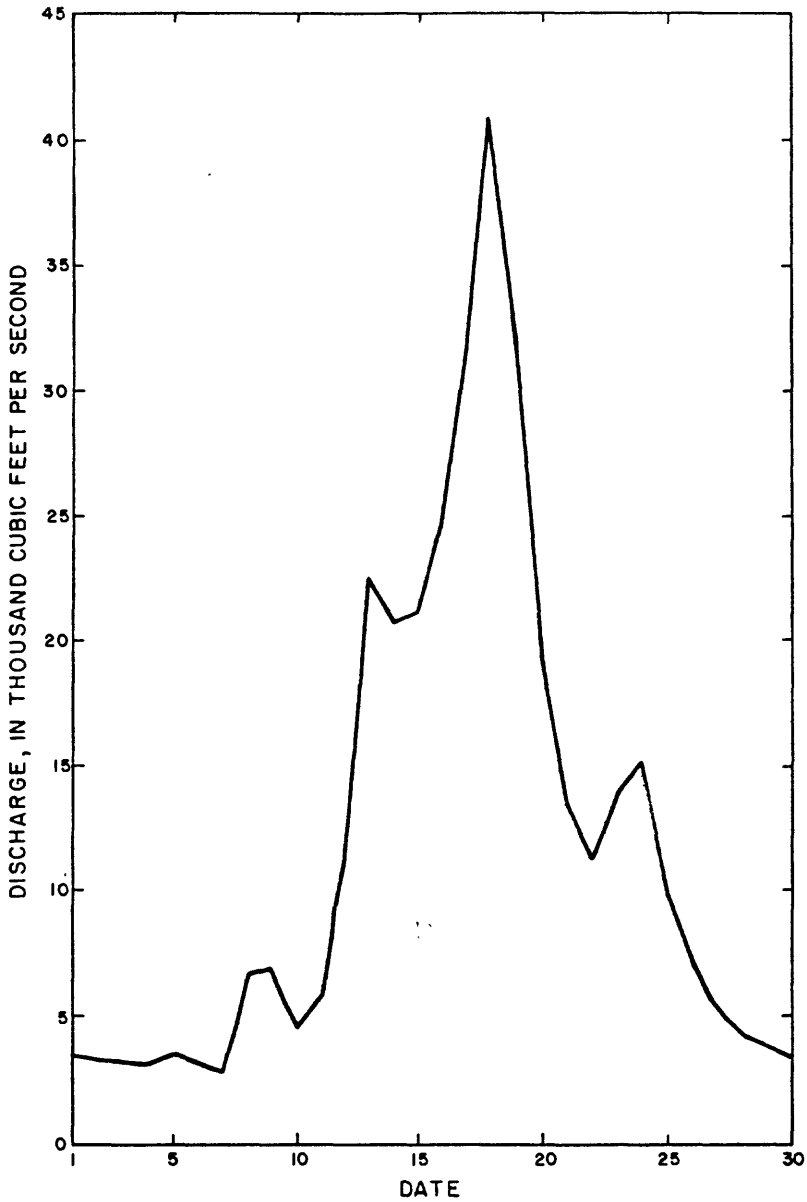

Figure 7.--Daily discharge for station 06800500, Elkhorn River at Waterloo, NE, June 1984.

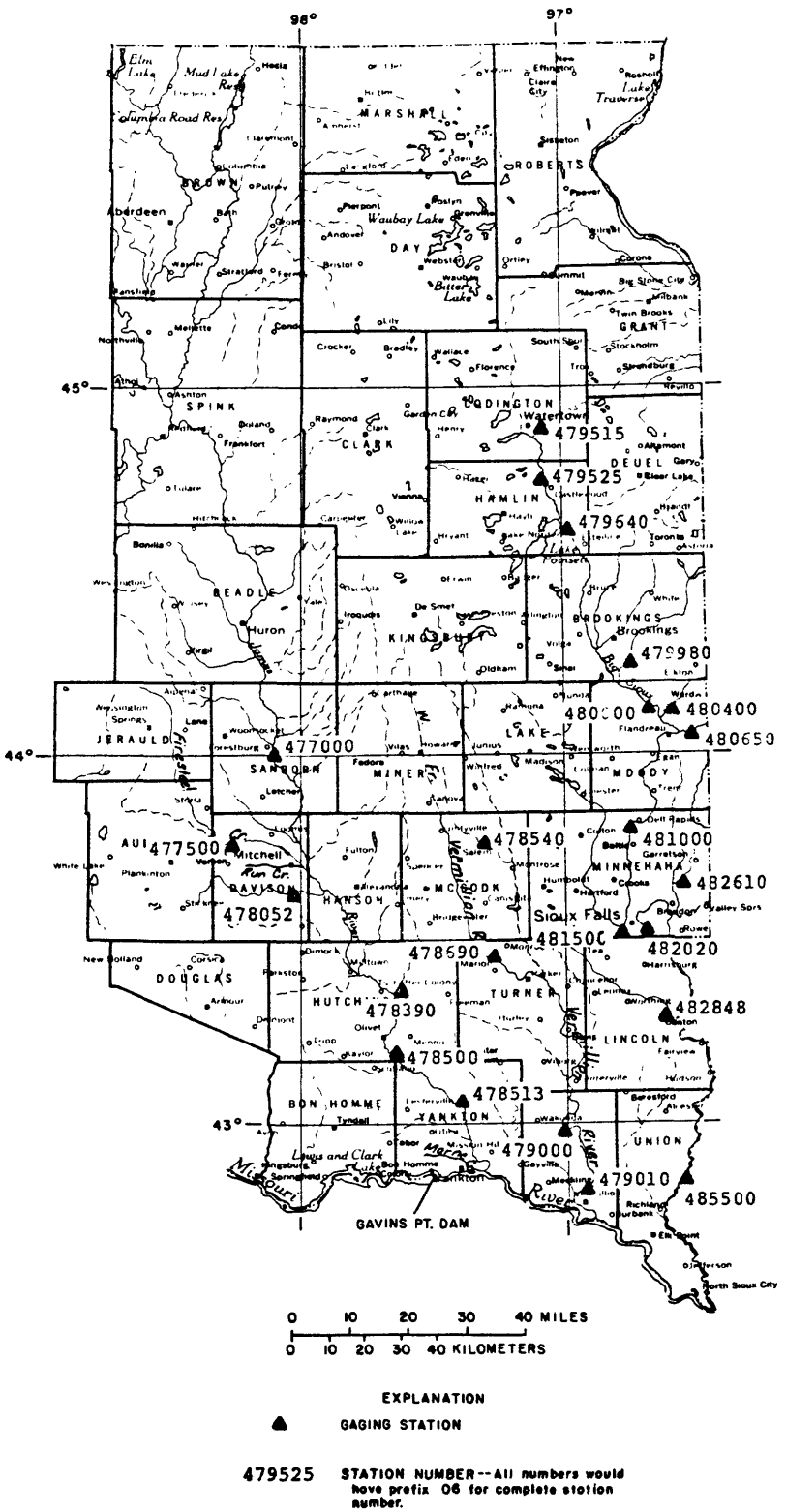

Figure 8.--Location of selected gaging stations in southeastern South Dakota.

The first large amount of rainfall in June occurred on June 4 and 5, causing some lowland flooding along the Vermillion and Big Sioux Rivers. Rain occurred again over the area on June 7, 8, 9, and 10, and on June 11 rainfall amounts of up to 5 inches occurred in some areas. This produced flash flooding on smaller streams, and rises soon started on the Big Sioux, Vermillion, and James Rivers. Many roads and bridges were damaged throughout the area.

Scattered rains of 1-4 inches over the area during June 14-17 caused additional flash flooding on smaller streams, and river levels remained high. The Vermillion River caused flooding in Davis (Turner County). The West Fork Vermillion River near Parker (station 06478690) peaked on June 16 at 4,800 ft^3/s, a new maximum for the period of record (1962-84).

Intense rainstorms occurred daily over some parts of the area from June 19 to 22. On June 19, very severe thunderstorms produced rainfall up to 7 inches in Kingsbury, Hamlin, and Beadle Counties. Runoff from these storms caused severe erosion and flash flooding. Many roads, bridges, and culverts were washed out. Basements collapsed in some areas. Many small stock dams collapsed, and as a result, roads and culverts were washed out downstream. Aurora, Davison, Hutchinson, and Yankton Counties also received large amounts of rain. In Mount Vernon (Davison County), water was 3-4 feet deep in some homes. Firesteel Creek near Mount Vernon (station 06477500) peaked on June 21 at 5,080 ft^3/s, the third largest in the 29 years of record. The daily discharge hydrograph for the month of June at this gaging station is shown in figure 9. Twenty homes were evacuated in Mitchell (Davison County) due to flooding along Run Creek.

On June 21, flooding from Marne Creek occurred in Yankton (Yankton County). Some streets were under 5 feet of water; many homes were extensively damaged, and evacuations were necessary. In Sioux Falls (Minnehaha County) many streets were closed, and approximately 20 families were evacuated. During June 21-22, flooding was estimated to have damaged or inundated 1,000 miles of roads and over 1 million acres of cropland. Soil erosion was extensive and many crops were washed away (National Oceanic and Atmospheric Administration, 1984).

All reporting points on the lower James, Vermillion, and Big Sioux Rivers and most of their tributaries crested at well above bankfull stages. Most tributary streams crested during the period June 20-22, while the larger rivers crested on June 23. The James and Vermillion Rivers exceeded past record flows at downstream gaging stations. Daily discharge hydrographs for June 1984 at gaging stations near the mouths of the James, Vermillion, and Big Sioux Rivers are shown in figures 10-12.

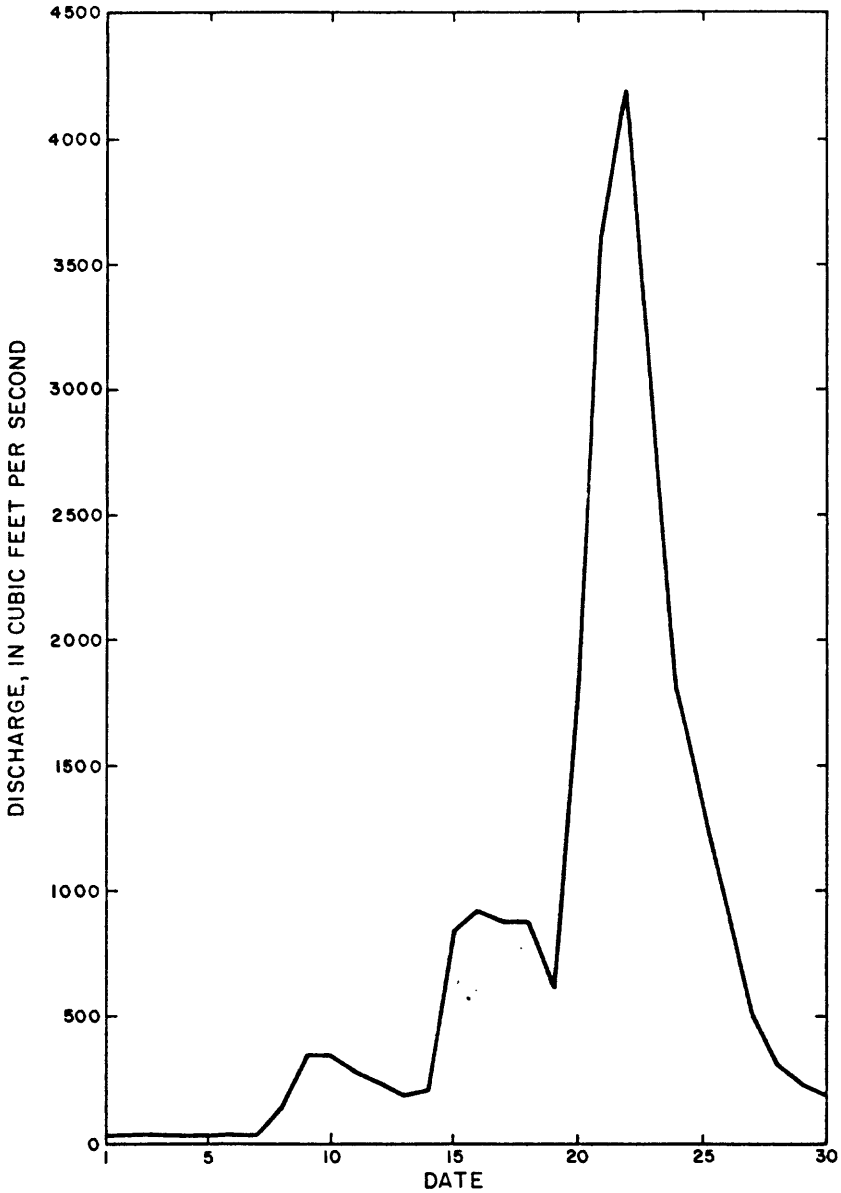

Figure 9.--Daily discharge for station 06477500, Firesteel Creek near Mount Vernon, SD, June 1984.

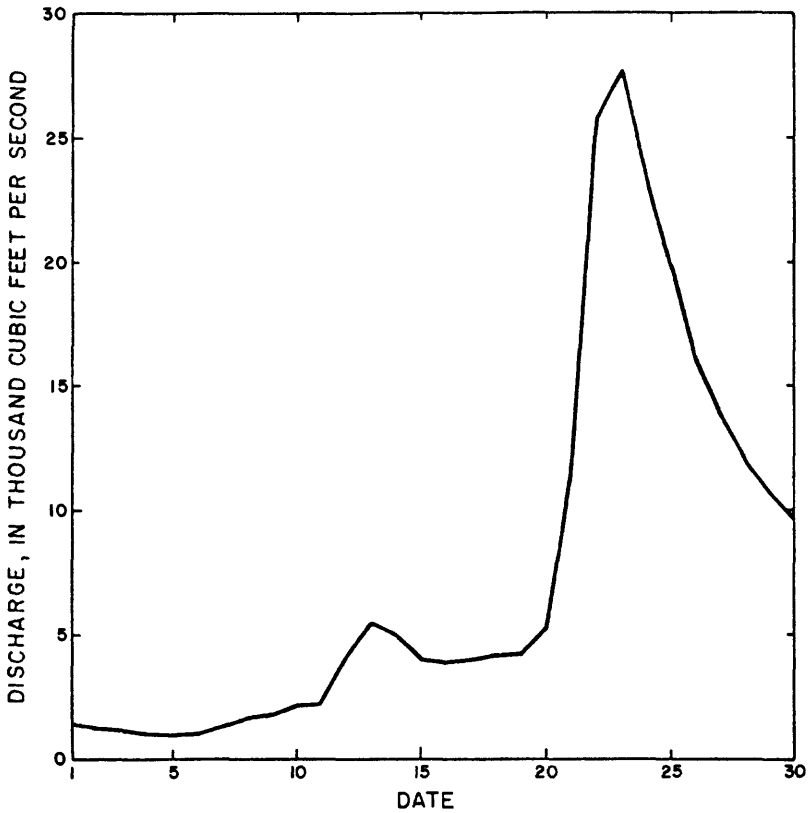

Figure 10.--Daily discharge for station 06478500, James River near Scotland, SD, June 1984.

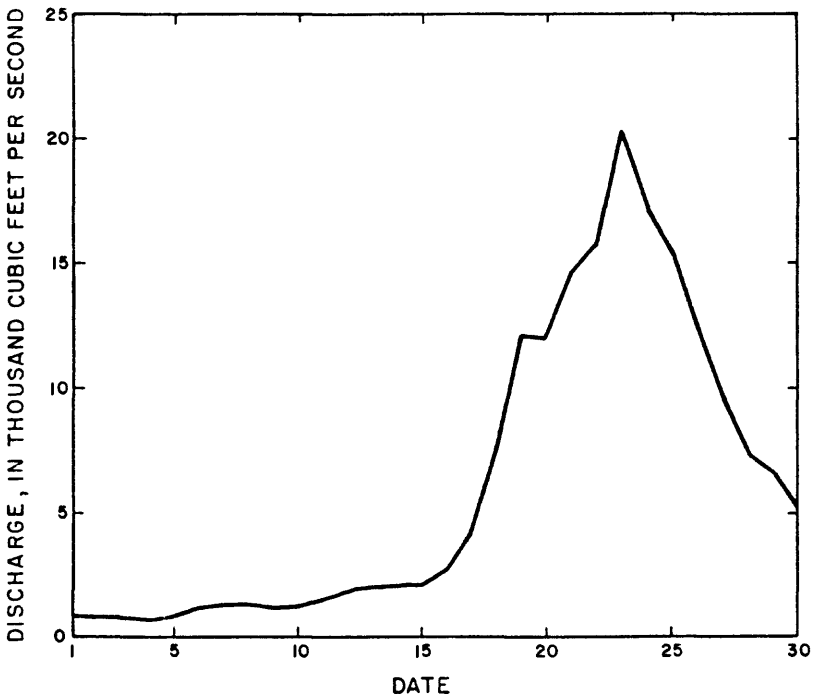

Figure 11.--Daily discharge for station 06479010, Vermillion River near Vermillion, SD, June 1984.

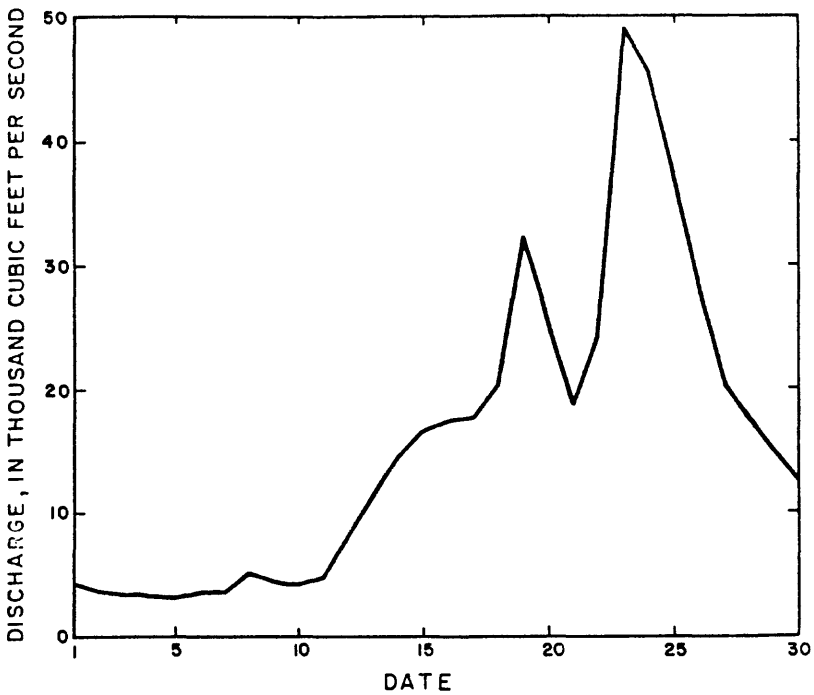

Figure 12.--Daily discharge for station 06485500, Big Sioux River at Akron, IA, June 1984.

Missouri River Mainstem

During mid-June, the combination of unusually large discharge of the Platte River, discharges of smaller tributaries on both the Nebraska side and the Iowa and Missouri side of the Missouri River, and discharge of the Missouri River produced the most widespread flooding since April 1952 along the Missouri River from the Platte River mouth to Rulo, Nebr. (U.S. Corps of Engineers, 1984). Near LaPlatte, Nebr., 200 residents had to leave their homes for nearly 2 weeks; and at Plattsmouth, Nebr., some businesses and many cabins along the river were flooded. The peak discharge of 182,000 ft^3/s on June 15 at Missouri River at Nebraska City (station 06807000) is considered to have a 25-year recurrence interval (the average time interval between occurrences of a hydrologic event of a given magnitude).

Inflow from tributaries on both sides of the Missouri River downstream from Nebraska City produced even greater flooding between Brownville and Rulo. Many local levees were breached and homes and cabins were flooded. The peak discharge of 242,000 ft^3/s on June 16 at Missouri River at Rulo (station 06813500) was an even rarer event--estimated to have a 100-year recurrence interval (U.S. Corps of Engineers, 1984). Daily hydrographs for Platte River at Louisville and Missouri River at Rulo are shown for comparison in figure 13.

The extremely large flows that entered the Missouri River from tributary streams in South Dakota about 1 week later produced the highest stages since April 1952 on the Missouri River from Sioux City, Iowa, to Omaha, Nebr. (U.S. Corps of Engineers, 1984). Riverfront property, county roads, and cropland along the river were flooded for many days. The Missouri River crested at Sioux City, Iowa (station 06486000) on June 25 with a discharge of 104,000 ft^3/s, which is considered to have a recurrence interval of 50 years (U.S. Corps of Engineers, 1984). Tributary inflow from the Nebraska and Iowa sides of the Missouri River between Sioux City and Omaha had decreased considerably from flows earlier in the month, and the flood peak attenuated as it moved downstream. The peak discharge at Missouri River at Omaha (station 06610000) on June 27 was 116,000 ft^3/s, which has a considerably lower recurrence interval than the 1984 peak discharge at Sioux City. Releases from Gavins Point Dam, upstream from the flooded area, were reduced significantly during this period to lessen flooding. Discharges at downstream sites continued to be large for an extended period due to the upstream inflow (fig. 13).

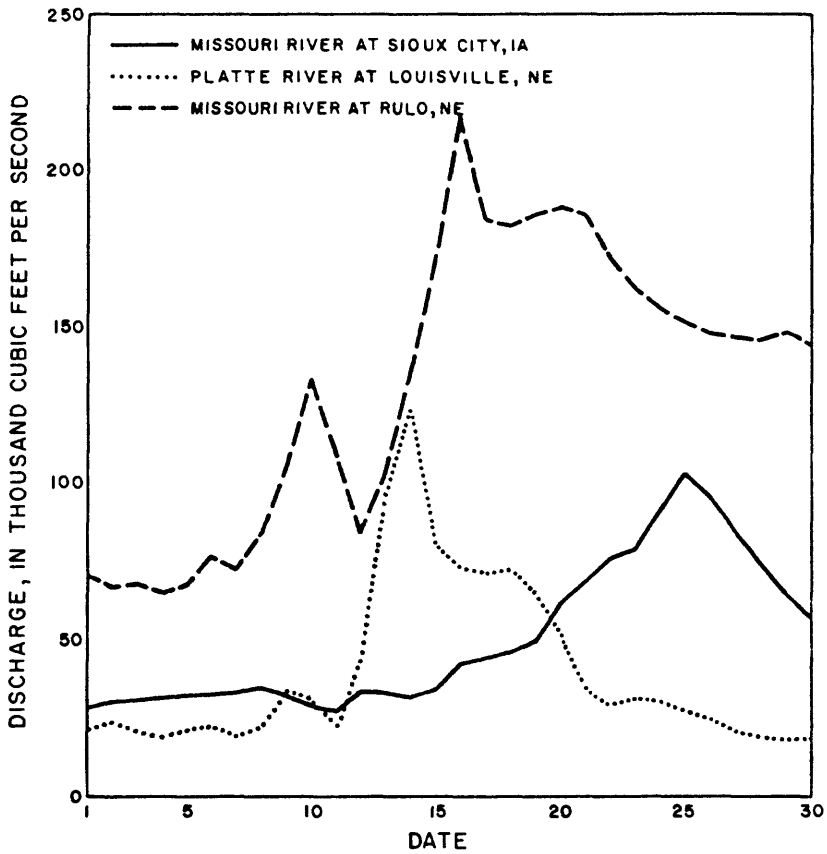

Figure 13.--Daily discharge for stations 06486000, Missouri River at Sioux City, IA; 06805500, Platte River at Louisville, NE; and 06813500, Missouri River at Rulo, NE, June 1984.

SIGNIFICANCE OF FLOODS

The storms that developed in June 1984 were unusual in the short periods of time between the succeeding storms and in the duration of the storm period. As each storm occurred, the rain fell on saturated ground that was primed to yield substantial runoff. In addition to the maximum and near maximum peak flows that occurred, the long time span of the high flows produced volumes of runoff that were significant. Table 2 shows, for selected sites, the highest average flows for periods of 7 consecutive days and 15 consecutive days in 1984; their ranking in order of magnitude when compared with similar flow durations during the period of record and the previous highs of such flows.

DAMAGE ESTIMATES

In Nebraska, 44 counties had some degree of flooding during the storm period. The Federal disaster declaration for either public damage assistance or individual assistance included only 23 counties in eastern Nebraska most heavily damaged. These counties are shown in figure 14. The total damage, loss, recovery and mitigation costs of the disaster were estimated to be about $79 million (Nebraska Civil Defense Agency, 1985).

In South Dakota, 16 counties were included in the Federal disaster declaration. Those counties are shown in figure 15. Damage estimates were placed at $300 million, most of which was to the agricultural sector (South Dakota Department of Military and Veterans Affairs, 1985). In addition to these counties, another 15 counties were identified for State disaster assistance or low-interest agricultural loans.

SUMMARY OF STREAMFLOW DATA

This section summarizes peak discharge information of selected stream-gaging stations in eastern Nebraska and southeastern South Dakota. The discharge data presented in table 3 include peak flows for 1984, previous maximum peak flows, and rank and occurrence interval of the 1984 peaks. The location of the gaging stations listed are shown in figures 4 and 8.

Table 2.--Sustained floodflows during June 1984 and during period of historic record at selected sites in eastern Nebraska and southeastern South Dakota

[Average flows for highest 7 and 15 consecutive days. All flows in cubic feet per second. Period of record is in water years (October 1 to September 30). Rank of 1 indicates highest event during period of record; 2 indicates second highest, and so forth]

Station number	Name	Period of record	High 7 days				High 15 days			
			1984		Previous High		1984		Previous High	
			Flow	Rank	Flow	Year	Flow	Rank	Flow	Year
06800500	Elkhorn River at Waterloo, NE	1929-84	27,600	4	38,000	1944	19,700	2	20,000	1944
06805500	Platte River at Louisville, NE	1953-84	82,700	1	75,300	1960	56,900	1	55,700	1967
06882000	Big Blue River at Barneston, NE	1933-84	27,800	1	25,600	1974	16,900	1	15,300	1960
06884000	Little Blue River near Fairbury, NE	1933-84	11,800	4	14,800	1974	7,100	3	8,130	1974
06477000	James River near Forestburg, SD	1950-84	5,260	5	11,100	1969	4,170	5	9,080	1969
06478500	James River near Scotland, SD	1929-84	19,800	1	13,500	1962	13,600	1	11,200	1960
06481000	Big Sioux River near Dell Rapids, SD	1949-84	12,100	2	20,600	1969	8,940	2	12,200	1969
06485500	Big Sioux River at Akron, IA	1929-84	33,000	3	59,500	1969	25,600	2	36,400	1969

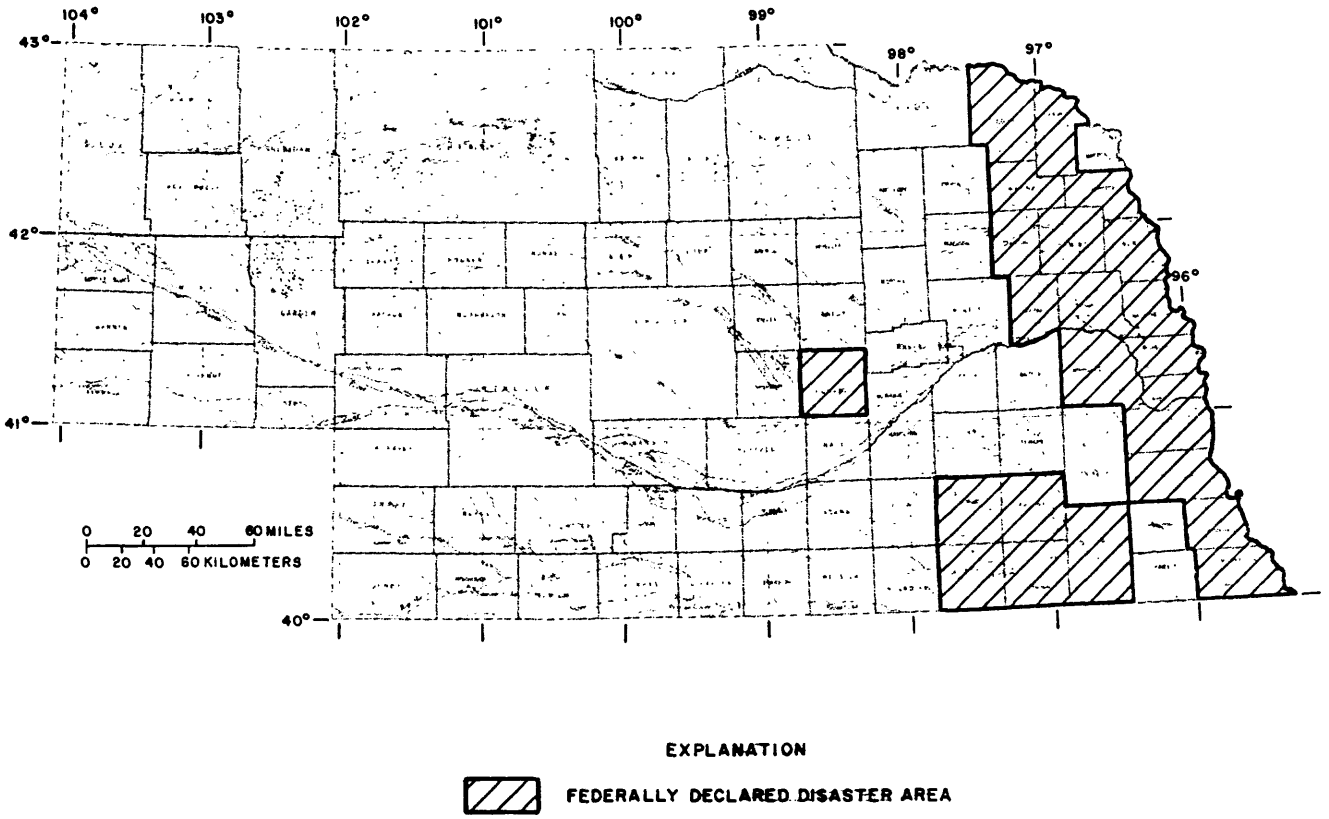

Figure 14.--Counties in eastern Nebraska declared disaster areas as a result of the June 1984 flooding.

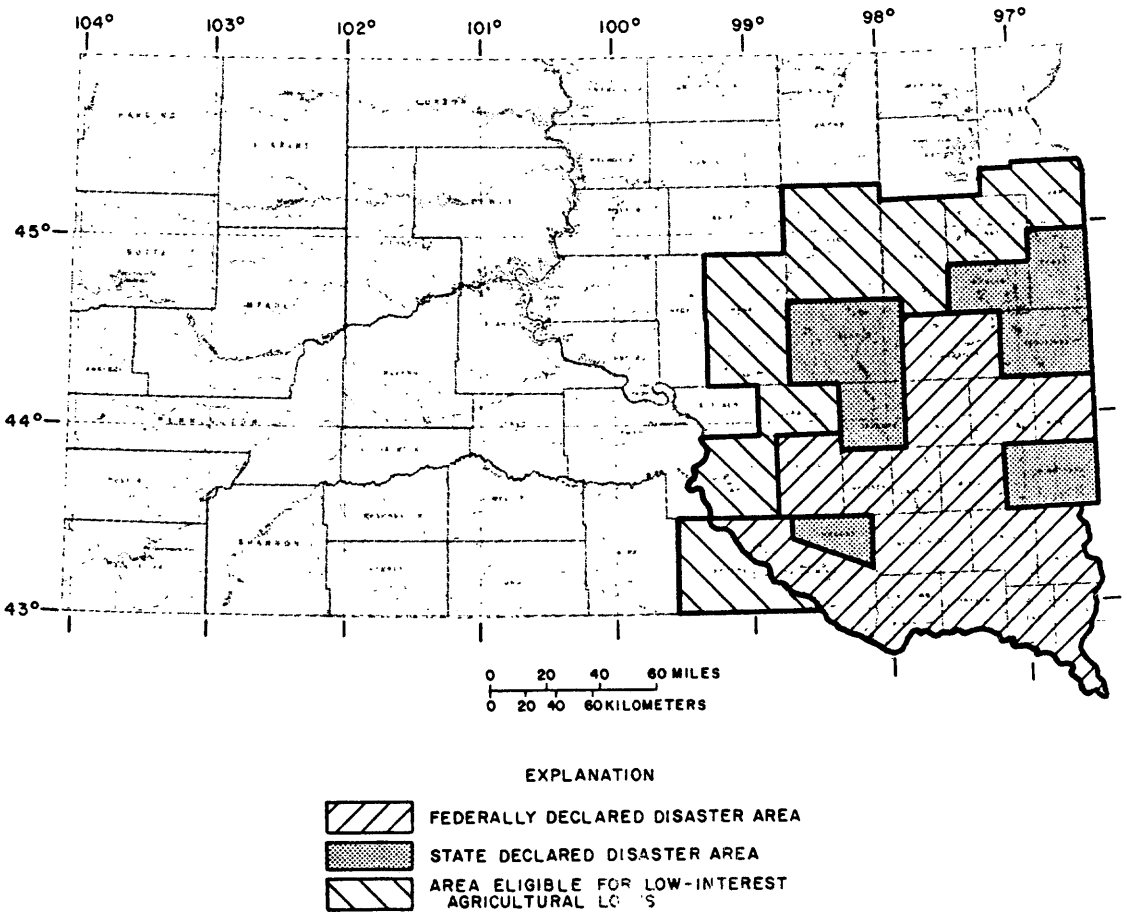

Figure 15.--Counties in southeastern South Dakota declared disaster areas as a result of the June 1984 flooding.

Table 3.--Peak discharges for the 1984 water year and for the period of historic record at selected gaging stations in eastern Nebraska and southeastern South Dakota

[mi^2 = square miles; ft^3/s = cubic feet per second. Period of record is in water years (October 1 to September 30). Rank of 1 indicates highest peak during period of record; 2 indicates second highest, and so forth.]

Station number	Name	Drainage area (mi^2)	Period of record	1984 and previous peak flows: Date	Discharge (ft^3/s)	Gage height (feet)	Rank of 1984 peak	Recurrence interval of 1984 peak (years)
			NEBRASKA					
Loup River basin and Platte River								
06783500	Mud Creek near Sweetwater	707	1947-84	6-12-84 6-22-47	2,420 27,000	18.90 23.20	5	5
06784000	South Loup River at St. Michael	2,350	1944-84	6-13-84 6-22-47	11,800 50,000	10.73 12.0	5	8
06784800	Turkey Creek near Dannebrog	66.2	1966-70, 1979-84	6-12-84 6-14-67	1,790 2,680	19.26 19.21	2	--
06785000	Middle Loup River at St. Paul	8,090	1895-99, 1903, 1929-84	6-12-84 6-23-47	29,100 72,000	6.46 12.67	2	25
06793000	Loup River near Genoa	14,400	1929-32, 1944-84	6-13-84 8-13-66	44,700 129,000	10.62 13.93	4	15
06796000	Platte River at North Bend	77,100	1949-84	6-13-84 3-29-60	65,200 112,000	9.13 10.04	5	15
Blue River basin								
06881200	Turkey Creek near Wilber	460	1960-84	6-13-84 3-28-60	33,000 7,300	21.43 14.92	1	100
06881500	Big Blue River at Beatrice	3,900	1902-84	6-14-84 10-12-73	55,100 49,100	a31.27 33.02	1	75
06882000	Big Blue River at Barneston	4,447	1932-84	6-14-84 6-09-41	55,800 57,700	a30.21 34.3	2	100
06883570	Little Blue River near Alexandria	1,557	1960-72, 1974-84	6-12-84 3-28-60	9,930 25,600	17.52 b17.30	6	4
06883940	Big Sandy Creek at Alexandria	607	1980-84	6-13-84 9-29-83	21,900 10,200	16.71 15.37	1	--
06884000	Little Blue River near Fairbury	2,350	1908-15, 1929-84	6-13-84 10-12-73	41,900 37,800	a16.98 18.96	1	50
06884025	Little Blue River near Hollenburg, KS	2,752	1975-84	6-13-84 3-15-78	36,600 17,200	21.00 c16.58	1	--
Lower Platte River and Weeping Water Creek basins								
06803500	Salt Creek at Lincoln	684	1950-84	6-13-84 6-02-51	15,600 28,200	20.92 26.15	d3	10
06803510	Little Salt Creek near Lincoln	43.6	1969-84	6-12-84 6-15-82	7,500 6,520	16.20 15.80	1	40

Table 3.--Peak discharges for the 1984 water year and for the period of historic record at selected gaging stations in eastern Nebraska and southeastern South Dakota--Continued

Station number	Name	Drainage area (mi^2)	Period of record	1984 and previous peak flows			Rank of 1984 peak	Recurrence interval of 1984 peak (years)
				Date	Discharge (ft^3/s)	Gage height (feet)		
Lower Platte River and Weeping Water Creek basins--Continued								
06803520	Stevens Creek near Lincoln	47.8	1969-84	6-13-84 6-15-82	4,620 3,820	19.57 18.85	1	10
06803530	Rock Creek near Ceresco	119	1970-84	6-12-84 6-15-82	5,800 10,800	17.47 18.84	2	8
06803555	Salt Creek at Greenwood	1,051	1952-84	6-13-84 6-24-63	46,800 41,000	26.50 23.46	1	25
06804000	Wahoo Creek at Ithaca	271	1950-84	6-12-84 6-24-63	6,910 77,400	21.21 22.93	16	4
06805500	Platte River at Louisville	85,800	1953-84	6-14-84 3-30-60	144,000 124,000	a11.34 12.45	1	100
06806500	Weeping Water Creek at Union	241	1950-84	6-13-84 5-09-50	53,500 60,300	29.53 29.80	2	60
Elkhorn River basin and Missouri River tributaries								
06478518	Bow Creek near St. James	304	1979-84	6-17-84 6-27-83	21,400 13,200	13.23 12.40	1	--
06608000	Tekamah Creek at Tekamah	23.0	1949-84	6-16-84 6-05-63	4,160 6,180	13.93 16.62	7	5
06799200	Union Creek at Madison	174	1979-84	6-17-84 5-19-82	7,630 5,540	22.90 21.15	1	--
06799350	Elkhorn River at West Point	5,100	1961-84	6-18-84 6-25-69	24,300 33,000	12.49 13.21	5	7
06799385	Pebble Creek at Scribner	204	1979-84	6-16-84 10-09-82	20,300 7,880	e23.75 23.33	1	--
06799450	Logan Creek at Pender	731	1966-84	6-16-84 2-19-71	9,750 36,900	16.96 23.11	10	3
06799500	Logan Creek at Uehling	1,030	1941-84	6-16-84 2-20-71	10,900 25,200	17.95 20.15	10	5
06800000	Maple Creek at Nickerson	450	1952-84	6-17-84 6-21-60	6,430 10,800	17.65 e14.67	5	8
06800500	Elkhorn River at Waterloo	6,900	1899-1903, 1911-15, 1929-84	6-18-84 6-12-44	43,100 100,000	18.12 f16.6	4	20

Table 3.--Peak discharges for the 1984 water year and for the period of historic record at selected gaging stations in eastern Nebraska and southeastern South Dakota--Continued

Station number	Name	Drainage area (mi^2)	Period of record	1984 and previous peak flows			Rank of 1984 peak	Recurrence interval of 1984 peak (years)
				Date	Discharge (ft^3/s)	Gage height (feet)		
			SOUTH DAKOTA					
James River basin								
06477000	James River near Forestburg	17,400	1950-84	6-25-84 4-09-69	6,140 12,500	15.75 17.16	5	9
06477500	Firesteel Creek near Mt. Vernon	540	1956-84	6-21-84 4-04-69	5,080 6,610	15.56 15.34	3	11
06478052	Enemy Creek near Mitchell	181	1976-84	6-22-84 3-19-78	4,280 1,390	15.15 11.27	1	--
06478390	Wolf Creek near Clayton	386	1976-84	6-21-84 6-20-83	6,520 2,740	18.01 16.67	1	--
06478500	James River near Scotland	20,300	1929-84	6-23-84 4-03-62	29,400 15,200	20.45 18.74	1	100
06478513	James River near Yankton	20,600	1982-84	6-23-84 6-27-83	26,400 2,760	24.34 12.19	1	--
Vermillion River basin								
06478540	Little Vermillion River near Salem	77.7	1967-84	6-20-84 3-21-78	900 676	9.88 7.79	1	10
06478690	West Fork Vermillion River near Parker	370	1962-84	6-16-84 3-27-82	4,800 4,340	12.57 12.33	1	17
06479000	Vermillion River near Wakonda	1,680	1946-84	6-23-84 4-08-69	17,000 9,880	17.62 16.22	1	40
06479010	Vermillion River near Vermillion	1,779	1984	6-23-84	21,400	31.77	1	--
Big Sioux River basin								
06479515	Willow Creek near Watertown	110	1972-84	6-15-84 3-31-78	4,040 2,930	7.50 7.02	1	--
06479525	Big Sioux River near Castlewood	1,997	1977-84	6-16-84 3-31-78	1,160 1,740	10.68 11.10	5	--
06479640	Hidewood Creek near Estelline	164	1969-84	6-15-84 4-07-69	1,110 3,630	8.22 11.36	5	--
06479980	Medary Creek near Brookings	200	1981-84	6-21-84 3-02-82	2,590 1,210	11.27 10.19	1	--

Table 3.--Peak discharges for the 1984 water year and for the period of historic record at selected gaging stations in eastern Nebraska and southeastern South Dakota--Continued

Station number	Name	Drainage area (mi^2)	Period of record	1984 and previous peak flows			Rank of 1984 peak	Recurrence interval of 1984 peak (years)
				Date	Discharge (ft^3/s)	Gage height (feet)		
Big Sioux River basin--Continued								
06480000	Big Sioux River near Brookings	3,898	1954-84	6-22-84 4-09-69	13,700 33,900	13.70 14.77	2	--
06480400	Spring Creek near Flandreau	63.2	1983-84	6-20-84 3-01-83	2,030 895	15.72 15.16	1	--
06480650	Flandreau Creek above Flandreau	100	1982-84	6-20-84 3-01-83	2,650 1,500	11.02 9.92	1	--
06481000	Big Sioux River near Dell Rapids	4,483	1949-84	6-23-84 4-09-69	17,400 41,300	15.20 16.47	3	15
06481500	Skunk Creek at Sioux Falls	622	1949-84	6-21-84 6-17-57	11,000 29,400	15.54 17.78	2	17
06482020	Big Sioux River at North Cliff Ave. at Sioux Falls	5,216	1972-84	6-22-84 3-07-83	21,600 9,000	25.40 19.58	1	--
06482610	Split Rock Creek at Corson	464	1966-84	6-21-84 4-08-69	9,020 17,800	14.08 15.00	3	12
06482848	Beaver Creek at Canton	124	1983-84	6-17-84 6-20-83	2,570 2,530	13.72 14.61	1	--
06485500	Big Sioux River at Akron, IA	8,424	1929-84	6-23-84 4-09-69	52,200 80,800	22.27 22.99	3	25
Missouri River Mainstem								
06486000	Missouri River at Sioux City, IA	314,600	1929-31, 1939-84	6-25-84 4-14-52	104,000 441,000	30.91 24.28	g1	50
06610000	Missouri River at Omaha, NE	322,800	1929-84	6-27-84 4-18-52	116,000 396,000	29.02 40.20	g2	7
06807000	Missouri River at Nebraska City, NE	410,000	1930-84	6-15-84 4-19-52	182,000 414,000	24.78 27.66	g1	25
06813500	Missouri River at Rulo, NE	414,900	1950-84	6-16-84 4-22-52	242,000 358,000	24.40 25.60	g1	100

a Channel change between events.
b At different site and datum.
c Flood of October 1973 reached a stage of 23.07 ft, discharge not determined.
d Since Branched Oak Dam constructed in 1968.
e Overbank flow bypassed gage.
f At different datum.
g Since Gavins Point Dam constructed in 1955.

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