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 references to previously published reports.

DOWNSTREAM ORDER OF LISTING GAGING STATIONS

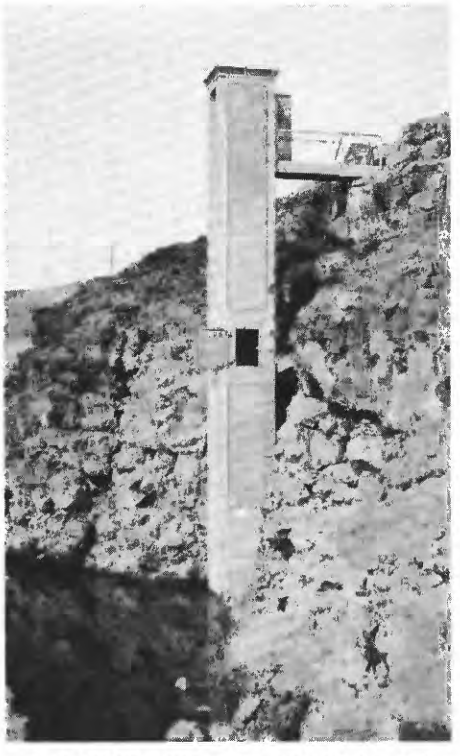
Beginning with the series of reports for the water year ending September 30, 1951, the order of listing gaging-station records was changed. In this report, in a downstream direction along the main stem all stations on a tributary entering above a main-stem station are listed before that station. If a 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 indention in the listing of gaging stations in the table of contents of this report represents one rank. This downstream order and system of indention 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.

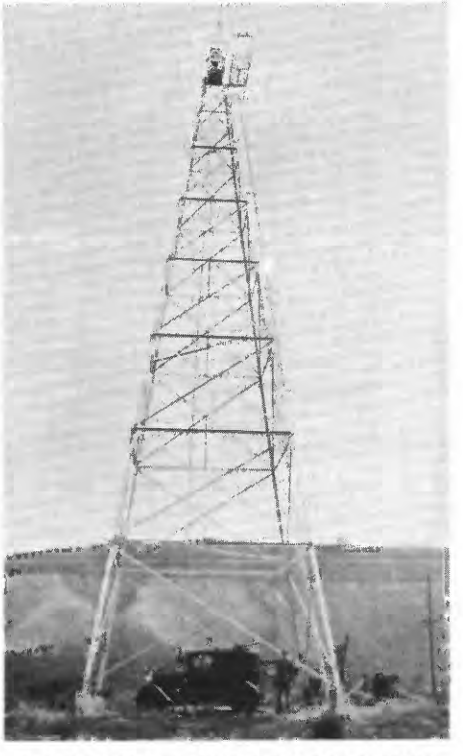
EXPLANATION OF DATA

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



A, COLUMBIA RIVER AT TRINIDAD, WASH.
Recording-gage shelter and stilling well.



B, COLUMBIA RIVER AT TRINIDAD, WASH.
East cable tower.

FIGURE 1.—GAGING-STATION STRUCTURES.

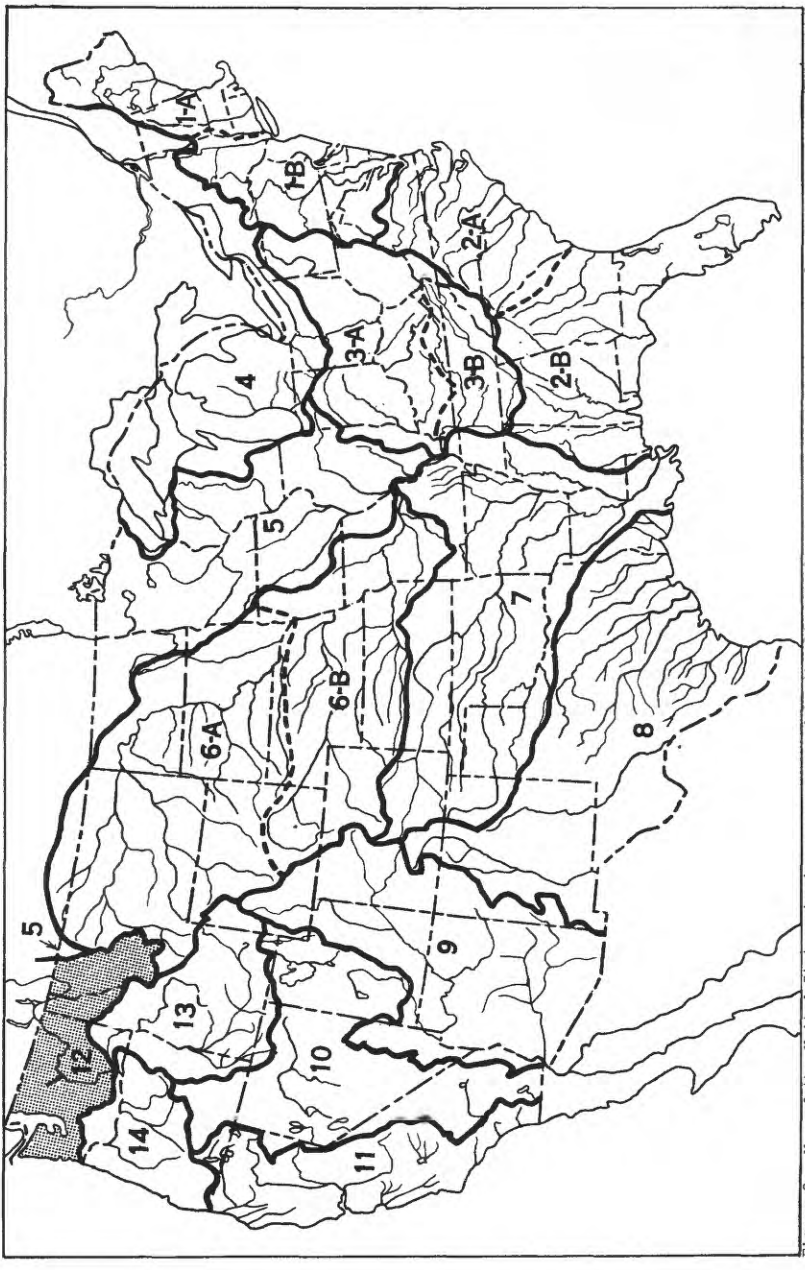


Figure 2.--Map of the United States showing areas covered by the 18 annual volumes on surface-water supply. The area covered by this report is shaded.

2. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

3. Sets are available for consultation in the offices of the Water Resources Division of the Geological Survey. Addresses of the offices in the area covered by this report are given on page 2.

Early records of the flow of streams in the United States are published in the reports listed below. 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 Septemner 1890.
12th A, pt. 2	....do.....	1884 to June 30, 1891.
13th A, pt. 3	....do.....	1884-92.
14th A, pt. 2	Monthly discharge.....	1888-93.
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 65, 66...	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.

Numbers of water-supply papers containing results of stream measurements in Pacific slope basins in Washington and upper Columbia River basin, 1899-1954

Year	WSP	Year	WSP	Year	WSP	Year	WSP	Year	WSP
1899	38	1911	312	1923	572	1934	767	1945	1042
1900	51	1912	332-A	1924	592	1935	792	1946	1062
1901	66, 75	1913	362-A	1925	612	1936	812	1947	1092
1902	85	1914	392	1926	632	1937	832	1948	1122
1903	100	1915	412	1927	652	1938	862	1949	1152
1904	135	1916	442	1928	672	1939	882	1950	1182
1905	178	1917	462	1929	692	1940	902	1951	1216
1906	214	1918	482	1930	707	1941	932	1952	1246
1907-8	252	1919-20	512	1931	722	1942	962	1953	1286
1909	272	1921	532	1932	737	1943	982	1954	1346
1910	292	1922	552	1933	752	1944	1012		

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 under "Miscellaneous discharge measurements" 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.

A compilation of records for the area covered by this report through September 1950 has been published as Water-Supply Paper 1316. That report contains a summary of monthly

and annual discharges for all previously published records as well as some records not contained in the annual series of water-supply papers. All records were reexamined and revised where warranted. Estimates of discharge were made to fill short gaps whenever practical.

Records of discharge have been published also in State reports. Most of these records are also compiled in Water-Supply Paper 1316; however some of them are not contained in the publications of the Geological Survey. The following table contains a list of these reports for the area covered by this report.

State reports containing compilations of records of discharge

State	Period	Report	Issued by
Montana.....	1898-1911	5th biennial report.....	Office of the State Engineer.
Do.....	1898-1938	Water resources of Montana, Part 2, Vol. IV.	Montana Agricultural Experiment Station.
Washington....	1878-1953	Bull. 6, Monthly and yearly summaries of hydrographic data.	Department of Conservation and Development.

Note.--In addition to the records contained in the reports listed above, the following States have issued annual or biennial reports in which are contained records of discharge: Idaho, Montana, Washington.

The reports listed in the foregoing table contain the customary records of discharge collected during the systematic operation of gaging stations. Detailed information on the stage and discharge of many streams during major floods has been included in special reports on these floods published by the Geological Survey. The more recent of these special reports also contain other pertinent hydrologic information and analyses and compilations of data relating to earlier notable floods. The following is a list of these reports:

WSP 771: Floods in the United States, magnitude and frequency.
WSP 847: Maximum discharges at stream-measurement stations through September 1938.
WSP 968-B: Floods of the Puyallup and Chehalis River basins, Washington.
WSP 1080: Floods of May-June 1948 in Columbia River basin.
WSP 1137-I: Summary of floods in the United States durin. 1950.
Cir. 191: Floods in western Washington, frequency and magnitude in relation to drainage basin characteristics.

RECORDS OF DISCHARGE COLLECTED BY AGENCIES OTHER THAN THE GEOLOGICAL SURVEY

The table below contains a list of gaging stations for the area covered by this report, at which records of discharge were collected during the water year October 1953 to September 1954 by agencies other than the Geological Survey. The records of these stations are not contained in publications of the Geological Survey, nor have they been published elsewhere.

Records of discharge collected by agencies other than the Geological Survey

Stream	Location	Period	Collected by	Remarks
Lake Whatcom.....	Bellingham, Wash.....	1923-54	City of Bellingham....	Unpublished.
Reservation drain.....	Alfalfa, Wash.....	1912-54	Office of Indian Affairs.	‡Unpublished since 1923.
Satus Creek.....	Downstream from Dry Creek, near Toppenish, Wash.	1913-54	....do.....	‡Unpublished since 1924.
Do.....	Near Satus, Wash.....	1932-54	....do.....	Unpublished.
Toppenish Creek.....	Near Fort Simcoe, Wash.	1909-54	....do.....	‡Unpublished since 1924.
Do.....	Near Alfalfa, Wash.....	1932-54	....do.....	Unpublished.
Yakima River.....	Easton, Wash.....	1904, 1910-15, 1940-54	Bureau of Reclamation.	‡Unpublished since 1915.

‡ Records for earlier years published in water-supply papers of Geological Survey.

Note.--Records of daily discharge for many canals and drains in Washington and Montana for 1953 and earlier years have been collected by the Bureau of Reclamation and the Office of Indian Affairs of the United States Department of the Interior in connection with irrigation and drainage projects. These records have not been published. The Northern Rocky Mountain Forest and Range Experiment Station collects records of runoff from an area of 960 acres on Benton Creek near Priest River, Idaho.

HYDROLOGIC CONDITIONS

The water year 1954 was characterized by well above normal runoff over most of the Pacific slope basins in Washington and upper Columbia River basin. Due to the heaviest snow pack ever recorded on many snow courses in the upper Columbia River basin, some snowmelt flooding occurred during May which exceeded or approached the record high flood peaks of 1948 before extended cool weather prevented disastrous floods from occurring. For two key gaging stations in the area covered by this report, a comparison of the monthly and yearly mean discharges during the 1954 water year with the median discharges for the 25-year period 1921-45 is shown in figure 3 below.

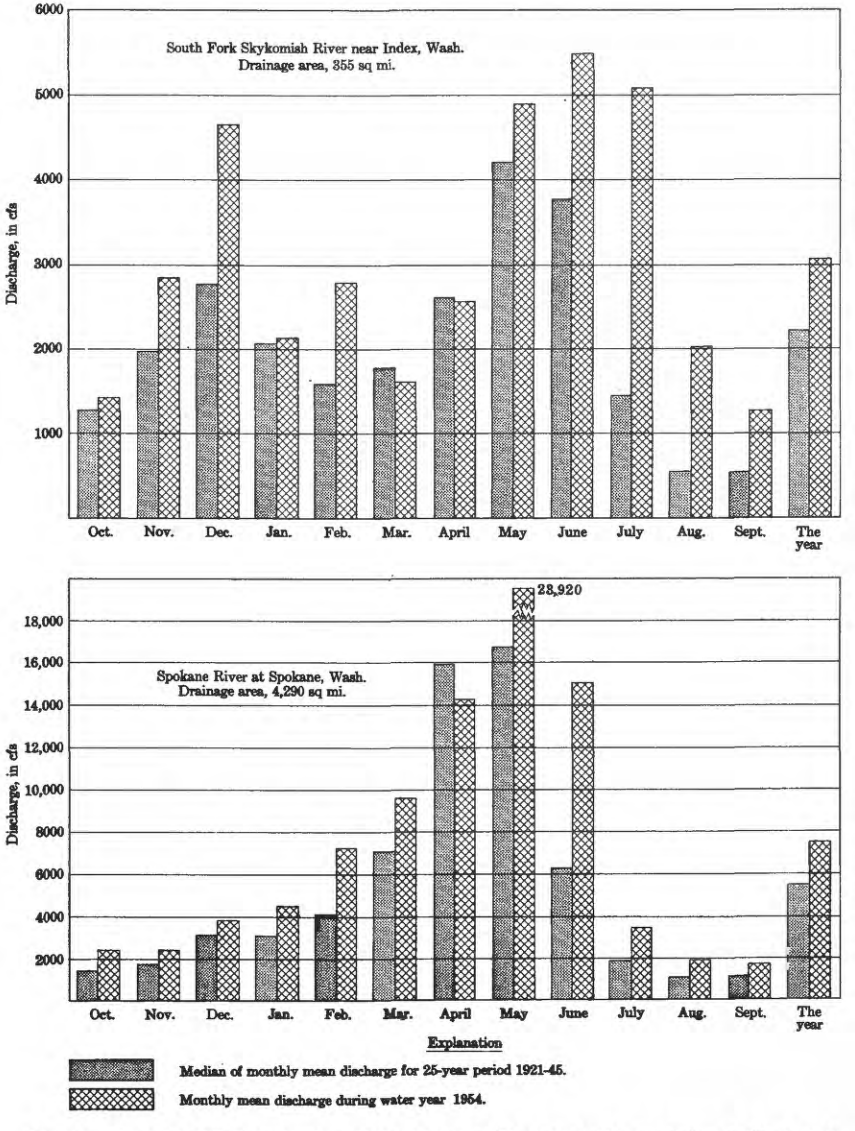


Figure 3. Comparison of discharge at two key gaging stations during 1954 water year with median discharge for 25-year period.