





























Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, a long reach of the channel, or an artificial structure.

Contents is the volume of water in a reservoir. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is so enclosed by a topographic divide that direct surface runoff from precipitation normally would drain by gravity into the river above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

WSP is used as an abbreviation for "Water-Supply Paper" in reference to previously published reports.

#### DOWNSTREAM ORDER OF LISTING GAGING STATIONS

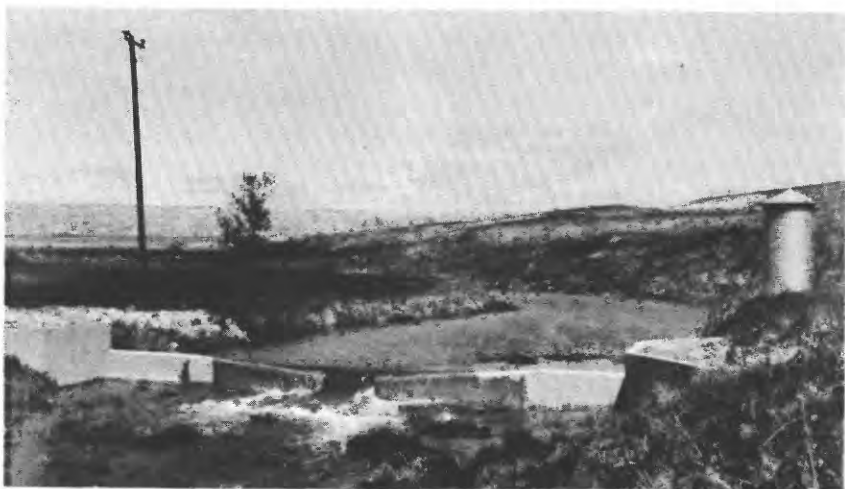
Beginning with the series of reports for the water year ending September 30, 1951, the order of listing gaging-station records was changed. In this report, in a downstream direction along the main stem all stations on a tributary entering above a main-stem station are listed before that station. If a tributary enters between two main-stem stations, it is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. To indicate the rank of any tributary on which a gaging station is situated and the stream to which it is immediately tributary, each indentation in the listing of gaging stations in the table of contents of this report represents one rank. This downstream order and system of indentation show which gaging stations are on tributaries between any two stations on a main stem and the rank of the tributary on which each gaging station is situated.

The order of listing used before the publication of the 1951 report listed first all stations on the main stem from headwaters toward mouth, then all stations on the uppermost tributary to the main stem from the tributary's source to mouth, and then all stations from source to mouth of the uppermost tributary to the tributary.

#### EXPLANATION OF DATA

The base data collected at gaging stations consist of records of stage and measurements of discharge. In addition, observations of factors affecting the stage-discharge relation, weather records, and other information are used to supplement base data in determining the daily flow. The records of stage are obtained either from direct readings on a nonrecording gage or from a water-stage recorder that gives a continuous record of fluctuations. Measurements of discharge are made with a current meter by the general methods adopted by the Geological Survey on the basis of experience in stream gaging since 1888. These methods are described in Water-Supply Paper 888 and are also outlined in standard textbooks on the measurement of stream discharge. Typical structures in use at gaging stations are shown in figure 1.

Rating tables giving the discharge for any stage are prepared from stage-discharge relation curves defined by discharge measurements. If extensions to the rating curves are necessary to define the extremes of discharge, they are made on the basis of indirect determinations of peak discharge (such as slope-area or contracted-opening determinations, computation of flow over dams or weirs, and by other methods), velocity-area studies, and



**A, NIOBRARA RIVER BELOW BOX BUTTE RESERVOIR, NEBR.**



**B, NORTH POPO AGIE RIVER NEAR LANDER, WYO.**

**FIGURE 1.—GAGING-STATION STRUCTURES.**









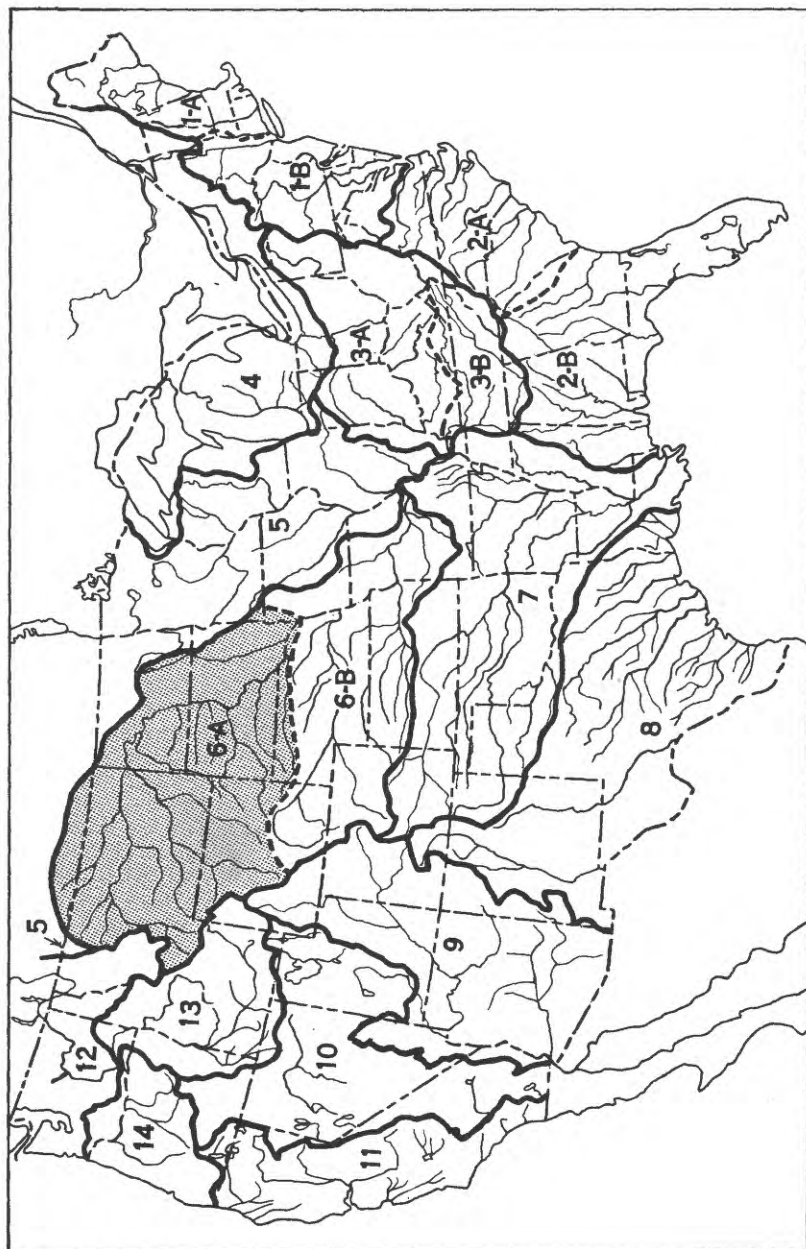


Figure 2.--Map of the United States showing areas covered by the 18 annual volumes on surface-water supply. The area covered by this report is shaded.

Early records of the flow of streams in the United States are published in the reports listed herein. In many of these reports records for years earlier than those indicated have been included for some streams.

Streamflow data for the years 1884-1901, in reports of the Geological Survey

(A = Annual Report; B = Bulletin)

Report	Character of data	Year
10th A, pt. 2	Descriptive information only.	
11th A, pt. 2	Monthly discharge and descriptive information.....	1884 to September 1890.
12th A, pt. 2	.....do.....	1884 to June 30, 1891.
13th A, pt. 3	.....do.....	1884-92.
14th A, pt. 2	Monthly discharge.....	1886-93.
B 131.....	Descriptions, measurements, gage heights, and ratings.....	1893-94.
16th A, pt. 2	Descriptive information only.	
B 140.....	Descriptions, measurements, gage heights, ratings, and monthly discharge.	1895.
WSP 11.....	Gage heights.....	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge.	1895-96.
WSP 15.....	Descriptions, measurements, and gage heights of streams east of the Mississippi River, and Missouri River and tributaries above Kansas River.	1897.
WSP 16.....	Descriptions, measurements, and gage heights of streams west of the Mississippi River, except Missouri River and tributaries above Kansas River.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge.	1897.
WSP 27.....	Measurements, ratings, and gage heights of streams east of the Mississippi River, and Missouri River and tributaries.	1898.
WSP 28.....	Measurements, ratings, and gage heights of streams west of the Mississippi River, except Missouri River and tributaries.	1898.
20th A, pt. 4	Monthly discharge.....	1898.
WSP 35 to 39.	Descriptions, measurements, gage heights, and ratings.....	1899.
21st A, pt. 4	Monthly discharge.....	1899.
WSP 47 to 52.	Descriptions, measurements, gage heights, and ratings.....	1900.
22d A, pt. 4.	Monthly discharge.....	1900.
WSP 55, 56...	Descriptions, measurements, gage heights, and ratings.....	1901.
WSP 75.....	Monthly discharge.....	1901.

Reports on surface-water supply containing records from 1899 to date for drainage basins in this report are listed below. The data for any particular gaging station will, in general, be found in the reports covering the years during which the station was maintained. Before 1951, records for the Missouri River basin above Sioux City, Iowa, were included with those of the other rivers of the Missouri River basin.

Numbers of water-supply papers containing results of stream measurements in Missouri River basin above Sioux City, Iowa, 1899-1955

Year	WSP	Year	WSP	Year	WSP	Year	WSP	Year	WSP
1899	a36, 37	1911	306	1923	566	1934	761	1945	1036
1900	49	1912	326	1924	586	1935	786	1946	1056
1901	66, 75	1913	356	1925	606	1936	806	1947	1086
1902	84	1914	386	1926	626	1937	826	1948	1116
1903	99	1915	406	1927	646	1938	856	1949	1146
1904	130	1916	436	1928	666	1939	876	1950	1176
1905	172	1917	456	1929	686	1940	896	1951	1209
1906	208	1918	476	1930	701	1941	926	1952	1239
1907-8	246	1919-20	506	1931	716	1942	956	1953	1279
1909	266	1921	526	1932	731	1943	976	1954	1339
1910	286	1922	546	1933	746	1944	1006	1955	1389

a Gallatin River.

The records at most of the stations discussed in these reports extend over many years. Discharge measurements at many points other than regular gaging stations have been made each year and are published at the end of each report. The streams and points of measurement are listed in the same order as the streams and gaging stations in the body of the report. An index of the records obtained before 1904 has been published in Water-Supply Paper 119.

Each of the reports on the surface-water supply for the year 1939 (Water-Supply Paper 876 for the Missouri River basin above Sioux City, Iowa) contains, for the area included in that report, a summary of yearly discharge at gaging stations at which 10 or more complete years of record had been collected. These summaries were reprinted separately.

Reports also have been published that are compilations of records for various areas,







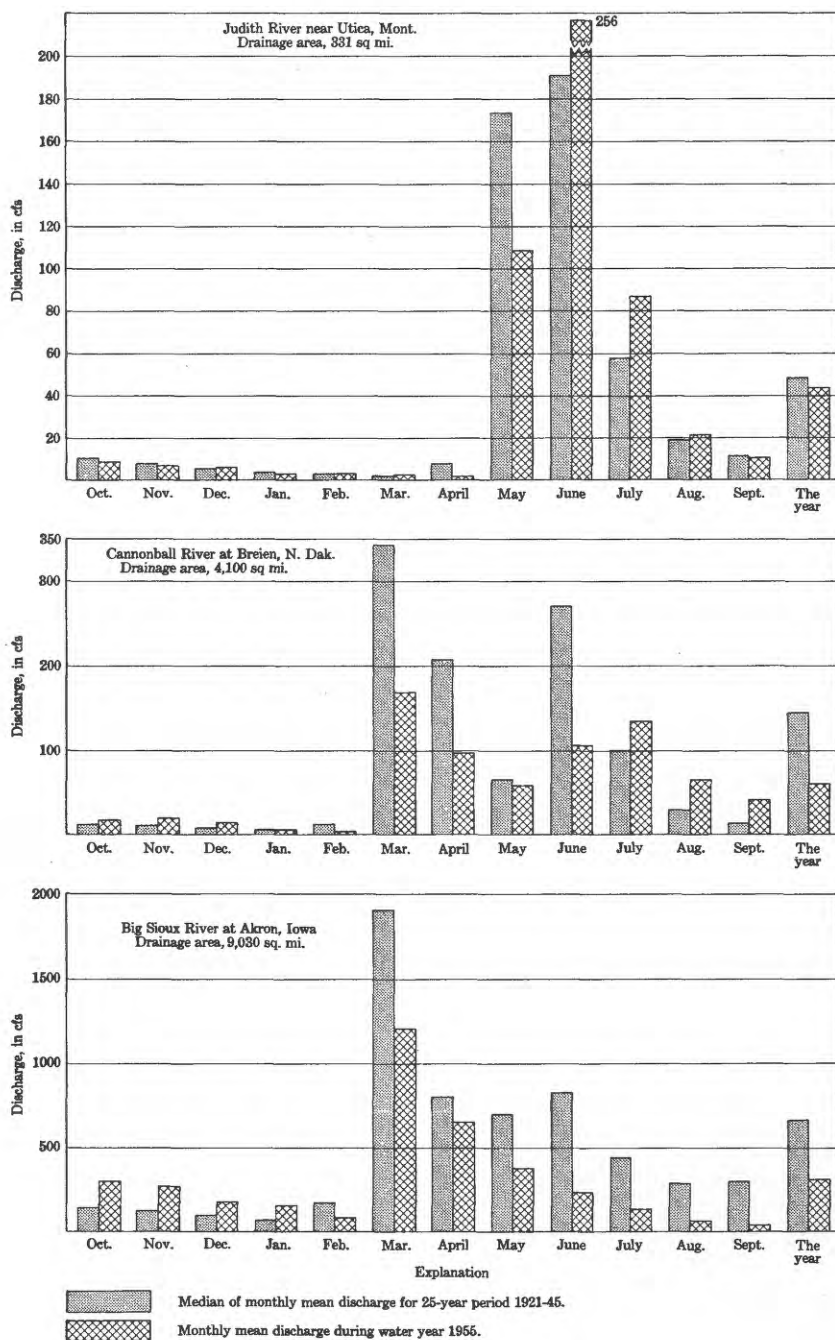


Figure 3. Comparison of discharge at three key gaging stations during 1955 water year with median discharge for 25-year period.

## GAGING-STATION RECORDS

## MISSOURI RIVER MAIN STEM

Red Rock River at Kennedy Ranch, near Lakeview, Mont.

Location.--Lat 44°39', long 112°03', near center of sec. 2, T. 14 S., R. 4 W., on right bank at Kennedy Ranch, 4 miles upstream from Long Creek and 14 miles northwest of Lakeview.

Drainage area.--318 sq mi.

Records available.--July 1936 to September 1955 (no winter records 1943-55).

Gage.--Water-stage recorder and wooden control. Datum of gage is 6,596.37 ft above mean sea level, unadjusted. Prior to Sept. 30, 1936, staff gage and Oct. 1, 1936, to Aug. 27, 1942, water-stage recorder, at site 1 mile upstream at different datum.

Extremes.--Maximum discharge recorded during year, 399 cfs Oct. 24 (gage height, 3.02 ft); minimum daily, 20 cfs Nov. 30, Dec. 1.  
1936-55: Maximum discharge recorded, 1,360 cfs Apr. 30, 1952 (gage height, 5.24 ft); minimum, 1.5 cfs Sept. 2, 1940.

Remarks.--Records good except those for period of no gage-height record, which are poor. Diversions for irrigation of about 6,000 acres above station.

Revisions (water years).--WSP 1086: 1946. WSP 1339: 1937.

Rating table, water year 1954-55, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.6	30	2.6	260
1.8	55	2.8	330
2.0	90	3.0	393
2.2	133	3.1	423
2.4	190		

Discharge, in cubic feet per second, water year October 1954 to September 1955

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	39	69	b20					a290	285	216	75	49
2	39	73						a290	296	213	75	44
3	37	77						a295	285	206	71	42
4	33	69						a300	285	193	69	42
5	38	69						a310	271	175	69	42
6	39	69						a330	260	166	65	41
7	*38	68						a350	260	146	63	40
8	33	73						a360	223	144	61	40
9	34	84						a370	256	152	58	40
10	38	*80						a370	267	146	55	38
11	37	71						a370	256	136	51	40
12	27	75						a370	245	126	51	39
13	35	71						a370	249	117	52	38
14	29	77						a390	274	110	57	36
15	39	79						a410	282	98	56	38
16	44	80						a400	*282	96	55	32
17	47	73						a390	365	92	54	34
18	42	82						*371	396	84	54	36
19	47	84						336	367	80	54	39
20	45	82						316	352	77	54	40
21	48	80						296	327	*73	54	44
22	51	80						299	299	75	52	40
23	48	84						310	278	79	52	42
24	112	86						303	271	90	51	47
25	126	86						323	253	92	55	52
26	77	71						306	234	90	57	55
27	65	38						274	225	90	54	49
28	66	b30						264	181	86	54	47
29	71	b25						271	181	80	54	40
30	69	b20						260	190	77	54	39
31	69	-----						253	-----	75	*52	-----
Total	1,560	2,105	-	-	-	-	-	10,147	8,213	3,680	1,790	1,249
Mean	50.3	70.2	-	-	-	-	-	327	274	119	57.7	41.6
Ac-ft	3,090	4,180	-	-	-	-	-	20,130	16,290	7,300	3,550	2,480
Calendar year	: Max		Min		Mean		Ac-ft		Ac-ft			
Water year	: Max		Min		Mean		Ac-ft		Ac-ft			

\* Discharge measurement made on this day.

a No gage-height record; discharge estimated on basis of 1 discharge measurement, weather records, and records for nearby stations.

b Stage-discharge relation affected by ice.





















































































































































































































































































































































































































































































































































































































































































































































































































































































































































