DEPARTMENT OF THE INTERIOR
JOHN BARTON PAYNE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

WATER-SUPPLY PAPER 459

RFACE WATER SUPPLY OF THE UNITED STATES

1917

PART IX. COLORADO RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
T FOLLANSBEE, C. C. JACOB, and C. E. ELLSWORTH, District Engineers

Prepared in cooperation with
THE STATES OF ARIZONA, NEVADA, UTAH, AND WYOMING

WASHINGTON
GOVERNMENT PRINTING OFFICE
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SURFACE WATER SUPPLY OF COLORADO RIVER BASIN, 1917.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1917.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

Provided, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry bills passed by Congress have carried the following item and appropriations:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1918.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000
1918	175,000

In the execution of the work many private and State organizations have cooperated, either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on pages 11–12.

Measurements of stream flow have been made at about 4,240 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,180 gaging stations were being maintained by the Survey and the cooperating organizations. Many

miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miners' inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth in inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1916, and ending September 30, 1917. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights give the discharge from which the daily, monthly, and yearly mean discharge is determined.

The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuations the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the

day. If such stations are equipped with water-stage recorders, the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 8, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

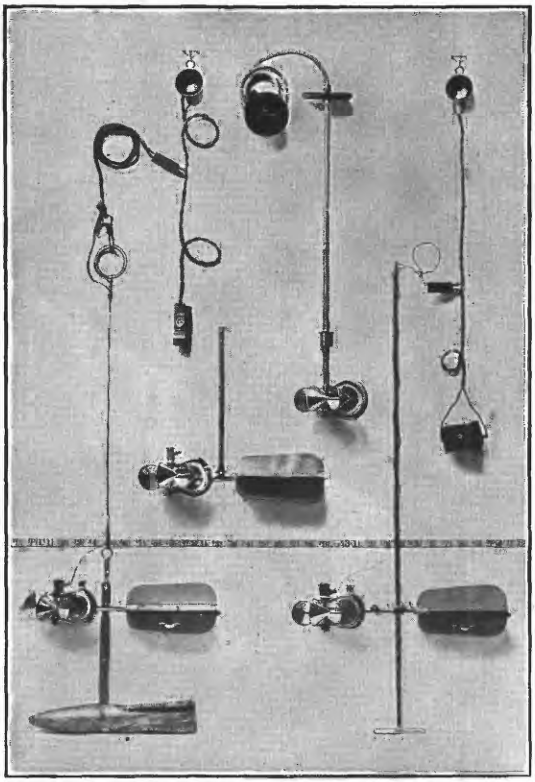
The accuracy of stream-flow data depends primarily (1) on the permanence of the stage-discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

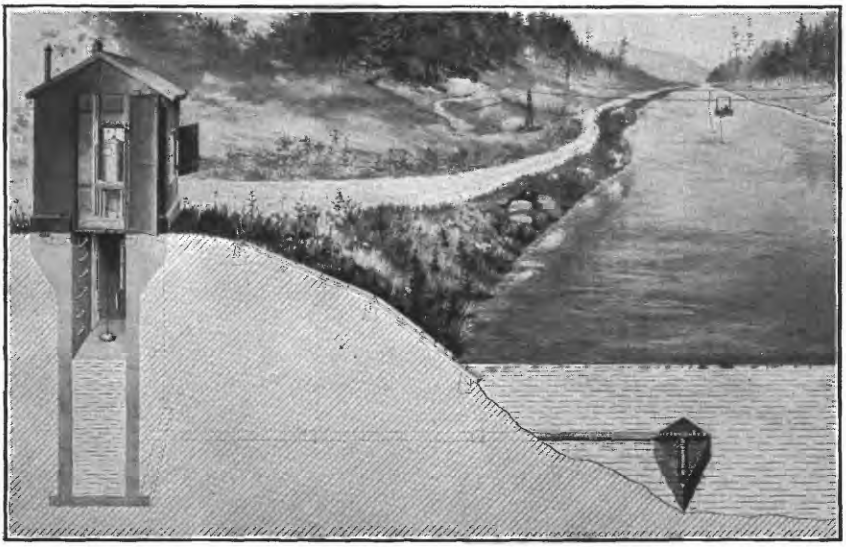
For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large non-contributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for

[1] For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C. Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53–59, 1916.



A. PRICE CURRENT METERS.



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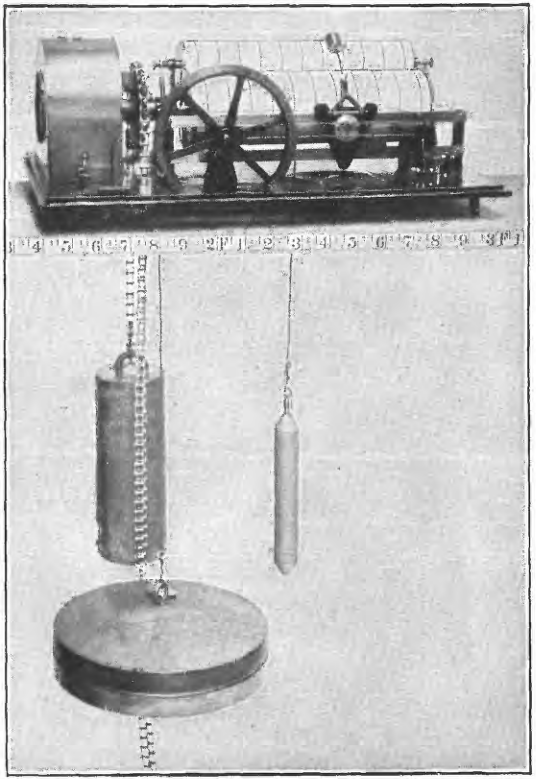

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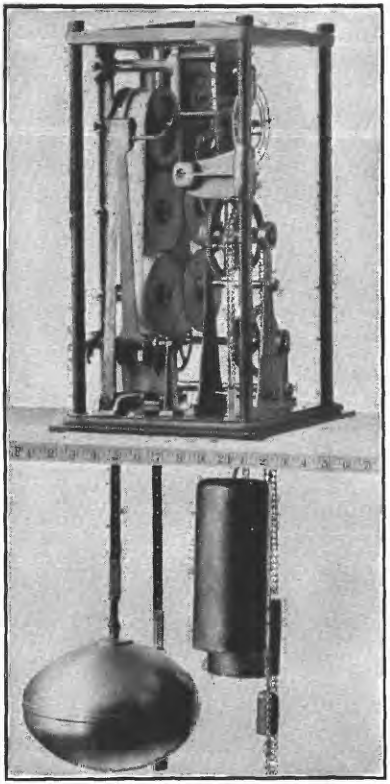

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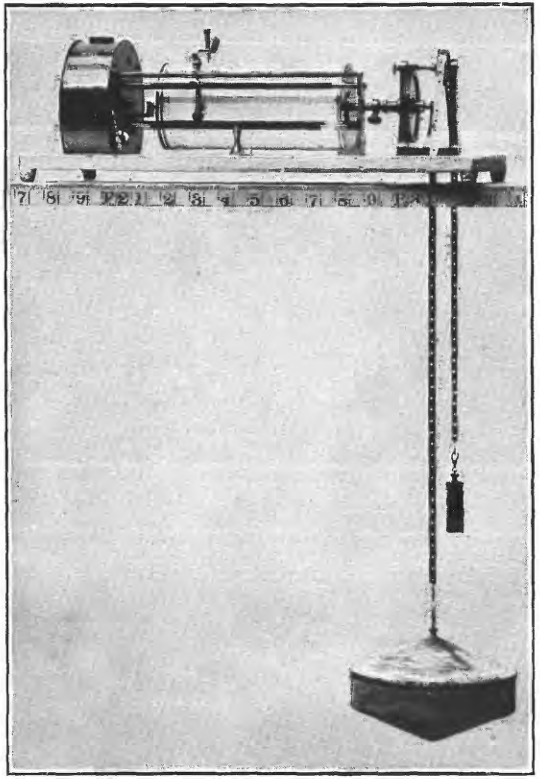

C. FRIEZ.

WATER-STAGE RECORDERS.

stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

The work in Arizona, Nevada, Utah, and Wyoming was carried on under cooperative agreement between the United States Geological Survey and the States, and special acknowledgments are due to the cooperating State officials, R. H. Forbes, director of the Arizona State Agricultural Experiment Station; W. M. Kearney, succeeded by J. G. Scrugham, State engineer of Nevada; W. D. Beers, succeeded by G. F. McGonagle, State engineer of Utah; and J. B. True, State engineer of Wyoming.

The State engineer of Colorado, A. J. McCune, paid the observers at the stations on North Fork of Grand River near Grand Lake, Grand River near Kremmling, and Williams Fork near Parshall, and cooperated in the maintenance of station on Yampa River near Maybell.

The United States Reclamation Service paid for a part of the maintenance of stations on Green River at Green River, Wyo., and Yampa River near Maybell, Colo.

The United States Forest Service furnished gage-height record for stations on Pine Creek at Fremont Lake outlet, and at Pinedale, Wyo.; also furnished the services of an hydrographer for part of the time during winter, and all or a part of gage-height records for 18 stations in the Grand River basin in Colorado.

Records of stage for East Fork at East Fork canal were furnished by S. E. Bartlett; and for Crystal River at Marble, Colo., by the Colorado-Yule Marble Co.; for Leroux Creek near Lazear, Colo., by J. E. Hansen.

Financial assistance for work in Utah and Nevada has been rendered by the U. S. Reclamation Service, the U. S. Office of Indian Affairs, the Utah Power & Light Co., Muddy Valley Irrigation District, The Vernal Milling & Light Co., and R. C. Savage.

The United States Indian Service cooperated in the maintenance of stations on Gila River at Guthrie, near Solomonville, near San Carlos, at Winkelman, at Kelvin, and on San Francisco River at Clifton, Ariz.

The United Verde Copper Co. cooperated in maintaining station on Verde River near Clarkedale, Ariz.

The Southwestern Arizona Fruit & Irrigation Co. furnished gage-height record for Gila River near Sentinel, Ariz.

DIVISION OF WORK.

Data for stations in Arizona were collected and prepared for publication under the direction of C. E. Ellsworth, district engineer, assisted by J. B. Spiegel, M. D. Anderson, Wallace Adams, and Mrs. Carol H. Shrigley.

Data for stations in Colorado and Wyoming were collected and prepared for publication under the direction of Robert Follansbee, district engineer, who was assisted by S. B. Soulé, H. W. Fear, P. V. Hodges, H. K. Smith, and Miss Bessie Meyers.

For stations in Nevada and Utah data were collected and prepared for publication under the direction of C. C. Jacob, district engineer, assisted by A. B. Purton, L. W. Jordan, J. J. Sanford, W. E. Dickinson, C. W. Bennett, R. P. Flagel, and Miss Ruby Christensen.

The manuscript was reviewed and assembled by B. J. Peterson and B. L. Hopkins.

GAGING-STATION RECORDS.

GREEN RIVER AND THE MAIN COLORADO.

GREEN RIVER NEAR DANIEL, WYO.

LOCATION.—Near line between Tps. 32 and 33 N., R. 110 W., at highway bridge 6 miles southwest of Daniel, in Fremont County. No tributary of importance within several miles.

DRAINAGE AREA.—932 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1917. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain located on downstream side of bridge; read by Mrs. A. P. Sommers.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and small boulders; control 100 feet downstream at small rapids which was practically permanent during 1917. Banks are high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 5.5 feet, June 24 to 27 inclusive (discharge, 4,810 second-feet); minimum discharge probably occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 212 second-feet from Green River above station near Daniel.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter period. Rating curve well defined between 400 and 4,600 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage reading to rating table. Records good.

Discharge measurements of Green River near Daniel, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 2	H. K. Smith	2.38	276	June 23	H. K. Smith	5.42	4,040
May 21	do	4.72	3,370	Sept. 27	S. B. Soulé	2.71	430
25	do	4.68	3,270				

Daily discharge, in second-feet, of Green River near Daniel, Wyo., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	580	2,400	4,050	1,810	465	16	.....	3,120	3,860	2,760	825	625
2	.....	500	2,230	3,860	1,650	465	17	.....	3,120	4,050	2,580	825	625
3	.....	540	2,060	3,670	1,570	430	18	.....	3,120	4,050	2,400	825	540
4	.....	670	1,980	3,670	1,570	430	19	.....	2,760	4,240	2,140	770	500
5	.....	625	2,400	3,670	1,340	465	20	.....	3,120	4,430	2,140	720	500
6	.....	625	2,060	4,050	1,270	465	21	.....	3,300	4,430	2,140	720	465
7	.....	670	1,810	4,050	1,200	500	22	.....	3,670	4,620	2,060	670	465
8	.....	770	2,060	4,050	1,200	500	23	.....	3,670	4,620	2,060	670	465
9	.....	880	2,230	4,050	1,130	465	24	.....	3,670	4,810	2,060	625	500
10	.....	1,000	1,810	3,860	1,060	465	25	.....	3,480	4,810	2,060	625	540
11	.....	1,500	2,760	3,670	1,000	465	26	.....	3,120	4,810	1,980	580	465
12	.....	1,810	3,860	3,480	940	500	27	1,730	3,120	4,810	1,980	580	430
13	.....	2,140	2,850	3,300	940	540	28	880	3,300	4,620	1,980	540	430
14	.....	2,760	1,980	3,120	940	670	29	770	3,120	4,620	1,890	540	430
15	.....	3,300	2,400	2,940	880	720	30	670	2,940	4,430	1,890	500	430
							31	.....	2,580	.....	1,810	500	.....

Monthly discharge of Green River near Daniel, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April 27-30	1,730	670	1,010	8,010
May	3,670	500	2,240	138,000
June	4,810	1,810	3,400	202,000
July	4,050	1,810	2,880	177,000
August	1,810	500	936	57,600
September	720	430	498	29,600
The period	.....	.....	.....	612,000

GREEN RIVER AT GREEN RIVER, WYO.

LOCATION.—In sec. 22, T. 18 N., R. 107 W., at highway bridge a quarter of a mile south of railroad station at Green River, in Sweetwater County. No tributary within several miles.

DRAINAGE AREA.—7,670 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—May 2, 1895, to October 31, 1906; March 1, 1915, to September 30, 1917.

GAGE.—Chain on upstream side of left span read by Wm. Hutton, jr. Vertical staff attached to submerged cribbing on the east bank of the river near pump house one-third mile above present location used from 1895 to 1906. No determined relation between gages.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Channel composed of compact gravel and small boulders with sand bar on one side; practically permanent during 1917; no well-defined control. Banks are high and not subject to overflow at stages less than 10.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 11.45 feet at 5 p. m. June 28 (discharge, 18,900 second-feet); minimum discharge of 250 second-feet occurred November 13, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and records of temperature.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 208 second-feet from Green River between station near Daniel and Green River station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; seriously affected by ice during winter months. Rating curve well defined between 900 and 18,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records are excellent except during period affected by ice, for which they are good.

COOPERATION.—The United States Weather Bureau furnished gage heights October 1 to November 30 and March 1 to September 30.

Discharge measurements of Green River at Green River, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	H. K. Smith	4.06	992	May 31	H. K. Smith	7.63	6,550
Dec. 9	P. V. Hodges	4.44	419	June 26	do	11.07	17,300
Jan. 12	H. K. Smith	5.15	440	Aug. 2	Robert Follansbee	6.81	4,370
Feb. 9	do	5.18	340	Sept. 21	S. B. Soulé	4.27	1,180
Mar. 9	do	5.48	454				

Daily discharge, in second-feet, of Green River at Green River, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sept.
1	692	950	420	365	365	420	1,030	2,670	6,550	17,300	5,170	1,470
2	725	910	420	365	365	420	1,030	2,390	5,840	17,300	4,560	1,380
3	725	870	420	392	365	420	1,030	2,130	5,390	17,000	3,990	1,290
4	725	870	448	420	365	420	1,030	2,130	5,390	15,600	3,630	1,290
5	832	870	448	420	365	448	1,030	1,890	5,390	13,800	3,290	1,380
6	870	870	420	420	365	448	1,120	1,890	5,170	13,800	3,130	1,470
7	950	795	420	448	365	448	1,240	1,890	4,760	13,800	3,130	1,470
8	910	760	420	448	340	448	1,380	2,130	4,560	14,500	2,970	1,570
9	832	595	419	448	340	448	1,470	2,130	4,960	14,200	2,670	1,570
10	832	595	420	448	340	448	1,620	2,130	5,390	13,800	2,530	1,570
11	870	535	420	448	340	448	1,780	2,390	6,310	13,800	2,390	1,570
12	832	315	420	448	340	448	1,890	2,970	8,400	13,100	2,250	1,570
13	832	250	420	315	365	448	2,130	3,630	7,840	12,800	2,190	1,470
14	832	270	420	315	365	448	2,530	3,990	5,840	12,000	2,150	1,380
15	950	315	420	315	365	448	2,670	4,760	5,610	10,800	2,100	1,380
16	910	315	420	315	365	475	2,390	5,840	5,610	9,890	2,090	1,380
17	870	340	420	315	365	475	2,010	6,800	6,550	9,290	2,040	1,380
18	870	340	420	340	365	475	1,780	5,840	8,990	8,120	1,980	1,380
19	870	340	420	340	365	475	1,890	5,390	11,100	7,840	1,940	1,290
20	870	365	420	340	365	475	1,670	5,390	13,100	7,310	1,890	1,200
21	870	365	420	340	365	505	2,130	6,070	14,800	7,050	1,850	1,200
22	870	365	420	340	365	505	2,130	7,050	15,200	6,800	1,800	1,200
23	910	392	392	340	365	505	2,390	8,120	16,200	6,550	1,750	1,120
24	950	420	392	365	365	505	3,130	8,400	16,600	6,550	1,710	1,030
25	960	420	365	365	392	535	3,990	8,400	17,300	6,070	1,670	1,120
26	950	420	365	365	392	595	4,370	7,570	17,600	5,840	1,640	1,200
27	950	420	365	365	392	660	5,170	7,310	18,000	5,390	1,610	1,200
28	950	420	365	365	392	760	4,960	6,800	18,400	5,170	1,590	1,200
29	950	420	340	365	.....	870	3,990	6,310	18,000	5,170	1,580	1,200
30	950	420	340	365	.....	950	2,970	6,550	17,300	5,390	1,570	1,200
31	950	.....	340	365	.....	1,030	.....	6,550	.....	5,390	1,470	.....

NOTE.—Stage-discharge relation affected by ice Nov. 12, 1916, to Apr. 10, 1917; discharge based on daily gage heights, discharge measurements, observer's notes, and temperature records. Gage was not read Aug. 12–29; discharge obtained from comparative hydrograph with Green River near Daniel, Wyo.

Monthly discharge of Green River at Green River, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	990	692	874	53,700
November	950	250	518	30,800
December	448	340	405	24,900
January	448	315	374	23,000
February	392	340	364	20,200
March	1,030	420	529	32,500
April	5,170	1,030	2,260	134,000
May	8,400	1,890	4,760	293,000
June	18,400	4,560	10,100	601,000
July	17,300	5,170	10,400	640,000
August	5,170	1,470	2,400	148,000
September	1,570	1,030	1,340	79,700
The year	18,400	250	2,870	2,080,000

GREEN RIVER AT LITTLE VALLEY, NEAR GREEN RIVER, UTAH.

LOCATION.—In sec. 4, T. 22 S., R. 16 E., 1 mile above old Little Valley ferry and 6 miles downstream from Green River, Emery County.

DRAINAGE AREA.—41,000 square miles.

RECORDS AVAILABLE.—December 18, 1910, to September 30, 1917. Records obtained at Green River (known also as Elgin or Blake) from 1894 to 1899, and 1905 to 1911, give practically the same flow.

GAGE.—Friez water-stage recorder on left bank about a mile above old ferry cable inspected by R. C. Wheeler. Various gages at cable were in use from December 18, 1910, to November 6, 1914, when the Friez recorder was installed. The records at Green River were obtained from chain gage at the Denver & Rio Grande Railroad bridge until December 2, 1910, when the gage was moved 200 feet upstream to the new highway bridge.

DISCHARGE MEASUREMENTS.—Made from a car on the ferry cable.

CHANNEL AND CONTROL.—Bed composed of gravel and sand. Control probably about two-thirds of a mile below the gage; apparently fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, from water-stage recorder, 14.53 feet at 6 a. m. June 27 (discharge, 68,100 second-feet); minimum stage, from water-stage recorder, −0.15 foot at 11 a. m. November 18 (discharge, 995 second-feet).

1894–1899, 1905–1917: Maximum discharge recorded, 68,800 second-feet, May 29, 1897; minimum discharge recorded, 0.35 foot at 8 a. m. December 21, 1915, (discharge, 875 second-feet).

ICE.—Stage-discharge relation seriously affected by ice nearly every winter.

DIVERSIONS.—Station is below practically all diversions from Green River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except as affected by ice December 28 to March 3. Rating curve well defined between 800 and 70,000 second-feet, by measurements made 1915 to 1919. Operation of water-stage recorder satisfactory except for period January 27 to February 23, when daily readings of staff gage were secured. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection. For period when stage-discharge relation was affected by ice, means of discharge were estimated from observer's notes and weather records. Records good.

Discharge measurements of Green River at Little Valley, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 7	J. J. Sanford	1.43	3,140	July 29	R. P. Flagel	4.40	9,850
Mar. 6	Sanford and Flagel	1.76	3,710	Aug. 31	do	1.91	3,660
June 22	A. B. Purton	12.60	[a] 49,500	Sept. 11	Jacobs and La Rue	1.95	[c] 3,880
23	do	13.30	[b] 58,400				

[a] Area determined by prolonging area curve. Mean velocity assumed 75 per cent of maximum velocity as determined from drift-wood floating in main part of current. Measured at Green River.

[b] Measured by timing floats between highway bridge and railroad bridge. Mean velocity determined from a horizontal velocity curve of surface velocities and a coefficient of 0.85 for reducing surface velocity to mean in vertical. Area determined from soundings of measurement on July 29. Measured at Green River.

[c] Measured from highway bridge at Green River.

Daily discharge, in second-feet, of Green River at Little Valley, near Green River, Utah, for December, 1915.

1	2,100	11	2,460	21	875
2	1,830	12	2,460	22	1,000
3	1,720	13	2,380	23	1,120
4	1,700	14	2,460	24	1,370
5	1,900	15	2,460	25	1,420
6	2,070	16	2,220	26	1,640
7	2,240	17	2,150	27	2,010
8	2,300	18	2,220	28	2,010
9	2,380	19	1,300	29	1,880
10	2,460	20	875	30	1,700
				31	1,530

NOTE.—Because of better definition of rating curve based on extreme low-water measurements made in 1919, records for this month are revised, and supersede those published in Water-Supply Paper 439.

Discharge estimated because of backwater from ice Dec. 22-31, from observer's notes and temperature records. The abnormally low flow on Dec. 20 and 21 was caused by water being held back several miles upstream by an ice jam in the canyon.

Monthly discharge of Green River at Little Valley, near Green River, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	8,440	2,800	3,940	242,000
November	3,910	2,380	2,830	168,000
December	2,460	875	1,880	116,000
January	----------	----------	1,720	106,000
February	2,720	----------	2,240	129,000
March	17,600	2,630	9,080	558,000
April	18,500	7,340	10,500	625,000
May	30,300	15,800	21,000	1,290,000
June	26,200	15,800	23,000	1,370,000
July	15,400	6,420	10,300	633,000
August	8,520	3,150	5,750	354,000
September	2,970	1,990	2,570	153,000
The year	30,300	875	7,930	5,740,000

NOTE.—Discharge records for December, 1915, have been revised. Figures in the above table supersede those published in Water-Supply Paper 439, page 21.

Daily discharge, in second-feet, of Green River at Little Valley, near Green River, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,570	3,620	2,250	.....	8,670	20,400	33,500	59,400	12,600	3,810
2	3,330	3,520	2,150	.....	14,000	17,400	34,100	57,600	11,800	3,710
3	3,520	3,520	2,080	.....	9,580	14,900	35,200	54,000	10,900	3,610
4	4,110	3,520	2,300	3,420	8,180	14,000	34,600	51,600	10,900	3,610
5	3,520	3,520	2,710	3,150	7,080	15,900	31,800	49,200	10,500	3,610
6	4,010	3,420	2,970	3,330	6,240	15,400	31,800	45,700	9,760	3,520
7	8,180	3,330	3,060	2,970	5,600	13,100	33,500	42,100	8,860	3,420
8	4,430	3,330	2,150	2,800	5,360	11,800	34,100	38,600	8,180	3,420
9	5,600	3,240	1,480	2,880	6,380	11,300	32,900	36,900	7,540	3,610
10	7,890	3,240	1,370	3,060	7,380	10,900	31,800	35,200	7,230	3,810
11	11,300	3,150	1,320	3,060	9,760	10,900	33,500	33,500	6,940	4,110
12	7,380	3,150	1,140	3,060	14,000	11,300	38,100	32,400	6,790	5,000
13	7,850	3,060	1,470	3,150	15,400	12,600	41,000	30,700	6,790	4,110
14	6,650	2,800	1,760	3,150	16,400	14,900	44,500	29,000	6,240	4,110
15	5,730	2,300	1,880	3,060	15,900	17,400	46,800	26,800	5,980	4,430
16	5,980	1,760	1,940	3,150	15,900	20,900	46,800	24,600	5,730	4,650
17	6,110	1,190	2,150	3,060	14,500	26,800	46,200	22,500	5,600	4,770
18	5,480	1,070	2,300	2,970	13,100	30,700	46,200	20,900	5,480	4,540
19	4,540	1,240	2,220	2,880	11,800	34,600	48,000	19,400	5,240	4,110
20	4,220	1,640	1,950	2,880	10,100	38,600	51,000	17,400	5,240	3,910
21	4,220	1,890	2,150	3,150	9,760	41,000	54,000	15,900	5,120	3,810
22	4,110	2,180	2,010	3,240	9,390	42,700	55,800	14,900	4,880	3,810
23	4,010	2,090	2,150	3,240	8,860	43,900	58,800	14,000	4,770	4,320
24	3,910	1,880	2,150	3,710	8,680	44,500	61,200	13,100	4,650	4,320
25	3,810	1,910	2,150	4,010	9,390	44,500	63,100	12,600	4,430	4,110
26	3,810	1,910	2,460	3,910	12,600	41,000	64,300	12,200	4,320	4,430
27	3,710	2,250	2,380	3,610	17,400	39,800	66,700	11,800	4,110	4,220
28	3,710	2,460	.....	3,710	19,900	39,800	65,500	11,800	4,010	3,910
29	3,710	2,380	.....	3,710	22,500	39,800	63,100	11,300	4,010	3,810
30	3,710	2,380	.....	3,610	24,100	37,500	61,200	10,900	3,910	3,710
31	3,710	.....	.....	4,540	.....	34,600	.....	11,800	3,810	.....

NOTE.—Discharge estimated because of ice Dec. 28–31, 1,900 second-feet; Jan. 1–15, 1,500 second-feet; Jan. 16–31, 1,100 second-feet; Feb. 1–15, 1,300 second-feet; Feb. 16–28, 3,000 second-feet; and Mar. 1–3, 3,800 second-feet.

Monthly discharge of Green River at Little Valley, near Green River, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	11,300	2,570	4,990	307,000
November	3,620	1,070	2,560	152,000
December	3,060	1,140	2,060	127,000
January	.....	.....	1,290	79,300
February	.....	.....	2,090	116,000
March	4,540	2,800	3,350	206,000
April	24,100	5,360	11,900	708,000
May	44,500	10,900	26,200	1,610,000
June	66,700	31,800	46,300	2,760,000
July	59,400	10,900	28,000	1,720,000
August	12,600	3,810	6,660	410,000
September	5,000	3,420	4,010	239,000
The year	66,700	.....	11,700	8,430,000

COLORADO RIVER NEAR TOPOCK, ARIZ.

LOCATION.—In E. ½ sec. 16, T. 7 N., R. 24 E., San Bernardino base and meridian, at head of canyon 1¾ miles below Atchison, Topeka & Santa Fe Railway bridge at Topock and 16 miles (by main channel of river) below Needles, Calif.

DRAINAGE AREA.—171,000 square miles (169,000 square miles at Hardyville, Ariz., plus about 2,000 square miles between Hardyville and gaging station).

RECORDS AVAILABLE.—February 1, 1917, to September 30, 1917.

GAGE.—Stevens water-gage recorder on right (California) bank just above point where river rapidly narrows and enters rock canyon.

DISCHARGE MEASUREMENTS.—Made from highway bridge at Topock or from boat. Cable installed April, 1918, in canyon just below gage.

CHANNEL AND CONTROL.—Channel straight above and below gage. Above the gage the channel is wide and the bed of loose sand is constantly shifting. At low stages large sand bars form numerous islands between Topock and the gage. Below the gage the river enters a steep-walled rock canyon and the channel rapidly narrows from about 800 feet to 400 feet. The bed in the canyon shifts during floods. After floods it probably gradually regains its normal condition, which is maintained until the next rise when it again scours out. The control is indefinite.

EXTREMES OF DISCHARGE.—Maximum stage since station was established, 27 feet, about July 1, determined from flood marks on gage (approximate discharge determined from extension of rating curve 156,000 second-feet); minimum discharge of 6,000 second-feet occurred on February 4 at a gage height of 4.7 feet. Minimum stage was 2.9 feet on September 10 (discharge 9,450 second-feet).

DIVERSIONS.—Water is diverted for irrigation and power development from main river and tributaries above the station.

ACCURACY.—Stage-discharge relation not permanent. Standard rating curve fairly well defined below 90,000 second-feet by 22 measurements made from April 21, 1915, to July 7, 1918. Operation of water-stage recorder not satisfactory until September 15, when a new instrument was installed. Mean daily gage heights determined by inspecting recorder graph or by averaging hourly gage height except as indicated in footnote to daily-discharge table. Daily discharge determined as follows: February 1 to July 16 by applying mean daily gage heights to standard curve; July 17 to August 31 from parallel curve through measurements made August 25 and 28; September 1 to 30 by indirect method. Records poor.

Discharge measurements of Colorado River near Topock, Ariz., during the period ending Mar. 23, 1915, to Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Mar. 23	C. C. Jacob	.....	11,000	Oct. 24	Ellsworth and Bobst	5.7	25,100
Apr. 21	Jacob and Anderson	10.2	32,700				
May 19	M. D. Anderson	11.2	38,200	1917.			
21	do	12.35	51,600	Feb. 3	M. D. Anderson	4.78	6,100
June 24	do	11.8	49,100	Apr. 13	C. E. Ellsworth	7.50	16,000
				Aug. 25	Ellsworth and Bobst	3.95	14,100
1916.				28	do	3.70	13,400
June 1	M. D. Anderson	9.2	22,200				
Aug. 18	Ellsworth and Anderson.	8.7	33,200				

Daily discharge, in second-feet, of Colorado River near Topock, Ariz., for the year ending Sept. 30, 1917.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6,750	9,100	12,300	65,600	59,600	135,000	34,400	12,000
1	6,250	9,800	14,300	71,000	63,200	134,000	30,900	11,200
3	6,250	11,200	15,200	73,800	67,500	139,000	28,100	10,800
4	6,000	13,900	16,000	71,000	68,200	138,000	24,600	10,500
5	6,500	14,700	18,000	68,200	65,000	131,000	24,600	10,200
6	6,500	14,300	22,200	52,300	64,400	123,000	24,600	9,800
7	6,750	13,500	28,800	48,800	64,400	114,000	24,600	9,800
8	6,500	12,700	26,000	45,500	62,600	106,000	24,600	9,680
9	6,500	11,600	18,000	43,900	64,400	95,500	24,600	9,570
10	6,500	10,500	17,000	42,300	69,600	82,200	24,000	9,450
11	7,300	9,800	15,200	41,500	69,600	71,000	22,200	9,720
12	7,600	9,800	14,300	40,700	66,800	56,500	21,600	9,990
13	7,300	9,800	15,600	30,900	73,800	59,600	19,000	10,300
14	7,600	9,800	16,500	33,700	75,900	54,800	17,000	10,500
15	7,600	9,450	18,500	33,000	85,700	54,800	17,000	10,800
16	7,900	9,100	25,300	33,000	99,700	56,500	16,000	14,300
17	8,500	9,100	36,000	36,700	110,000	55,600	17,000	12,300
18	8,500	9,100	47,200	41,500	119,000	48,800	18,000	13,100
19	8,200	9,450	54,800	45,500	123,000	44,700	16,000	15,200
20	7,600	9,800	55,600	59,000	123,000	38,300	15,600	15,600
21	7,600	9,800	56,500	76,600	126,000	36,700	15,600	13,900
22	7,300	9,800	45,500	88,200	134,000	33,000	15,600	13,100
23	7,300	10,200	41,500	100,000	138,000	30,200	15,200	14,700
24	7,600	10,200	41,500	108,000	140,000	29,500	14,700	14,300
25	8,200	10,200	36,700	113,000	138,000	30,200	14,300	14,300
26	7,900	10,500	29,500	114,000	137,000	30,200	13,900	13,500
27	8,200	10,500	36,700	108,000	140,000	28,100	13,500	13,500
28	8,500	10,500	36,000	98,300	135,000	30,900	13,100	12,700
29	.....	11,900	53,100	79,400	138,000	30,900	13,500	12,700
30	.....	13,500	57,300	78,000	140,000	33,000	13,500	12,300
31	.....	12,700	.....	66,800	.....	36,000	12,700	.....

NOTE.—Gage heights subject to slight error on account of imperfect operation of recorder on following days: Apr. 14–21, May 30 to June 1, July 17–19, 30–31, Aug. 8 and 9. Gage heights from staff gage readings on following days: Apr. 7, 8, 9, 26, and 28; May 2, 6, 13, 19, 21, 22, 25, and 29; June 12 and 22; July 5 and 12; Aug. 25; Sept. 2, 6, 7, and 10. Gage heights on Apr. 23–25, 27; Apr. 29 to May 1; May 3–5, 7–12, 14–18, 20, 23, 24, 26–28; June 2–11, 13–21, 23–26, 28–30; July 1–4, 6–11, 13–16, determined from correlative curve between Survey gage and U. S. Weather Bureau gage on railroad bridge at Topock. Discharge interpolated Aug. 5–7, 26, and 31; Sept. 1, 3–5, 8–9, and 11–14.

Monthly discharge of Colorado River near Topock, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
February	8,500	6,000	7,330	407,000
March	14,700	9,100	10,800	664,000
April	57,300	12,300	30,700	1,830,000
May	114,000	30,900	64,800	3,980,000
June	140,000	59,600	98,700	5,870,000
July	139,000	28,100	67,300	4,140,000
August	34,400	12,700	19,400	1,190,000
September	15,600	9,450	12,000	714,000
The period	140,000	6,000	39,200	18,800,000

COLORADO RIVER AT YUMA, ARIZ.

LOCATION.—In sec. 35, T. 16 S., R. 22 E., at Southern Pacific Co.'s railroad bridge at Yuma, Yuma County, 1½ miles below mouth of Gila River.

DRAINAGE AREA.—242,000 square miles.

RECORDS AVAILABLE.—April 1, 1878, to September 30, 1917.

GAGE.—Vertical staff in two sections at the bridge; the zero of the gage is 102.79 feet above sea level.

DISCHARGE MEASUREMENTS.—Made from cable 600 feet below the gage.

CHANNEL AND CONTROL.—Shifting sand.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge, 1902–1917, 240,000 second-feet, January 22, 1916; for further particulars regarding this flood see news item, "Colorado River Flood at Yuma": Eng. News, vol. 75, p. 246, 1916. Minimum mean daily discharge, 2,600 second-feet, January 20, 1913; stage, 13.95 feet.

DIVERSIONS.—Water is diverted for irrigation and power purposes from main river and tributaries above the station.

REGULATION.—None.

ACCURACY.—Discharge measurments are frequently made; discharge determined by shifting-control method. Records considered good for a station of this type.

COOPERATION.—Results of current-meter measurements and records of daily discharge furnished by United States Reclamation Service through the project manager.

Discharge measurements of Colorado River at Yuma, Ariz., during the year ending Sept. 30, 1917.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 2	16.70	6,900	Jan. 26	17.70	14,200	May 25	22.10	50,300
4	16.70	6,300	29	16.90	9,900	28	23.85	65,400
6	17.25	8,500	31	16.70	9,300	30	25.45	78,800
7	17.20	7,900	Feb. 2	16.60	8,300	June 1	26.15	91,200
9	17.25	8,700	5	16.40	7,600	4	25.60	88,300
11	19.20	18,500	7	16.50	7,400	6	23.95	85,200
13	21.55	33,600	9	16.50	6,700	8	22.35	74,300
16	22.30	40,700	12	16.40	6,700	11	21.90	70,600
18	25.40	68,900	14	16.70	7,200	13	21.80	69,900
20	23.55	59,700	16	16.80	6,800	15	21.75	68,600
23	19.40	32,400	19	16.70	7,000	18	22.35	72,200
25	18.50	24,500	21	17.00	7,800	20	23.25	81,800
27	18.00	21,200	23	17.00	8,000	22	24.75	91,900
30	17.60	18,000	26	17.00	8,300	25	27.15	114,800
Nov. 1	17.50	16,800	28	18.10	13,500	27	28.25	125,700
3	17.30	15,800	Mar. 2	18.15	14,300	29	29.30	131,900
6	17.10	14,200	5	17.80	13,600	July 2	29.30	139,700
8	17.00	13,500	7	18.30	15,100	4	29.10	142,900
10	16.90	13,100	9	17.90	13,000	6	28.90	135,100
14	16.70	11,900	12	17.00	8,500	9	27.90	137,500
15	16.70	11,900	14	16.80	8,400	11	26.65	139,400
17	16.70	11,500	16	16.80	7,900	13	25.00	120,500
20	16.55	10,300	19	16.50	7,800	16	22.40	89,600
22	16.60	10,400	21	16.55	7,600	18	21.40	83,300
24	16.40	9,500	23	16.60	7,600	20	20.60	73,100
27	16.00	7,900	26	16.35	7,000	23	18.80	54,500
29	16.00	7,800	28	16.40	7,500	25	17.40	45,800
Dec. 1	16.25	7,900	30	16.40	6,700	27	16.40	39,700
4	16.60	9,500	Apr. 2	16.80	8,600	30	16.75	34,800
6	16.50	8,600	4	17.10	9,700	Aug. 1	17.70	41,600
8	16.50	8,600	6	17.60	12,000	4	17.20	38,100
11	16.35	7,700	9	19.20	21,300	6	16.40	33,000
13	16.20	7,400	10	18.80	18,400	8	15.60	29,700
15	16.40	8,200	11	18.50	17,600	10	15.80	29,100
18	16.40	8,100	13	17.80	14,900	13	14.90	24,000
20	15.70	6,500	16	17.70	14,300	15	14.00	19,300
22	15.60	5,200	18	19.00	20,400	17	14.00	18,400
26	15.80	5,100	20	25.45	69,900	20	14.35	18,900
27	16.40	7,000	23	21.75	46,400	23	14.10	17,500
29	16.30	6,600	25	21.25	44,700	27	13.70	13,800
Jan. 2	16.90	7,600	27	20.50	37,800	30	13.50	11,600
3	17.00	7,800	30	20.35	35,800	Sept. 3	13.10	10,800
5	16.90	7,300	May 2	21.25	44,700	4	13.20	8,300
8	16.95	7,800	4	22.20	48,100	10	13.20	8,400
10	16.40	5,400	7	22.75	53,700	13	13.45	7,600
12	16.70	6,400	9	22.55	52,200	17	12.70	6,700
15	16.70	8,400	11	21.00	46,400	19	14.00	9,900
17	16.60	7,800	14	19.60	37,800	21	14.40	9,600
19	16.60	6,800	16	19.35	35,000	24	14.40	9,300
22	16.60	6,600	18	19.50	32,700	26	14.60	10,000
23	19.60	22,500	21	20.50	40,600	28	14.40	10,100
24	18.25	15,600	23	21.25	48,200			

Daily discharge, in second-feet, of Colorado River at Yuma, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8,000	16,800	7,900	7,500	9,000	13,800	9,100	41,700	91,200	141,000	41,600	11,400
2	6,900	16,800	8,500	7,600	8,300	14,300	8,600	47,500	95,200	140,000	43,500	12,200
3	6,600	15,800	9,400	7,800	8,300	14,400	8,700	48,000	93,800	141,000	41,700	10,800
4	6,300	15,600	9,500	8,000	7,900	13,500	9,900	48,100	86,500	143,000	38,100	9,800
5	6,800	14,700	8,000	7,300	7,600	13,700	11,700	48,700	87,700	138,000	35,500	8,800
6	8,500	14,200	8,600	7,000	7,500	14,500	12,300	51,200	83,400	135,000	33,000	8,300
7	7,900	13,500	8,500	6,500	7,500	15,100	15,000	53,700	76,800	136,000	30,300	8,200
8	8,000	13,500	8,600	6,900	7,500	14,200	18,500	53,500	74,300	137,000	29,700	8,000
9	8,700	13,500	8,700	5,300	6,700	13,000	21,300	51,000	72,200	137,000	29,100	8,500
10	19,000	13,100	8,000	5,500	6,600	12,500	18,400	49,600	70,300	139,000	29,100	8,400
11	18,700	13,000	7,600	5,900	6,400	9,700	17,600	46,400	70,000	139,000	27,300	7,900
12	29,500	12,500	7,400	6,400	6,700	8,500	16,200	43,500	69,500	127,000	25,300	7,700
13	33,600	12,200	7,400	8,200	7,200	8,500	14,900	40,600	69,700	120,000	24,000	7,600
14	37,200	11,900	7,800	7,800	7,300	8,400	15,300	37,800	69,000	114,000	21,000	7,500
15	40,800	11,900	8,200	8,400	7,300	8,200	14,600	37,200	68,600	101,000	19,300	7,200
16	41,500	11,600	8,500	8,200	7,100	7,900	14,300	35,100	70,500	89,600	18,800	7,100
17	55,000	11,500	8,500	7,800	7,500	8,400	17,400	34,000	71,500	85,500	18,400	6,700
18	68,500	12,000	8,000	7,100	6,700	7,900	21,000	32,700	72,200	82,200	18,100	7,300
19	61,700	10,800	7,200	6,800	7,000	7,800	27,500	36,100	76,500	77,700	18,600	9,900
20	59,700	10,400	6,500	6,900	7,400	7,800	69,900	38,000	82,700	73,100	18,900	9,800
21	52,000	10,600	6,100	6,500	7,800	7,600	60,700	42,500	86,200	68,200	16,500	9,600
22	37,000	10,800	5,200	13,200	7,900	7,600	49,600	45,200	91,900	60,600	17,300	9,900
23	32,200	10,600	5,300	20,800	8,000	7,600	46,300	48,200	99,500	54,400	17,500	9,800
24	27,500	9,500	5,300	17,500	8,600	7,500	44,800	49,200	111,000	50,500	17,500	9,300
25	24,600	9,400	5,200	17,000	8,400	7,800	42,000	50,300	115,000	45,500	17,100	9,700
26	23,200	9,000	5,100	14,200	8,300	7,000	41,000	55,200	122,000	42,400	16,300	10,000
27	21,200	7,900	6,200	12,000	12,000	7,300	36,500	60,800	126,000	39,700	13,800	10,000
28	20,800	7,800	6,700	10,200	13,500	7,500	36,000	65,400	129,000	40,500	13,300	10,100
29	18,000	7,800	6,600	9,900	.....	7,100	34,000	72,000	132,000	39,200	13,500	9,400
30	18,000	7,800	7,200	9,800	.....	6,800	35,900	78,800	134,000	34,800	11,600	9,300
31	17,300	.....	7,400	9,300	.....	7,900	.....	85,500	.....	39,800	11,500	.....

NOTE.—Quantities changed slightly to conform to computation rules of U. S. Geological Survey.

Monthly discharge of Colorado River at Yuma, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	68,500	6,300	26,600	1,640,000
November	16,800	7,800	11,900	708,000
December	9,500	5,100	7,390	454,000
January	20,800	5,300	9,140	562,000
February	13,500	6,400	7,930	440,000
March	15,100	6,800	9,800	603,000
April	69,900	8,600	26,300	1,560,000
May	85,500	32,700	49,300	3,030,000
June	134,000	68,600	89,900	5,350,000
July	143,000	34,800	93,900	5,770,000
August	43,500	11,500	23,500	1,440,000
September	12,200	6,700	9,010	536,000
The year	143,000	5,100	30,500	22,100,000

NOTE.—Computed by engineers of U. S. Geological Survey.

HORSE CREEK BASIN.

HORSE CREEK AT DANIEL, WYO.

LOCATION.—About sec. 2, T. 33 N., R. 111 W., at highway bridge three-fourths mile south of Daniel, in Lincoln County. No tributary between station and mouth.

DRAINAGE AREA.—193 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1917. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on upstream side of left abutment; read by Mrs. Flora Chennett and Mrs. S. R. Hill.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading nearby.

CHANNEL AND CONTROL.—Channel composed of gravel; control is 100 feet below gage at small rapids which were practically permanent during 1917.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.9 feet at 6 p. m. June 23, 24, 25, and 26 (discharge, 1,260 second-feet); minimum stage during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 161 second-feet from Horse Creek, all above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation slightly shifting during October and November; practically permanent remainder of year; affected by ice during winter months. Rating curve well defined below 1,200 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for period during which stage-discharge relation was affected by shifting control. Records only fair owing to unreliable gage heights during greater part of the yesr.

Discharge measurements of Horse Creek at Daniel, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 2	H. K. Smith	1.26	18.4	Aug. 6	Robert Follansbee	1.40	38.1
May 19	do	3.06	461	Sept. 27	S. B. Soulé	1.20	21.3
June 19	do	4.63	1,140				

Daily discharge, in second-feet, of Horse Creek at Daniel, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	13	15	515	460	895	95	16
2	13	21	390	515	940	54	15
3	13	21	136	553	673	31	13
4	19	15	161	515	715	16	14
5	19	15	174	322	673	19	29
6	19	15	186	273	632	46	44
7	19	15	200	390	673	35	39
8	19	15	132	592	632	33	37
9	19	21	102	760	553	31	23
10	19	21	132	940	478	35	20
11	19	21	213	940	478	31	19
12	19	15	258	760	424	29	17
13	19	15	273	515	372	29	20
14	19	15	305	478	322	29	18
15	19	15	305	515	273	37	19
16	20	15	305	673	273	33	18
17	20	15	553	895	186	36	15
18	20	15	673	1,080	125	43	17
19	20	15	460	1,120	150	45	17
20	20	15	515	1,080	106	50	15
21	20	15	592	1,080	150	43	14
22	20	15	715	1,160	125	28	14
23	20	.....	673	1,160	88	27	25
24	20	.....	673	1,160	44	25	27
25	20	.....	553	1,160	43	25	24
26	20	.....	592	1,160	37	22	20
27	20	.....	592	1,080	49	27	21
28	21	.....	553	1,160	95	27	21
29	21	.....	553	1,120	70	27	20
30	21	.....	553	985	55	20	15
31	15	.....	553	.....	78	17	.....

NOTE.—Discharge Oct. 1 to Nov. 22, computed by indirect method for shifting control. No gage-height record Sept. 5 and 25; discharge interpolated.

Monthly discharge of Horse Creek at Daniel, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	21	13	18.9	1,160
November 1-22	21	15	16.4	716
May	715	102	406	25,000
June	1,160	273	820	48,800
July	940	37	336	20,700
August	95	16	33.7	2,070
September	44	13	20.9	1,240

COTTONWOOD CREEK BASIN.

COTTONWOOD CREEK NEAR BIG PINEY, WYO.

LOCATION.—Approximately in sec. 21, T. 32 N., R. 111 W., at highway bridge near Hayden's ranch, 16 miles north of Big Piney, in Lincoln County.

DRAINAGE AREA.—241 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—April 25, 1916, to September 30, 1917.

GAGE.—Creek flows in two channels 1 mile apart; vertical staff on each channel at highway bridge; read by Mrs. J. G. Hayden.

DISCHARGE MEASUREMENTS.—Made from bridge on each channel or by wading.

CHANNEL AND CONTROL.—Bed of north channel composed of coarse gravel; control shifted slightly during 1917. Bed of south channel composed of sand and gravel. Control shifted during high water of 1917.

EXTREMES OF DISCHARGE.—(North channel) Maximum stage recorded during year 3.65 feet at 5 p. m. June 23 and 24 (discharge 590 second-feet); minimum stage possibly occurred during winter when records are discontinued. (South channel) Maximum stage recorded during year 4.7 feet at 5 p. m. on June 24 (discharge 266 second-feet); minimum stage recorded, 1.8 feet, November 15, 1918 (discharge practically zero).

ICE.—Station not operated during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 38 second-feet from Cottonwood Creek above station and 55 second-feet below.

REGULATION.—None.

ACCURACY.—(North channel) Stage-discharge relation slightly shifting during October; practically permanent for remainder of year; affected by ice after October 21. Rating curve well defined between 20 and 450 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage reading for day to rating table except for period October 1 to 21 when discharge is computed by indirect method for shifting control. Records fair. (South channel) Stage-discharge relation shifted during high water of 1917; practically permanent for remainder of year; affected by ice during winter. Rating curve well defined below 230 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage reading for day to rating table except for period May 11 to June 13 when discharge is computed by indirect method for shifting control. Records fair.

Discharge measurements of Cottonwood Creek near Big Piney, Wyo., during the year ending Sept. 30, 1917.

NORTH CHANNEL.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 4	H. K. Smith	1.60	49.0	Aug. 6	Robert Follansbee	1.70	71
May 21	do	2.88	343	Sept. 27	S. B. Soulé	1.33	23.6
June 19	do	3.13	420				

Discharge measurements of Cottonwood Creek near Big Piney, Wyo., during the year ending Sept. 30, 1917—Continued.

SOUTH CHANNEL.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 4	H. K. Smith	1.94	a1.6	Aug. 6	Robert Follansbee	2.42	26.2
May 21	do	3.99	212	Sept. 27	S. B. Soulé	2.21	13.7
June 19	do	4.42	226				

a Discharge estimated.

Daily discharge, in second-feet, of Cottonwood Creek near Big Piney, Wyo., for the year ending Sept. 30, 1917.

NORTH CHANNEL.

Day.	Oct.	May.	June.	July.	Aug.	Sept.	Day.	Oct.	May.	June.	July.	Aug.	Sept.
1	15	.....	248	396	86	26	16	30	.....	276	132	53	28
2	15	.....	248	396	86	26	17	30	.....	290	122	50	26
3	20	.....	222	364	78	26	18	30	.....	364	113	48	26
4	20	.....	222	364	78	26	19	30	.....	396	113	45	24
5	20	.....	185	333	63	26	20	30	460	524	104	42	24
6	20	.....	152	333	63	28	21	30	460	540	95	40	22
7	25	.....	152	333	70	30	22	.....	492	556	95	37	22
8	25	.....	174	304	64	30	23	.....	460	590	86	35	22
9	25	.....	222	276	62	30	24	.....	396	590	86	32	22
10	25	.....	276	248	62	30	25	.....	333	524	78	32	20
11	25	.....	248	262	59	30	26	.....	304	492	78	32	20
12	25	.....	198	222	59	30	27	.....	304	428	86	30	20
13	25	.....	152	198	56	28	28	.....	318	428	86	30	20
14	30	.....	174	174	56	28	29	.....	304	412	104	28	20
15	30	.....	198	152	53	28	30	.....	276	396	104	28	20
							31	.....	276	.....	95	28	.....

SOUTH CHANNEL.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	8		.....	152	201	29	12
2	8	4	.....	142	170	29	12
3	8	4	.....	142	158	26	12
4	6	4	.....	122	137	26	13
5	6	1.7	.....	87	117	26	13
6	6	1.7	.....	82	97	23	13
7	6	1.7	.....	64	72	26	13
8	6	1.7	.....	92	77	25	14
9	4	1.7	.....	102	97	25	14
10	4	1.7	.....	137	107	25	14
11	4	1.7	132	142	97	24	14
12	4	.5	176	122	87	22	14
13	6	.5	188	82	82	21	14
14	8	.5	188	112	72	21	14
15	8	.2	201	122	72	21	13
16	8	.2	201	132	67	20	13
17	8	.2	188	152	67	20	13
18	8	.2	176	176	62	20	13
19	8	.....	176	227	58	19	13
20	11	.....	176	240	54	19	13
21	11	.....	201	240	42	18	13
22	8	.....	201	240	35	18	13
23	8	.....	201	253	29	16	14
24	8	.....	201	266	23	15	13
25	6	.....	227	240	23	14	13
26	6	.....	201	227	29	14	13
27	6	.....	201	214	32	14	13
28	6	.....	214	214	42	13	13
29	6	.....	201	201	42	13	13
30	6	.....	164	201	35	13	13
31	4	.....	152	.....	35	12	.....

Monthly discharge of Cottonwood Creek near Big Piney, Wyo., for the year ending Sept. 30, 1917.

NORTH CHANNEL.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October 1–21	30	15	25.0	1,040
May 20–31	492	276	365	8,690
June	590	152	329	19,600
July	396	78	191	11,700
August	86	28	51.1	3,140
September	30	20	25.3	1,510

SOUTH CHANNEL.

October	11	4	6.8	418
November 1–18	4	.2	1.68	60
May 11–31	214	132	189	7,870
June	266	64	164	9,760
July	201	23	74.6	4,600
August	29	12	20.2	1,240
September	14	12	13.2	786

EAST FORK BASIN.

EAST FORK AT EAST FORK CANAL, WYO.

LOCATION.—In sec. 10, T. 31 N., R. 106 W., 300 feet above intake of East Fork canal, 18 miles southeast of Boulder, in Fremont County.

DRAINAGE AREA.—106 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—May 14, 1916, to September 30, 1917.

GAGE.—Vertical staff on left bank; read by Andrew Bottondy.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel composed of small boulders; control 100 feet downstream, apparently permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.6 feet at 12 p. m. June 23 and 9 a. m. June 25 (discharge not computed); minimum discharge probably occurs during winter.

ICE.—No data.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions or 37 second-feet from East Fork above station.

REGULATION.—Flow regulated to limited extent by many small lakes at headwaters.

ACCURACY.—Discharge not determined because of no high-water measurements.

The following discharge measurement was made by H. K. Smith:

October 31, 1916: Gage height, 1.11 feet; discharge, 12 second-feet (estimated).

Daily gage height, in feet, of East Fork at East Fork canal, Wyo., for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	2.2	3.9	1.90	1.30	16	2.0	3.6	3.0	1.40	1.20
2	.....	2.3	3.7	1.80	1.30	17	2.1	3.9	3.1	1.40	1.20
3	.....	2.35	3.8	1.70	1.30	18	2.15	4.4	2.9	1.40	1.20
4	.....	2.1	3.8	1.60	1.40	19	2.1	4.3	2.8	1.40	1.20
5	.....	2.1	3.7	1.50	1.60	20	2.1	4.5	2.6	1.50	1.20
6	.....	2.2	3.9	1.50	1.60	21	2.2	4.2	2.8	1.40	1.20
7	.....	2.3	3.8	1.50	1.40	22	2.2	4.4	2.4	1.40	1.20
8	.....	2.4	3.1	1.50	1.30	23	2.3	4.6	2.05	1.45	1.30
9	.....	2.8	3.7	1.50	1.30	24	2.3	4.4	2.2	.....	1.40
10	.....	3.1	3.5	1.50	1.40	25	2.25	4.6	2.1	1.40	1.50
11	.....	2.9	3.2	1.5	1.50	26	2.2	4.50	2.2	1.30	1.60
12	.....	2.8	2.9	1.5	1.40	27	2.2	4.20	2.3	1.30	1.60
13	.....	2.7	3.0	1.3	1.30	28	2.25	4.30	2.1	1.30	1.40
14	.....	2.7	2.9	1.4	1.30	29	2.3	4.10	2.1	1.30	1.40
15	2.0	3.4	2.9	1.5	1.20	30	2.3	4.30	2.0	1.30	.....
						31	2.3	.....	2.0	1.30	.....

EAST FORK AT NEWFORK, WYO.

LOCATION.—About sec. 33, T. 32 N., R. 108 W., at highway bridge one-quarter mile south of Newfork, in Fremont County. No tributary between station and mouth, 1 mile below.

DRAINAGE AREA.—348 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—April 1, 1905, to October 31, 1906; May 11, 1915, to September 30, 1917.

GAGE.—Vertical staff on downstream side of left abutment; read by John Tarkelson. Gage one-quarter mile upstream used during 1905; 1906 gage located at bridge and referred to datum 0.27 foot higher than present gage.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of sand and gravel; control 100 feet downstream at gravel bar which remained practically permanent during 1917. Banks are overflowed at stage of 6 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 6.7 feet at 6.30 a. m. June 19 (discharge, 2,940 second-feet); minimum discharge probably occurs during winter.

ICE.—Discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 82 second-feet from East Fork River between stations near East Fork canal and Newfork.

REGULATION.—Flow of East Fork regulated to limited extent by many small lakes at headwaters.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve used October 1 to November 12 well defined between 60 and 200 second-feet, and curve used April 16 to September 30 well defined between 150 and 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of East Fork at Newfork, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	H. K. Smith	1.43	70	June 21	H. K. Smith	6.64	2,900
May 30	do	2.56	374	Sept. 28	S. B. Soulé	1.42	71

Daily discharge, in second-feet, of East Fork at Newfork, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	48	67	.....	78	296	2,100	134	80
2	72	65	.....	77	296	1,620	112	72
3	73	68	.....	80	279	1,440	101	71
4	75	72	.....	80	246	1,380	94	67
5	73	68	.....	74	216	1,500	92	67
6	68	68	.....	76	202	1,560	92	73
7	68	67	.....	83	246	1,320	87	77
8	67	67	.....	77	279	1,260	81	87
9	68	68	.....	83	492	1,080	83	81
10	68	67	.....	91	920	975	86	74
11	72	65	.....	99	810	920	80	73
12	68	.....	.....	123	655	865	80	69
13	68	.....	.....	129	515	755	80	68
14	67	.....	.....	175	538	655	76	67
15	67	.....	.....	262	865	538	72	67
16	65	.....	95	314	1,560	470	73	67
17	65	.....	83	314	2,100	410	78	65
18	70	.....	81	332	2,620	390	81	61
19	78	.....	80	314	2,940	332	83	61
20	80	.....	87	332	2,860	314	80	59
21	85	.....	175	351	2,860	296	77	59
22	89	.....	231	332	2,940	279	72	57
23	87	.....	390	332	2,860	246	69	62
24	80	.....	410	370	2,780	216	69	64
25	76	.....	314	351	2,780	216	69	67
26	78	.....	279	351	2,700	202	69	73
27	78	.....	175	314	2,540	175	80	72
28	78	.....	110	314	2,380	175	84	71
29	75	.....	101	332	2,380	188	92	68
30	72	.....	81	370	2,380	162	89	69
31	68	.....	.....	351	.....	150	86	.....

Monthly discharge of East Fork at Newfork, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	89	48	72.5	4,460
November 1–11	72	65	67.5	1,470
April 15–30	410	80	179	5,330
May	370	74	225	13,800
June	2,940	202	1,520	90,400
July	2,100	150	716	44,000
August	134	69	83.9	5,160
September	87	57	68.9	4,100

NEW FORK NEAR BOULDER, WYO.

LOCATION.—About sec. 8, T. 32 N., R. 108 W., at highway bridge 1 mile west of Boulder, in Fremont County. Nearest tributary, Boulder Creek, enters one-eighth mile below.

DRAINAGE AREA.—578 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—May 11, 1915, to September 30, 1917.

GAGE.—Vertical staff on downstream side of left abutment; read by J. O. Orcutt.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading nearby.

CHANNEL AND CONTROL.—Channel is composed of sand and gravel underlain by slate and is somewhat shifting; no well-defined control. At high water there are two overflow channels, one around right end of bridge, and other from New Fork to Boulder Creek. At extreme high water affected by backwater from Boulder Creek.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.8 feet at 6 p. m. June 25 when there was backwater. Maximum discharge estimated at 3,180 second-feet July 1. Minimum discharge occurs during winter when records are discontinued.

ICE.—Stage-discharge relation seriously affected by ice; records discontinued.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 199 second-feet from New Fork above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; seriously affected by ice during winter. Rating curve used October 1 to November 30 well defined between 130 and 220 second-feet, and curve used March 13 to September 30 is fairly well defined between 200 and 2,500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except for extreme high water and for periods affected by ice for which they are fair.

Discharge measurements of New Fork near Boulder, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	H. K. Smith	1.93	171	June 21	H. K. Smith	5.74	2,380
Jan. 18	do	a3.06	84	Aug. 5	Robert Follansbee	3.65	993
May 29	do	3.31	818	Sept. 28	S. B. Soulé	2.32	295

a Gage height affected by ice.

Daily discharge of New Fork near Boulder, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	128	170	320	700	3,180	1,340	340
2	136	170	300	670	3,100	1,220	340
3	161	170	320	645	2,980	1,150	320
4	170	164	340	670	2,870	1,090	320
5	164	164	380	570	2,870	970	320
6	158	158	400	520	2,870	970	400
7	158	155	420	495	2,980	910	380
8	155	152	400	520	2,980	850	380
9	150	149	400	520	2,980	790	360
10	147	147	400	520	2,980	760	340
11	155	150	470	645	2,870	700	380
12	158	136	520	700	2,870	645	360
13	158	110	545	730	2,680	620	360
14	158	87	545	730	2,680	595	400
15	158	100	595	730	2,430	570	400
16	158	115	620	820	2,360	545	360
17	158	136	545	1,090	2,220	545	340
18	174	139	545	1,410	2,080	520	320
19	186	139	595	1,800	2,010	520	340
20	177	139	620	2,220	1,940	495	340
21	189	136	620	2,360	1,800	445	300
22	192	136	850	2,500	1,800	445	300
23	196	136	970	2,580	1,740	400	300
24	189	135	1,090	2,700	1,670	400	300
25	189	134	970	2,800	1,600	380	340
26	199	134	730	2,880	1,540	380	340
27	192	133	850	2,950	1,480	420	320
28	189	132	790	3,000	1,410	400	300
29	180	131	820	3,050	1,480	380	280
30	177	130	790	3,100	1,480	360	280
31	174	.....	730	.....	1,410	340	.....

NOTE.—Stage-discharge relation affected by ice Nov. 7–9, 12–30, and Mar. 13 to Apr. 30; discharge based on gage-height and temperature records, and observer's notes. Stage-discharge relation affected by backwater from Boulder Creek June 24 to July 1; discharge based on comparative hydrograph of Pine Creek at Pinedale. The backwater from Boulder Creek ranged from 0.1 to 0.85 foot, depending on the relative stages of New Fork and Boulder Creek.

Monthly discharge of New Fork near Boulder, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	199	128	169	10,400
November	170	87	140	8,330
December			110	6,760
January			90	5,530
May	1,090	300	596	36,600
June	3,100	495	1,490	88,700
July	3,180	1,410	2,300	141,000
August	1,340	340	650	40,000
September	400	280	339	20,200

NOTE.—Monthly discharge for December and January is an estimate based on gage heights and temperature records, one discharge measurement, and observer's notes.

PINE CREEK AT FREMONT LAKE OUTLET, WYO.

LOCATION.—In sec. 22, T. 34 N., R. 109 W., at old Indian ford one-third mile below outlet of Fremont Lake, in Fremont County.

DRAINAGE AREA.—114 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—July 22, 1910, to June 30, 1912; October 11, 1915, to September 30, 1917. From April, 1905, to October 31, 1906, a station was maintained half a mile downstream. Records at two points not comparable as two ditches divert water between.

GAGE.—Chain on cantilever arm on left bank.

DISCHARGE MEASUREMENTS.—Made for cable near gage or by wading.

CHANNEL AND CONTROL.—Channel composed of small boulders but apparently permanent. No well-defined control. Banks are not subject to overflow.

EXTREMES OF DISCHARGE.—Data too meager.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued.

DIVERSIONS.—Fremont canal diverts water between station and lake outlet. During 1917 approximately 3 second-feet diverted from May 15 to September 30.

REGULATION.—Flow regulated naturally by Fremont Lake, which has an area of approximately 8 square miles.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 40 and 700 second-feet, but not well defined above 700 second-feet, being based on form of previous curve. Gage read to hundredths several times a week, but not at regular intervals. Daily discharge for days when there is a gage-height record is ascertained by applying mean daily gage height to rating. For days of missing gage heights the discharge is ascertained from comparative hydrograph of Pine Creek at Pinedale. Records fair.

Discharge measurements of Pine Creek at Fremont Lake outlet, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 27	H. K. Smith	1.96	190
June 20	....do	2.81	595
Sept. 29	S. B. Soulé	1.75	112

Daily discharge, in second-feet, of Pine Creek at Fremont Lake outlet, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	39	.....	.....	38	192	1,540	740	140
2	40	.....	.....	35	190	1,470	690	140
3	42	.....	.....	36	190	1,440	620	140
4	42	.....	.....	36	175	1,440	520	135
5	43	.....	.....	36	160	1,440	490	140
6	44	.....	.....	36	155	1,540	460	145
7	44	.....	.....	35	160	1,540	430	150
8	45	.....	.....	35	176	1,540	408	154
9	45	.....	.....	35	196	1,540	380	176
10	47	.....	.....	35	200	1,540	350	162
11	48	.....	.....	34	202	1,540	320	160
12	49	.....	.....	34	204	1,540	300	150
13	50	.....	.....	34	210	1,540	275	145
14	50	.....	.....	40	215	1,460	255	140
15	51	.....	.....	50	220	1,400	240	134
16	52	.....	.....	58	254	1,330	230	130
17	53	.....	.....	70	300	1,320	230	127
18	54	.....	.....	75	380	1,190	220	120
19	55	.....	.....	78	462	1,190	200	118
20	55	.....	.....	82	610	1,160	196	116
21	55	.....	.....	100	720	1,130	196	114
22	55	.....	.....	125	820	1,080	175	112
23	55	38	.....	145	940	1,040	160	110
24	55	.....	.....	165	1,040	990	154	110
25	55	.....	.....	168	1,140	950	154	110
26	55	.....	37	176	1,240	910	154	109
27	55	.....	37	186	1,340	900	158	106
28	55	.....	37	196	1,460	880	162	103
29	54	.....	37	195	1,470	840	150	115
30	53	.....	37	194	1,540	810	140	115
31	52	.....	.....	193	.....	780	140	.....

Monthly discharge of Pine Creek at Fremont Lake outlet, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	55	39	49.9	3,070
April 26–30	37	37	37.0	367
May	196	34	88.9	5,470
June	1,540	155	552	32,800
July	1,540	780	1,260	77,500
August	740	140	300	18,400
September	176	103	131	7,800

PINE CREEK AT PINEDALE, WYO.

LOCATION.—In sec. 4, T. 33 N., R. 109 W., one-fourth mile below bridge at Pinedale, Fremont County. No tributary of importance between station and mouth, 3 miles below.

DRAINAGE AREA.—128 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—May 8, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank one-fourth mile below highway bridge; vertical staff on downstream side of bridge pier used during high water. Read by forest ranger. Beginning August 17, 1917, bridge gage was read regularly and former gage abandoned.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading a short distance below gage.

CHANNEL AND CONTROL.—Channel at bridge may shift during high water; control located 100 feet downstream at small rapids practically permanent; banks will not be overflowed except at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year (bridge gage) 4.1 feet, June 30 and July 1 (discharge 1,800 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relation somewhat affected by ice. No estimates.

DIVERSIONS:—Prior to December 31, 1916, there were adjudicated diversions of 78 second-feet from Pine Creek between stations at Fremont Lake outlet and Pinedale and 4 second-feet below Pinedale.

REGULATION.—Flow naturally regulated by Fremont Lake which has an area of approximately 8 square miles and drains 110 square miles.

ACCURACY.—(Lower gage.) Stage-discharge relation practically permanent until high water of 1917 when it shifted seriously; affected by ice during winter period. Rating curve used October 1 to June 24 and August 4–16, fairly well defined before high water of 1917 but poorly defined after high water. (Bridge gage.) Stage-discharge relation practically permanent. Rating curve used June 25 to August 3 and August 17 to September 30 is well defined between 50 and 800 second-feet, and poorly defined above 800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for periods October 11 to December 5, April 20 to June 24, and August 4–16, when discharge was computed by indirect method for shifting control. Records good for October, November, April, May, and September. Fair for remainder of period.

Discharge measurements of Pine Creek at Pinedale, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	H. K. Smith	1.22	43.8	Aug. 5	Robert Follansbee	[c] 2.94	472
Jan. 15	do	[a] 1.57	18.8	Sept. 29	S. B. Soulé	1.48	97
May 29	do	2.08	201	30	do	1.48	97
June 20	do	[b] 2.78	502				

[a] Stage-discharge relation affected by ice. [b] Bridge gage read, 2.43. [c] Bridge gage read, 2.38.

Daily discharge, in second-feet, of Pine Creek at Pinedale, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	31	44	23	24	27	196	1,800	769	128
2	32	44	21	24	28	196	1,710	733	128
3	36	44	19	24	29	196	1,620	697	120
4	34	42	20	24	28	182	1,620	479	111
5	34	42	19	24	30	155	1,620	479	122
6	34	39	.....	24	28	140	1,710	446	131
7	35	38	.....	24	30	152	1,710	430	128
8	34	35	.....	24	31	140	1,710	415	128
9	32	31	.....	25	30	140	1,710	375	134
10	34	31	.....	25	32	152	1,710	338	138
11	35	31	.....	25	33	165	1,710	304	141
12	36	25	.....	25	34	165	1,710	292	141
13	37	20	.....	23	33	165	1,710	262	138
14	37	20	.....	23	39	179	1,620	251	134
15	37	22	.....	23	44	179	1,460	238	125
16	37	22	.....	24	51	190	1,380	221	122
17	37	22	.....	23	64	238	1,380	236	120
18	39	22	.....	26	69	292	1,300	216	117
19	42	22	.....	22	70	404	1,220	196	114
20	42	22	.....	24	78	514	1,220	182	111
21	49	22	.....	25	100	608	1,180	182	106
22	50	22	.....	24	129	792	1,140	164	100
23	50	22	.....	26	145	961	1,060	150	100
24	50	21	.....	33	185	1,140	1,030	144	103
25	48	21	.....	35	182	1,260	990	141	106
26	48	19	.....	37	182	1,380	952	141	100
27	49	19	.....	32	196	1,460	915	147	100
28	48	21	.....	30	196	1,540	915	141	95
29	48	21	.....	29	196	1,540	842	134	95
30	45	22	.....	27	196	1,710	842	134	95
31	45	.....	.....	.....	196	.....	806	128	.....

NOTE.—Stage-discharge relation affected by ice Nov. 12–17 and Apr. 1–8; discharge based on observer's notes and temperature record.

Monthly discharge of Pine Creek at Pinedale, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	50	31	40.2	2,470
November	44	19	27.6	1,640
April	37	22	25.9	1,540
May	196	27	87.5	5,380
June	1,710	140	551	32,800
July	1,800	806	1,360	83,600
August	769	128	296	18,200
September	141	95	118	7,020

BOULDER CREEK NEAR BOULDER, WYO.

LOCATION.—In sec. 4, T. 32 N., R. 108 W., at Sandlin ranch, 2 miles northwest of Boulder, in Fremont County. No tributary between station and mouth, 2 miles below.

DRAINAGE AREA.—112 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—April 23, 1904, to October 31, 1906; May 10, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank 60 feet northwest of ranch house; read by Mrs. M. M. Sandlin. Gage used 1904–1906 was located a short distance upstream. No comparison between the two gages as high water cut new channel and changed control.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge 1¼ miles downstream during high water.

CHANNEL AND CONTROL.—Channel composed of gravel; deep pool at gage; control, which is shifting, is located 150 feet downstream at rapids. Banks are high and not subject to overflow. Stage of zero flow 0.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 6.1 feet at 7 a. m. June 25 (discharge, 2,710 second-feet); minimum stage occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; records discontinued.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 47 second-feet from Boulder Creek, all above the station.

REGULATION.—None except natural regulation of Boulder Lake.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve fairly well defined between 20 and 2,000 second-feet; poorly defined above 2,000 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for period May 31 to September 26 when discharge was computed by indirect method for shifting control. Records good up to high water, 1917, after which they are fair.

Discharge measurements of Boulder Creek near Boulder, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	H. K. Smith	0.73	20.8	June 21	H. K. Smith	5.30	20.70
Jan. 17	do	[a] 1.74	27.3	Aug. 5	Robert Follansbee	1.64	118
May 30	do	1.79	218	Sept. 28	S. B. Soulé	1.06	47.7

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Boulder Creek near Boulder, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	7	20	18	176	2,480	237	80
2	7	20	19	173	2,160	204	80
3	8	17	22	170	1,850	158	57
4	7	17	25	179	1,150	136	52
5	7	17	25	170	1,780	128	51
6	8	12	25	164	2,160	120	72
7	8	12	25	141	2,480	130	81
8	8	22	25	182	1,940	111	107
9	8	20	25	244	1,860	94	116
10	10	17	27	327	1,710	78	118
11	10	22	29	378	1,640	75	111
12	11	24	32	374	1,500	73	104
13	12	23	37	370	1,430	59	94
14	12	23	45	330	1,230	51	83
15	12	23	64	327	1,040	43	77
16	12	.....	104	496	919	37	78
17	12	.....	141	814	802	32	69
18	13	.....	179	1,170	748	29	63
19	16	.....	192	1,570	700	28	56
20	40	.....	198	1,940	700	29	28
21	41	.....	230	2,070	600	26	25
22	41	.....	230	2,230	1,100	25	23
23	41	.....	230	2,310	488	24	29
24	36	.....	230	2,630	427	21	27
25	31	.....	230	2,710	393	1	29
26	31	.....	230	2,630	393	1	40
27	31	.....	208	2,550	393	1	45
28	29	.....	208	2,470	356	1	48
29	29	.....	198	2,470	356	72	48
30	22	.....	208	2,630	356	81	45
31	21	.....	192	.....	288	78	.....

Monthly discharge of Boulder Creek near Boulder, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	41	7	18.7	1,150
November 1–15	24	12	19.3	574
May	230	18	118	7,260
June	2,710	141	1,150	68,400
July	2,480	288	1,140	70,100
August	237	1	70.4	4,330
September	118	23	64.5	3,840

PINEY CREEK BASIN.

MIDDLE PINEY CREEK NEAR BIG PINEY, WYO.

LOCATION.—In sec. 30, T. 30 N., R. 113 W., at Black's ranch, 15 miles west of Big Piney, in Lincoln County. No tributary of importance within several miles.

DRAINAGE AREA.—46 square miles (measured on map in Bulletin 543).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1917. State engineer maintained station at this point during 1914.

GAGE.—Vertical staff on left bank 200 feet below house; read by Mrs. Orlin Black. Prior to 1916 gage was located 1 mile downstream at C. P. Budd's ranch. Datum lowered 0.50 May 17, 1917.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

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CHANNEL AND CONTROL.—Channel composed of gravel; control 50 feet below gage at small rapids which were permanent during 1917; banks are not overflowed except during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.56 feet at 6 a. m. July 1 (discharge, 260 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relations seriously affected by ice, record discontinued.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 34 second-feet from Middle Piney Creek above the station and 72 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; seriously affected by ice during winter. Rating curve well defined between 6 and 180 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Middle Piney Creek near Big Piney, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 5	H. K. Smith	0.18	6.7	June 19	H. K. Smith	2.12	162
May 17	do	[a]1.38	55	Sept. 26	S. B. Soulé	.94	19.7

[a] New datum.

Daily discharge, in second-feet, of Middle Piney Creek near Big Piney, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	12	7	.....	16	38	260	62	27
2	12	7	.....	14	38	230	60	26
3	13	6	.....	14	41	225	62	25
4	12	6	.....	16	39	218	60	25
5	12	5	.....	16	37	212	59	24
6	11	6	.....	17	38	212	60	24
7	12	6	.....	19	42	225	55	26
8	11	5	.....	16	45	218	52	26
9	11	5	.....	18	64	214	54	26
10	12	5	.....	21	92	212	52	25
11	13	5	.....	26	69	204	50	24
12	12	.....	.....	32	64	196	47	23
13	12	.....	.....	33	58	176	45	22
14	11	.....	.....	42	59	162	43	22
15	11	.....	.....	53	64	152	43	22
16	11	.....	7	57	85	136	42	21
17	11	.....	6	54	114	112	40	20
18	11	.....	6	54	152	100	26	19
19	12	.....	6	54	168	111	25	18
20	10	.....	7	59	184	106	24	18
21	10	.....	8	63	202	100	25	17
22	10	.....	12	62	225	96	33	19
23	10	.....	13	57	250	93	34	21
24	8	.....	15	56	252	89	32	20
25	10	.....	19	57	255	82	31	19
26	9	.....	26	58	252	77	30	19
27	8	.....	23	56	255	80	38	19
28	7	.....	19	54	252	77	34	18
29	7	.....	16	54	255	74	32	17
30	7	.....	18	53	255	70	31	•17
31	8	.....	.....	44	.....	68	28	.....

Monthly discharge of Middle Piney Creek near Big Piney, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	13	7	10.5	646
November 1–11	7	5	5.7	121
April 16–30	26	6	13.4	398
May	63	14	40.2	2,470
June	255	37	131	7,800
July	260	68	148	9,100
August	62	24	42.2	2,590
September	27	17	21.6	1,290

FONTENELLE CREEK BASIN.

FONTENELLE CREEK NEAR FONTENELLE, WYO.

LOCATION.—About sec. 3, T. 24 N., R. 113 W., at bridge at Holden's ranch, on stage road from Opal to Big Piney, 5 miles west of Fontenelle, Lincoln County. No important tributary between station and mouth.

DRAINAGE AREA.—224 square miles (measured on special map in Bulletin 543).

RECORDS AVAILABLE.—May 16, 1915, to September 30, 1917. State engineer maintained station at this point during 1914.

GAGE.—Vertical staff on downstream end of right abutment; read by Mrs. Howard Holden.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading below bridge.

CHANNEL AND CONTROL.—Channel composed of coarse gravel; control is small rapids 100 feet below gage and shifts occasionally. Banks may be overflowed during extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.7 feet at 7 a. m. May 22 (discharge, 900 second-feet); minimum discharge probably occurs during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 78 second-feet from Fontenelle Creek; percentage above station not known.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts between narrow limits; seriously affected by ice during winter. Rating curve used October 1 to May 21 fairly well defined between 30 and 550 second-feet, and curve used May 22 to September 30 fairly well defined between 40 and 700 second-feet. Gage read to quarter-tenths once daily except during high water when it is read twice daily. Daily discharge ascertained by applying the one gage height for the day or the mean daily gage height obtained from two readings to the rating tables. Records good.

Discharge measurements of Fontenelle Creek near Fontenelle, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	H. K. Smith	0.46	41.8	Aug. 7	Robert Follansbee	0.64	95
May 18	do	2.08	545	Sept. 25	S. B. Soulé	.46	52
June 18	do	2.13	626				

Daily discharge, in second-feet, of Fontenelle Creek near Fontenelle, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	87	37	.....	111	543	435	109	51
2	116	33	.....	111	520	435	109	51
3	111	33	.....	87	520	395	109	51
4	111	37	.....	116	498	355	97	51
5	111	33	.....	138	498	320	97	51
6	111	37	.....	138	475	320	97	62
7	111	40	.....	240	475	285	97	62
8	96	40	.....	153	498	285	97	58
9	91	40	.....	184	498	250	97	51
10	96	40	.....	240	632	250	85	44
11	122	.....	.....	348	800	220	85	58
12	116	.....	.....	465	700	190	85	51
13	111	.....	.....	485	520	190	85	58
14	104	.....	.....	625	435	190	85	51
15	96	.....	.....	665	455	161	85	51
16	40	.....	.....	745	455	134	85	30
17	37	.....	.....	645	542	148	85	23
18	37	.....	.....	625	678	161	85	19
19	40	.....	.....	665	800	134	85	19
20	40	.....	.....	705	800	134	80	19
21	37	.....	.....	765	800	129	80	19
22	37	.....	61	900	800	122	74	19
23	40	.....	91	825	800	122	74	40
24	40	.....	240	725	825	114	62	62
25	40	.....	311	700	775	109	62	51
26	37	.....	386	655	750	97	62	51
27	37	.....	465	610	700	97	62	44
28	37	.....	258	520	632	109	62	40
29	37	.....	184	588	565	109	62	40
30	33	.....	116	565	520	122	62	58
31	37	.....	.....	588	.....	122	62	.....

Monthly discharge of Fontenelle Creek, near Fontenelle, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	122	33	70.8	4,350
November 1-10	40	33	37.0	734
April 22-30	465	61	235	4,190
May	900	111	482	29,600
June	825	435	617	36,700
July	435	97	201	12,400
August	109	62	82.7	5,080
September	62	19	44.5	2,650

BIG SANDY CREEK BASIN.

BIG SANDY CREEK NEAR FARSON, WYO.

LOCATION.—In sec. 18, T. 27 N., R. 106 W., half a mile above head gate of Eden canal, 14 miles north of Farson, Sweetwater County. No tributary within several miles of station.

DRAINAGE AREA.—322 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—May 10, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank half a mile above head gate of Eden canal near Ten Trees; read by William Dewey.

DISCHARGE MEASUREMENTS.—Made by wading at control.

CHANNEL AND CONTROL.—Channel composed of sand which may shift; control 100 feet downstream apparently permanent during 1917. Banks are overflowed at stage of 3.7 feet. Stage of zero flow 1 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet at 10 a. m., June 24 (discharge not determined); minimum discharge occurs during winter.

ICE.—No data.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 38 second-feet from Big Sandy Creek above station and 4 second-feet below.

REGULATION.—None.

COOPERATION.—Daily gage heights furnished by Eden Land & Irrigation Co.

Data inadequate for determination of discharge.

Daily gage height, in feet, of Big Sandy Creek near Farson, Wyo., for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1.....	3.05	2.85	4.95	2.21	1.75	16.....	3.15	4.55	3.25	.....	1.55
2.....	3.05	2.81	4.91	2.05	1.75	17.....	2.95	4.75	3.05	1.65	1.75
3.....	3.05	2.79	4.75	1.85	1.75	18.....	3.05	4.85	2.95	1.75	1.65
4.....	3.05	2.85	4.55	1.79	1.71	19.....	3.11	5.15	2.75	1.85	1.65
5.....	2.85	2.79	4.55	1.65	1.65	20.....	3.15	5.35	2.71	1.89	1.55
6.....	2.85	2.75	4.35	1.45	1.65	21.....	3.19	5.55	2.55	1.85	1.55
7.....	2.75	2.95	4.25	1.55	1.69	22.....	3.25	5.45	2.65	2.05	1.51
8.....	2.85	3.35	4.31	1.55	1.75	23.....	3.25	5.35	2.69	2.85	1.55
9.....	2.95	3.55	4.05	1.95	1.75	24.....	3.15	5.35	2.75	2.55	1.45
10.....	3.05	3.75	3.55	1.91	1.95	25.....	3.05	5.31	2.65	2.35	1.45
11.....	3.05	3.75	3.35	1.65	1.85	26.....	3.11	5.65	2.55	1.95	1.41
12.....	3.15	3.85	3.25	1.55	1.65	27.....	3.15	5.55	2.55	1.91	1.41
13.....	3.15	3.65	3.11	1.55	1.65	28.....	3.05	5.55	2.55	2.05	1.35
14.....	3.25	3.25	3.05	1.75	1.65	29.....	3.05	5.25	2.55	1.95	1.35
15.....	3.35	4.05	3.19	1.69	1.55	30.....	2.95	5.05	2.51	1.85	.....
						31.....	2.91	.....	2.45	1.91	.....

BLACKS FORK BASIN.

BLACKS FORK NEAR URIE, WYO.

LOCATION.—In sec. 23, T. 16 N., R. 115 W., at highway bridge 4 miles northwest of Urie, in Uinta County. No tributary within 10 miles.

DRAINAGE AREA.—261 square miles (measured on U. S. Geological Survey 1:500,000 map).

RECORDS AVAILABLE.—August 21, 1913, to September 30, 1917.

GAGE.—Vertical staff on downstream side of center pier; read by Joseph Anderson. Datum lowered 0.50 foot August 19, 1915, to avoid negative readings.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading 100 feet downstream.

CHANNEL AND CONTROL.—Channel composed of well-compacted gravel. Control is small rapids just below the bridge and remained practically permanent during 1917. Right bank is high and is not overflowed; left bank is overflowed at stage of 3 feet approximately. Stage of zero flow 0.3 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 4.72 feet at 7 p. m., June 19 and 9 a. m., June 20 (discharge, 2,680 second-feet; minimum stage 0.30 foot September 2–5, discharge, 3 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Below all diversions. Prior to December 31, 1916, there were adjudicated diversions of 599 second-feet from Blacks Fork.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; seriously affected by ice during winter. Rating curve well defined below 1,400 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except during flood stages when they are good.

Discharge measurements of Blacks Fork near Urie, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	H. K. Smith	0.54	10.5	Aug. 1	Robert Follansbee	0.86	46.8
June 15	....do	3.48	1,340	Sept. 22	S. B. Soulé	.35	5.7

Daily discharge, in second-feet, of Blacks Fork near Urie, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	6	12	.....	122	238	772	65	3
2	6	12	.....	124	221	680	33	3
3	6	11	.....	84	274	569	25	3
4	6	11	.....	90	398	569	19	3
5	6	.....	.....	90	375	543	18	3
6	6	.....	.....	86	420	543	18	9
7	8	.....	.....	92	492	444	18	7
8	8	.....	255	76	543	444	15	6
9	8	.....	292	82	836	398	11	5
10	8	.....	398	70	1,360	375	7	5
11	9	.....	274	74	836	292	7	7
12	9	.....	255	82	680	221	7	7
13	9	.....	206	90	680	165	7	7
14	10	.....	190	117	975	154	7	7
15	10	.....	168	141	1,310	157	7	7
16	10	.....	112	206	1,410	139	8	7
17	10	.....	103	238	1,670	119	8	7
18	11	.....	97	398	1,890	97	7	5
19	11	.....	82	444	2,440	66	8	5
20	11	.....	103	467	2,110	29	8	4
21	11	.....	144	420	1,780	18	7	4
22	11	.....	152	420	2,000	16	7	4
23	12	.....	238	444	1,780	16	5	7
24	12	.....	221	398	1,460	20	4	10
25	12	.....	190	354	1,360	18	4	8
26	12	.....	274	332	1,260	19	6	7
27	12	.....	292	312	1,090	17	9	6
28	12	.....	144	292	940	18	9	6
29	12	.....	108	274	1,010	59	8	5
30	12	.....	105	312	940	74	6	4
31	12	.....	.....	274	.....	129	5	.....

Monthly discharge of Blacks Fork near Urie, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	12	6	9.61	591
November 1–4	12	11	11.5	91
April 8–30	398	82	191	8,710
May	467	70	226	13,900
June	2,440	221	1,090	64,900
July	772	16	232	14,300
August	65	4	12.0	738
September	10	3	5.70	339

YAMPA RIVER BASIN.

YAMPA RIVER NEAR MAYBELL, COLO.

LOCATION.—In sec. 2, T. 6 N., R. 95 W., at highway bridge 3 miles east of Maybell, Moffat County. Nearest tributary, Lay Creek, enters about 1 mile above.

DRAINAGE AREA.—3,410 square miles (measured on Land Office map).

RECORDS AVAILABLE.—April 25, 1916, to September 30, 1917.

GAGE.—Chain on upstream side of bridge, 55 feet from west abutment; read by Dr. L. B. Wheeler.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge.

CHANNEL AND CONTROL.—Channel composed of small boulders and gravel; control not well defined, probably permanent. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 9.4 feet at noon May 19 (discharge, 17,900 second-feet); minimum discharge probably occurs during winter, when records are discontinued.

ICE.—Stage-discharge relation seriously affected by ice; records discontinued during winter.

DIVERSIONS.—Court decrees for diversion of 481 second-feet from Yampa River above gaging station and 38 second-feet below. Also storage decree of 1,150 acre-feet above gaging station.

COOPERATION.—1917 records furnished complete by State engineer who maintained the station.

Discharge measurements of Yampa River near Maybell, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 25	Robert Follansbee	7.26	10,900	Aug. 29	B. T. Chase	0.65	522
June 30	M. N. Grant, jr	6.96	11,800	Oct. 4	do	−.47	447
July 13	Baily and Grant	4.05	5,060	Nov. 7[a]	do	.42	376
18	Chase and Grant	2.80	2,930	Dec. 4	do	.45	414
Aug. 2	B. T. Chase	1.84	1,620				

[a] Sack dam around piers.

Daily discharge, in second-feet, of Yampa River near Maybell, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	351	504	2,050	7,120	10,200	11,400	1,920	470
2	356	473	1,380	7,580	9,500	10,200	1,550	440
3	345	461	800	6,210	8,540	9,200	1,220	415
4	1,230	443	800	3,740	9,190	7,820	1,200	390
5	852	443	760	5,390	9,840	7,820	1,160	406
6	726	413	800	4,810	10,500	7,340	1,120	422
7	860	419	2,180	5,190	10,000	7,110	930	440
8	1,140	425	2,760	2,760	9,500	6,880	840	500
9	1,430	419	3,080	4,620	11,200	6,650	760	485
10	1,240	413	3,910	6,100	13,300	6,750	760	470
11	1,050	384	3,910	7,580	14,300	5,800	690	440
12	875	356	3,740	7,820	15,600	5,100	655	415
13	815	.....	3,910	8,060	14,800	4,810	620	440
14	778	.....	3,740	9,500	13,800	3,910	690	500
15	740	.....	3,910	12,100	13,300	3,600	655	440
16	748	.....	2,920	13,300	13,800	3,240	630	470
17	815	.....	2,320	15,600	14,300	2,760	575	440
18	815	.....	2,920	16,600	15,000	2,600	612	415
19	830	.....	2,610	17,300	15,300	2,460	593	369
20	890	.....	2,050	17,000	15,000	2,320	559	369
21	704	.....	2,180	16,600	14,800	2,320	511	356
22	654	.....	2,180	16,300	14,600	2,180	531	362
23	614	.....	3,570	13,100	14,300	2,180	500	369
24	600	.....	5,190	11,900	14,800	2,050	464	365
25	607	.....	6,210	12,400	14,300	1,790	421	340
26	588	.....	6,430	12,900	13,800	2,050	451	356
27	568	.....	10,200	11,200	13,600	1,790	479	369
28	535	.....	8,060	9,260	13,100	1,700	440	356
29	523	.....	6,210	8,540	12,500	1,550	500	390
30	485	.....	6,670	8,780	11,400	1,800	530	369
31	504	.....	.....	11,200	.....	1,920	500	.....

NOTE.—Figures have been slightly changed to comply with the computation rules of the United States Geological Survey.

Monthly discharge of Yampa River near Maybell, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,430	345	751	46,200
November 1–12	504	356	429	10,200
April	10,200	760	3,580	213,000
May	17,300	3,740	10,000	615,000
June	15,300	8,540	12,800	762,000
July	11,400	1,550	4,490	276,000
August	1,920	421	744	45,700
September	500	356	412	24,500

LITTLE SNAKE RIVER NEAR DIXON, WYO.

LOCATION.—In sec. 6, T. 12 N., R. 90 W., at highway bridge 1 mile west of Dixon, Carbon County. No important tributary within several miles.

DRAINAGE AREA.—1,060 square miles[1] (measured on U. S. G. S. 1:500,000 map).

RECORDS AVAILABLE.—May 27, 1910, to November 30, 1913, and October 1, 1916, to September 30, 1917.

GAGE.—Chain gage on upstream side of bridge; read by Miss Edith Madsen.

COOPERATION.—Complete records furnished by State engineer of Colorado.

[1] Revised since published in report of State engineer of Wyoming for 1915–16.

Discharge measurements of Little Snake River near Dixon, Wyo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 8	M. N. Grant	4.30	1,750
July 23	B. T. Chase	2.20	490
Aug. 15	....do	1.35	78

Daily discharge, in second-feet, of Little Snake River near Dixon, Wyo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	90	205	1,160	980	3,410	2,850	432	46
2	110	205	1,160	1,070	3,100	2,600	332	38
3	190	190	1,100	920	3,590	2,320	332	46
4	238	175	1,040	980	3,950	2,090	284	38
5	220	.....	950	920	3,820	2,170	284	58
6	190	.....	920	760	3,370	2,090	236	70
7	485	.....	760	920	3,410	1,900	188	70
8	735	.....	1,370	810	3,680	1,830	140	70
9	425	.....	1,190	1,040	4,450	1,760	140	58
10	325	.....	980	1,260	4,990	1,650	100	46
11	530	.....	1,070	1,720	4,990	1,490	120	38
12	465	.....	1,100	2,120	4,490	1,360	100	46
13	325	.....	1,160	2,770	4,220	1,200	100	70
14	290	.....	1,070	4,090	4,130	1,110	100	85
15	255	.....	920	4,270	4,360	960	70	100
16	255	.....	665	4,540	4,540	843	100	100
17	255	.....	687	4,990	4,630	814	100	70
18	238	.....	665	5,170	4,720	698	70	70
19	238	.....	642	5,210	4,630	640	85	70
20	220	.....	507	5,260	4,490	640	70	70
21	220	.....	665	4,990	4,400	562	70	46
22	255	.....	1,190	3,860	4,310	484	58	46
23	255	.....	1,800	3,640	4,270	484	46	46
24	238	.....	2,210	4,090	4,090	432	46	70
25	238	.....	2,210	4,320	4,040	484	38	70
26	255	.....	2,660	4,000	3,820	432	30	100
27	255	.....	2,260	3,370	3,590	380	46	100
28	255	.....	1,850	3,060	3,320	332	46	100
29	255	.....	1,160	3,640	3,100	332	46	100
30	220	.....	835	4,180	3,140	510	46	85
31	220	.....	.....	4,040	.....	510	46	.....

Monthly discharge of Little Snake River near Dixon, Wyo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	735	90	282	17,300
April	2,660	507	1,200	71,400
May	5,260	760	3,000	184,000
June	4,990	3,100	4,040	240,000
July	2,850	332	1,160	71,300
August	432	30	126	7,750
September	100	38	67.4	4,010

ASHLEY CREEK BASIN.

ASHLEY CREEK NEAR VERNAL, UTAH.

LOCATION.—In sec. 12, T. 3 S., R. 20. E., three-quarters of a mile above heading of power canal of Vernal Milling & Light Co., 4 miles above mouth of Dry Fork, and 12 miles northwest of Vernal, Uinta County.

DRAINAGE AREA.—101 square miles.

RECORDS AVAILABLE.—June 6, 1914, to September 30, 1917. From October 8, 1911, to June 5, 1914, fragmentary records were obtained at the power plant, the total flow of the creek being determined by including the discharge from the tailrace. Records are also available for a point below the mouth of Dry Fork from March 15, 1900, to December 31, 1904.

GAGE.—Staff gage on right bank 850 yards above diversion dam, July 12 to September 30, 1917; Lietz water-stage recorder on the right bank about 400 yards above diversion dam, April 15, 1915, to June 17, 1917, at same location as vertical staff gage from which fragmentary records had been obtained since June 6, 1914. Staff gage read and recorder inspected by F. A. Siddoway. From October 8, 1911, to June 5, 1914, records were obtained at the power plant; until June 28, 1913, from a gage below the tailrace, and after that date from a gage above the tailrace. While the gage above the tailrace was in use supplementary readings in the tailrace were taken and the flow added to obtain the total in the creek. The gage used from March 15, 1900, to December 31, 1904, was at E. Marett's ranch about 5 miles down-stream, and below Dry Fork. This gage was a vertical staff on the right bank at the wagon bridge.

DISCHARGE MEASUREMENTS.—Prior to June 17, 1917, made from a cable about 75 feet above the gage or by wading; after that date, by wading.

CHANNEL AND CONTROL.—Bed steep and rough; subject to change during high water.

EXTREMES OF DISCHARGE.—Maximum stage during year occurred about June 24 when water was reported over gage (discharge not determined); minimum stage recorded, 1.34 feet April 8 (discharge, 28 second-feet).

1911–1917: Maximum discharge recorded, 1,350 second-feet, May 23, 1914 (probably exceeded by high water in June, 1917); minimum stage occurred in 1917.

ICE.—Stage-discharge relation apparently not affected by ice.

DIVERSIONS.—Above all diversions.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation changed during latter part of June; not affected by ice. Rating curve used October 1 to June 17 well defined between 25 and 400 second-feet and poorly defined above 400 second-feet; that used July 12 to September 30 fairly well defined between 70 and 250 second-feet. Operation of water-stage recorder satisfactory October 1 to January 7, April 8–15, and June 11–17; gage read once a week during remainder of year. Daily discharge ascertained by applying to rating tables the mean daily gage height determined from recorder graph by inspection, or by applying weekly gage height to rating table and interpolating each week except for periods in May, June, and July when gage was not read. Record obtained from water-stage recorder graph good for stages below 400 second-feet; other records fair except those obtained during extremely high water, which are poor.

Discharge measurements of Ashley Creek near Vernal, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 28	J. J. Sanford	1.49	49.1	July 12	L. W. Jordan	[a] 2.48	223
May 3	A. B. Purton	1.50	45.6	Sept. 10	E. S. Borgquist	1.62	92

[a] Gage about 1,000 feet above former site.

Daily discharge, in second-feet, of Ashley Creek near Vernal, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	51	77	46	42	30	30	30	50	.....	.....	136	101
2	54	77	45	42	30	30	30	51	.....	.....	134	101
3	56	77	45	42	30	30	29	51	409	.....	131	101
4	56	76	45	42	30	30	29	.....	.....	.....	129	101
5	56	74	45	42	30	30	29	.....	.....	.....	127	100
6	59	72	45	42	30	30	28	.....	.....	.....	127	98
7	193	69	45	40	30	30	28	.....	.....	.....	127	96
8	102	69	45	40	30	30	28	.....	.....	.....	127	94
9	91	67	45	39	30	30	30	.....	.....	.....	127	92
10	89	65	45	38	30	30	31	.....	.....	.....	127	91
11	89	65	45	38	30	30	31	.....	780	.....	127	91
12	91	64	45	37	30	30	31	.....	780	237	127	91
13	93	61	44	36	30	30	36	.....	780	230	127	91
14	110	61	44	36	30	30	35	.....	810	224	127	91
15	91	57	45	35	30	30	36	.....	985	217	127	91
16	91	56	42	35	30	30	37	.....	1,100	211	127	91
17	93	56	42	35	30	30	38	.....	1,210	206	127	91
18	95	56	42	34	30	30	39	.....	.....	200	127	92
19	91	57	42	34	30	30	40	.....	.....	195	127	94
20	89	57	42	34	30	30	41	.....	.....	189	123	96
21	89	56	42	33	30	30	41	.....	.....	184	120	98
22	88	54	42	33	30	30	42	.....	.....	178	116	100
23	87	54	42	32	30	30	43	.....	.....	178	112	101
24	86	53	42	32	30	30	44	.....	.....	178	108	100
25	85	51	42	31	30	30	45	.....	.....	171	105	98
26	83	50	42	31	30	30	46	.....	.....	164	101	97
27	82	50	42	30	30	30	46	.....	.....	157	101	95
28	81	50	42	30	30	30	47	.....	.....	150	101	94
29	80	50	42	30	.....	30	48	.....	.....	143	101	92
30	79	48	42	30	.....	30	49	.....	.....	141	101	91
31	79	.....	42	30	.....	30	.....	.....	.....	138	101	.....

NOTE.—Discharge not determined May 3 to June 2, June 4–10, and June 18 to July 11.

Monthly discharge of Ashley Creek near Vernal, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	193	51	85.8	5,280
November	77	48	61.0	3,630
December	46	42	43.4	2,670
January	42	30	35.6	2,190
February	30	30	30.0	1,670
March	30	30	30.0	1,840
April	49	28	36.9	2,200
July 12–31	237	138	185	7,340
August	136	101	120	7,380
September	101	91	95.3	5,670

VERNAL MILLING & LIGHT CO.'S TAILRACE NEAR VERNAL, UTAH.

LOCATION.—In sec. 18, T. 3 S., R. 21 E., at power plant of Vernal Milling & Light Co., 10 miles northwest of Vernal, Uinta County.

RECORDS AVAILABLE.—May 3 to September 30, 1917.

GAGE.—Vertical staff nailed to tree on right bank 10 feet below the footbridge at lower side of power house.

DISCHARGE MEASUREMENTS.—Made by wading at the gage.

CHANNEL AND CONTROL.—Channel straight for 20 feet above and 50 feet below gage. Banks high and one channel at all stages. Bed of gravel and small boulders. Fairly permanent. No well-defined control.

ICE.—None.

ACCURACY.—Gage read hourly. Rating curve well defined between 3 and 30 second-feet. Daily discharge determined by applying to rating table mean daily gage height obtained by averaging the hourly readings. Records good.

Discharge measurements of Vernal Milling & Light Co.'s tailrace near Vernal, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 3	A. B. Purton	1.18	25.3	July 12	L. W. Jordan	1.20	22.8
July 12	L. W. Jordan	.95	15.7	Sept. 10	E. S. Borgguist	a1.05	26.9

a Observer's reading at time of measurement was 1.25 feet.

Daily discharge, in second-feet, of Vernal Milling & Light Co.'s tailrace near Vernal, Utah, for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	18	12	18	7.0	16	20	9.2	19	18	15
2	.....	18	18	15	15	17	20	12	17	19	21
3	19	5.9	18	15	19	18	16	16	17	18	20
4	19	16	12	17	17	19	19	15	18	11	20
5	19	14	16	12	16	20	14	16	18	18	21
6	15	18	17	18	16	21	19	13	19	18	21
7	18	17	17	18	17	22	19	16	14	18	16
8	20	18	12	16	16	23	19	17	15	19	1.5
9	18	16	18	16	16	24	18	12	15	20	3.7
10	19	14	17	16	19	25	22	14	19	19	19
11	28	17	18	16	19	26	20	16	19	14	20
12	21	17	18	14	19	27	14	17	18	19	19
13	15	17	18	15	20	28	19	17	18	19	20
14	19	14	18	19	19	29	19	16	14	18	20
15	19	18	15	18	21	30	16	14	15	19	11
						31	19	.....	18	20	.....

NOTE.—No water flowing in tailrace for part of day on June 3, 14, 16, 21, 30, July 30, Aug. 5, 19, Sept. 1, 23, 24, and 30.

Monthly discharge of Vernal Milling & Light Co.'s tailrace near Vernal, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May 3-31	28	14	18.7	1,080
June	18	5.9	15.3	910
July	19	12	16.7	1,030
August	20	11	17.1	1,050
September	21	1.5	16.8	1,000
The period	.....	.....	.....	5,070

DUCHESNE RIVER BASIN.

DUCHESNE RIVER AT MYTON, UTAH.

LOCATION.—In NW. ¼ sec. 25, T. 3 S., R. 2 W., at highway bridge at Myton, Duchesne County, 3 miles below mouth of Lake Fork and 15 miles above mouth of Uinta River.

DRAINAGE AREA.—2,750 square miles.

RECORDS AVAILABLE.—October 26, 1899, to November 30, 1910, and July 26, 1911, to September 30, 1917.

GAGE.—Chain gage on upstream rail near the left end of steel highway bridge; installed August 6, 1910, at a new datum; readings about 2.7 feet lower than those on old gage; read by Abe Smith. From October 26, 1899, to June 6, 1909, a chain gage was used at an old wooden bridge about half a mile below present site. June 6, 1909, the river cut a new channel, and a new chain gage was installed July 9, 1909, about a quarter of a mile upstream and at a different datum. August 9, 1909, this gage was replaced by another chain gage about 100 feet downstream on right bank, but at same datum.

DISCHARGE MEASUREMENTS.—Made from the highway bridge or by wading about 100 feet below the bridge.

CHANNEL AND CONTROL.—Stream bed of coarse gravel; banks comparatively low, but not likely to be overflowed, although they are subject to erosion during high water. Current comparatively swift and makes an angle with the bridge at low stages. Control probably a gravel bar at the ford 100 or 200 feet below the gage; apparently fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.4 feet June 20, 22, and 23 (discharge, 9,690 second-feet); minimum discharge occurred during ice-affected period (quantity not determined).

1899–1917: Maximum discharge occurred in 1917; minimum discharge recorded, 100 second-feet, August 28 to September 1, 1915.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, one discharge measurement, and weather records.

DIVERSIONS.—Much of the low-water flow of the river and its tributaries is diverted for irrigation above the station.

REGULATION.—Annual run-off is affected by storage in the United States Reclamation Service reservoir on Strawberry River, one of the main tributaries.

ACCURACY.—Stage-discharge relation changed during high water July 29 and 30; affected by ice November 16 to March 21. Rating curve used to July 28 well defined between 100 and 10,000 second-feet; that used July 31 to September 30 poorly defined. Gage read to half-tenths twice a day. Daily discharge ascertained by applying mean daily gage height to rating table, except that for periods when stage-discharge relation was affected by ice or shifting control. Records prior to July 28 obtained by use of rating table, good; other records fair.

Discharge measurements of Duchesne River at Myton, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	J. J. Sanford	[a] 2.12	431	June 25	Borgquist and Balka	7.25	9,550
May 1	A. B. Purton	2.70	882	July 14	L. W. Jordan	3.85	1,930
June 16	Borgquist and Balka	5.95	4,630	Sept. 17	C. C. Jacob	2.00	495

[a] Six feet of shore ice at both banks.

Daily discharge, in second-feet, of Duchesne River at Myton, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	534	502	.....	567	878	2,440	6,180	1,320	362
2	472	472	.....	502	964	2,320	5,200	1,010	346
3	502	502	.....	442	878	2,210	4,980	921	362
4	502	502	.....	442	836	2,320	4,770	754	346
5	442	502	.....	502	794	2,820	4,380	638	362
6	442	502	.....	638	794	2,820	4,380	638	387
7	878	472	.....	714	794	3,100	4,030	638	472
8	794	442	.....	676	921	3,390	4,030	567	490
9	638	472	.....	836	1,100	3,390	3,390	534	431
10	1,010	502	.....	794	1,050	4,380	3,100	567	398
11	1,410	442	.....	794	1,050	4,570	2,690	534	534
12	836	387	.....	714	1,100	4,200	2,560	502	567
13	714	326	.....	794	1,230	4,030	2,320	472	567
14	794	266	.....	878	1,500	4,030	1,900	454	714
15	754	225	.....	878	1,900	4,570	1,700	472	502
16	676	.....	.....	836	2,210	5,200	1,500	490	567
17	638	.....	.....	676	2,320	6,450	1,320	454	502
18	602	.....	.....	638	2,560	8,050	1,230	454	472
19	638	.....	.....	638	2,560	8,830	1,140	454	387
20	638	.....	.....	567	2,440	9,690	1,050	454	414
21	602	.....	.....	567	2,560	9,250	964	442	442
22	638	.....	964	567	2,320	9,690	878	398	442
23	602	.....	878	714	2,320	9,690	964	387	964
24	638	.....	878	1,320	2,820	8,830	1,050	387	1,100
25	638	.....	878	1,500	2,320	8,830	878	346	714
26	602	.....	638	1,320	2,210	8,430	878	346	638
27	567	.....	567	1,500	2,000	8,050	794	362	567
28	602	.....	638	1,140	2,000	7,350	754	346	567
29	567	.....	794	1,050	2,100	7,350	1,370	336	567
30	567	.....	921	794	2,100	6,730	1,350	336	567
31	502	.....	878	.....	2,320	.....	1,800	346	.....

NOTE.—Mean discharge estimated because of ice Nov. 16-30, 385 second-feet; Dec. 1-9, 360 second-feet Dec. 10 to Jan 31, 245 second-feet; Feb. 1-28, 565 second-feet; and Mar. 1-21, 875 second-feet.

Monthly discharge of Duchesne River at Myton, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,410	442	659	40,500
November	502	225	410	24,400
December	.....	.....	278	17,100
January	.....	.....	245	15,100
February	.....	.....	565	31,400
March	964	.....	852	52,400
April	1,500	442	800	47,600
May	2,820	794	1,710	105,000
June	9,690	2,210	5,770	343,000
July	6,180	754	2,370	146,000
August	1,320	336	528	32,500
September	1,100	346	525	31,200
The year	9,690	.....	1,220	886,000

STRAWBERRY RIVER AT DUCHESNE, UTAH.

LOCATION.—In sec. 2, T. 4 S., R. 5 W., at Winslow's ranch, about a mile west of post office at Duchesne, Duchesne County, half a mile above mouth of Indian Canyon, a small tributary entering from the south, and 1½ miles above confluence of Strawberry River with Duchesne River.

DRAINAGE AREA.—1,040 square miles.

RECORDS AVAILABLE.—June 10, 1908, to November 30, 1910, and March 16, 1914, to September 30, 1917.

GAGE.—Inclined staff installed April 12, 1914, on right bank, about 50 feet below footbridge at Winslow's house; read by E. S. Winslow. Gage datum lowered 1 foot November 5, 1915. Chain gage at approximately same site, but different datum was used 1908–1910. A staff gage at the county bridge about a mile below was used from March 16 to April 11, 1914.

DISCHARGE MEASUREMENTS.—Made from cable just below footbridge or by wading.

CHANNEL AND CONTROL.—Banks comparatively low; covered with underbrush; left bank subject to overflow at very high stages. Control is gravel bar; apparently fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.2 feet June 11 (discharge, 1,580 second-feet); minimum discharge probably occurred in January, quantity not determined.

1908–1917: Maximum discharge recorded, 1,860 second-feet, April 22, 1910; minimum discharge, 30 second-feet, November 20, 1914. Records obtained prior to 1914 incomplete.

ICE.—Stage-discharge relation affected by ice; flow estimated from observer's notes, one discharge measurement, and weather records.

DIVERSIONS.—Water stored in Strawberry Valley reservoir (capacity, 250,000 acre-feet) about 40 miles above station, is diverted by means of a tunnel to the Spanish Fork drainage basin. Some water is also diverted from the upper end of Strawberry Valley to the basin of Provo River.

REGULATION.—Since 1912 flow of river has been affected by operation of Strawberry Valley reservoir.

ACCURACY.—Stage-discharge relation changed slightly during high water in June; affected by ice November 13 to March 27. Rating curve well defined between 50 and 1,000 second-feet. Gage read to half-tenths twice a day except from January 1 to March 24 when it was read once a day. Daily discharge ascertained by applying mean daily gage height to rating table except for period when stage-discharge relation was affected by ice. Records obtained by use of rating table good; others fair.

Discharge measurements of Strawberry River at Duchesne, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 23	J. J. Sanford	[a] 1.69	332
July 14	L. W. Jordan	1.84	281

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Strawberry River at Duchesne, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	121	127	.....	247	384	1,240	613	251	135
2	170	125	.....	220	400	1,240	540	251	135
3	147	127	.....	207	384	1,240	540	225	135
4	154	125	.....	194	367	1,290	486	201	135
5	136	117	.....	194	384	1,410	469	201	135
6	261	117	.....	290	367	1,370	434	201	135
7	261	117	.....	207	367	1,370	504	196	278
8	170	117	.....	207	469	1,460	434	183	160
9	154	112	.....	275	469	1,460	400	178	152
10	290	96	.....	261	469	1,540	367	174	156
11	452	96	.....	220	504	1,580	352	167	278
12	220	96	.....	220	576	1,500	336	167	160
13	182	.....	.....	234	650	1,410	321	167	156
14	194	.....	.....	220	763	1,240	292	178	156
15	177	.....	.....	261	958	1,330	278	183	146
16	163	.....	.....	234	1,200	1,330	278	183	146
17	158	.....	.....	234	1,330	1,290	278	178	146
18	147	.....	.....	220	1,330	1,240	264	178	146
19	147	.....	.....	207	1,370	1,240	251	178	139
20	136	.....	.....	234	1,370	1,200	251	178	135
21	136	.....	.....	207	1,410	1,160	251	174	135
22	136	.....	.....	207	1,330	1,080	238	156	135
23	136	.....	.....	320	1,330	1,080	540	156	540
24	136	.....	.....	504	1,330	998	306	152	196
25	136	.....	.....	687	1,200	918	251	152	160
26	136	.....	.....	613	1,160	879	238	146	156
27	136	.....	.....	540	1,080	840	238	146	156
28	136	.....	234	504	1,040	763	278	146	152
29	136	.....	335	469	1,080	725	452	139	146
30	136	.....	335	400	1,160	687	367	135	152
31	125	.....	290	.....	1,240	.....	278	135	.....

NOTE.—Mean discharge estimated because of ice Nov. 13–30, 75 second-feet; Dec. 1–26, 95 second-feet; Dec. 27–31, 55 second-feet; Jan. 1–31, 45 second-feet; Feb. 1–28, 85 second-feet; Mar. 1–17, 135 second-feet; and Mar. 18–27, 194 second-feet.

Monthly discharge of Strawberry River at Duchesne, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	452	121	172	10,600
November	127	.....	90.7	5,400
December	.....	.....	88.5	5,440
January	.....	.....	45.0	2,770
February	.....	.....	85.0	4,720
March	335	.....	175	10,800
April	687	194	301	17,900
May	1,410	367	886	54,500
June	1,580	687	1,200	71,400
July	613	238	359	22,100
August	251	135	176	10,800
September	540	135	170	10,100
The year	1,580	.....	313	227,000

LAKE FORK BELOW FORKS, NEAR ALTONAH, UTAH.

LOCATION.—In sec. 32, T. 1 N., R. 4 W. Uinta special meridian, one-eighth mile below junction of East and West forks, one-eighth mile above heading of United States Lake Fork canal, and 5 miles northwest of Altonah, Duchesne County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 4 to September 18, 1917. A station known as Lake Fork below forks, near Whiterocks, Utah, was maintained at approximately same site during 1904 and May 10, 1907, to November 30, 1910.

GAGE.—Inclined staff on right bank about 150 feet below site of chain gage used September 1, 1907, to November 30, 1910. No determined relation between datums of gages.

DISCHARGE MEASUREMENTS.—Made by wading, from cable, or from bridge half a mile below.

CHANNEL AND CONTROL.—Bed of stream composed of small boulders. Channel straight above and below gage, but conditions changed during season by work done for diverting water into United States Lake Fork canal.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.6 feet at 1 p. m. June 19 (discharge determined by extending rating curve, 3,920 second-feet); minimum stage, 1.50 feet, September 3–5 (discharge, 155 second-feet).

1907–1910: Maximum discharge recorded, 9,300 second-feet, July 4, 1907; minimum discharge, 150 second-feet, December 15-31, 1907.

DIVERSIONS.—The Farnsworth canal diverts from the West Fork in sec. 18, and this company has developed a few hundred acre-feet of storage in three small lakes. The Payne canal diverts from the East or Yellowstone Fork in sec. 21. A small amount of water is also stored in a lake on this fork by the Farmers' Irrigation Co.

ACCURACY.—Gage read once daily to tenths. Stage-discharge relation believed permanent from June to September. Rating curve fairly well defined between 150 and 2,500 second-feet. Daily discharge determined by applying daily gage height to rating table. Records fair.

Discharge measurements of Lake Fork below forks, near Altonah, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 29	E. S. Borgquist	2.00	325
July 8	....do	3.70	1,590
Sept. 18	Jacob and Borgquist	1.55	173

Daily discharge, in second-feet, of Lake Fork below forks, near Altonah, Utah, for the year ending Sept. 30, 1917.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	2,430	400	172	16	1,900	770	245	176
2	.....	2,280	325	163	17	2,560	670	245	172
3	.....	2,120	285	155	18	3,230	600	245	168
4	600	2,350	245	155	19	3,920	475	233	.....
5	600	2,120	245	155	20	3,500	420	222	.....
6	600	1,900	245	210	21	3,300	420	210	.....
7	708	1,790	245	180	22	3,100	395	210	.....
8	820	1,590	228	180	23	3,100	370	210	.....
9	980	1,490	210	190	24	2,970	355	210	.....
10	1,140	1,400	245	200	25	2,840	340	210	.....
11	1,310	1,140	245	210	26	2,590	325	210	.....
12	1,310	1,020	245	180	27	2,840	325	210	.....
13	1,220	900	245	180	28	2,540	325	210	.....
14	1,400	980	245	180	29	2,230	420	210	.....
15	1,690	880	245	180	30	2,590	475	210	.....
					31	.....	475	180	.....

NOTE.—Discharge interpolated on account of lack of gage heights June 10, 17, 21, 24, 28, July 1, 2, 5, 12, 15, 16, 22, 24, 25, Aug. 1, 5, 8, 12, 13, 19, 20, 22, 25–27 Sept. 1, 2, 9, 10, 16, 17.

Monthly discharge of Lake Fork below forks, near Altonah, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
June 4–30	3,920	600	2,060	110,000
July	2,430	325	1,020	62,700
August	400	180	238	14,600
September 1–18	210	155	178	6,360
The period				194,000

LAKE FORK NEAR MYTON, UTAH.

LOCATION.—In sec. 21, T. 3 S., R. 2 W., Uinta special base and meridian, 100 yards below highway bridge half a mile above confluence of Lake Fork with Duchesne River, and 3½ miles northwest of Myton, Duchesne County. From 1900–1903 this station was known as "Lake Creek at mouth."

DRAINAGE AREA.—468 square miles.

RECORDS AVAILABLE.—July 3, 1900, to December 31, 1903; June 13, 1907, to November 30, 1910; July 26, 1911, to September 30, 1917.

GAGE.—Inclined staff installed September 13, 1912, on left bank at cable; read by Taylor Beasley and J. C. Zentner. From July 3, 1900, to June 30, 1907, records were obtained from a vertical staff gage near mouth of creek at an old bridge, which was washed out with the gage July 1, 1907. A chain gage installed August 18, 1907, on right bank, about 250 feet below site of old bridge, at new datum, was used until December 31, 1907; in March, 1908, it was moved upstream about a quarter of a mile and installed at new datum on right bank, just below cable. This gage was moved to the left bank and established at same datum June 22, 1909, and used until August 10, 1912, when the chain was stolen. A temporary gage was used by the observer until September 12, 1912, when the present inclined staff was installed at the same site and datum as gage stolen August 10.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL CONTROL.—Banks perpendicular and comparatively high. Stream bed of gravel and control fairly permanent. Stage of zero flow about 0.9 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.4 feet, June 22 and 23 (discharge, 4,350 second feet); minimum stage recorded, 1.60 feet, August 23 and August 29 to September 1 (discharge, 9 second-feet).

1900–1903 and 1907–1917: Maximum discharge occurred in 1917; minimum discharge recorded July 24, 1916, probably zero.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—No diversions below station; several canals of the United States Indian Office and some privately-owned canals divert water above for irrigation.

REGULATION.—Flow affected by irrigation diversions above.

ACCURACY.—Stage-discharge relation changed during ice-affected period and during high water in June and July; affected by ice November 9–12 and November 15 to March 19. Rating curve used October 1 to ice, well defined between 4 and 1,400 second-feet; that used March 21 to July 5 fairly well defined between 60 and 4,000 second-feet; and that used July 6 to September 30 well defined between 10 and 4,000 second-feet. Gage read to hundredths once a day. Daily discharge ascertained by applying daily gage height to rating table except for periods when stage-discharge relation was affected by ice. For these periods it was estimated from observer's notes, weather records, and one discharge measurement. Records obtained by use of rating tables good; others fair.

Discharge measurements of Lake Fork near Myton, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 24[a]	J. J. Sanford	2.55	119	July 14	L. W. Jordan	3.65	489
May 1	A. B. Purton	2.13	98.7	Aug. 7	E. S. Borgquist	1.82	24.6
June 24[b]	E. S. Borgquist	9.06	4,020	Sept. 16	Jacob and Dietz	1.87	22.2

[a] 6 to 10 feet shore ice.
[b] Measured at highway bridge about 500 feet above gage.

Daily discharge, in second-feet, of Lake Fork near Myton, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	104	.....	104	107	312	2,170	160	9
2	40	100	.....	85	131	278	1,960	84	12
3	43	111	.....	102	111	266	1,650	28	14
4	22	100	.....	71	93	252	1,470	17	14
5	15	102	.....	111	82	296	1,410	17	17
6	14	96	.....	164	82	272	1,180	17	20
7	135	94	.....	102	77	344	978	18	24
8	79	93	.....	121	56	394	828	20	17
9	13	.....	.....	197	63	500	780	26	14
10	368	.....	.....	146	159	807	733	32	12
11	351	.....	.....	168	82	900	687	42	42
12	115	.....	.....	159	77	900	555	37	17
13	91	18	.....	192	70	677	524	20	32
14	288	21	.....	164	159	900	492	17	17
15	102	.....	.....	137	233	1,350	234	24	17
16	88	.....	.....	90	225	1,650	218	24	24
17	68	.....	.....	102	238	2,380	160	26	20
18	72	.....	.....	121	266	3,080	148	28	17
19	106	.....	.....	125	264	3,640	135	21	14
20	102	.....	137	121	252	3,640	124	14	14
21	102	.....	210	102	207	3,720	103	14	14
22	111	.....	180	85	225	4,350	82	12	14
23	135	.....	107	152	328	4,350	61	9	174
24	131	.....	164	154	290	3,810	54	12	84
25	121	.....	125	159	278	4,080	54	12	76
26	115	.....	111	187	278	3,000	37	12	68
28	111	.....	146	212	266	3,400	39	17	61
28	98	.....	129	154	244	2,840	37	12	42
29	115	.....	121	121	212	3,160	148	9	42
30	106	.....	148	152	255	2,680	160	9	42
31	102	.....	152	.....	312	.....	267	9	.....

NOTE.—Mean discharge estimated because of ice Nov. 9–12, 60 second-feet; Nov. 15–24, 70 second-feet; Nov. 25–30, 105 second-feet; Dec. 1–31, 85 second-feet; Jan. 1–31, 65 second-feet; Feb. 1–28, 100 second-feet; and Mar. 1–19, 125 second-feet.

Monthly discharge of Lake Fork near Myton, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	368	13	110	6,760
November	.....	18	80.3	4,780
December	.....	.....	85.0	5,230
January	.....	.....	65.0	4,000
February	.....	.....	100	5,550
March	210	.....	132	8,120
April	212	71	135	8,030
May	328	56	185	11,400
June	4,350	252	1,940	115,000
July	2,170	37	564	34,700
August	160	9	25.8	1,590
September	174	9	32.8	1,950
The year	4,350	9	287	207,000

PRICE RIVER BASIN.

PRICE RIVER NEAR HELPER, UTAH.

LOCATION.—In sec. 36, T. 13 S., R. 9 E., at ford 300 feet west of Denver & Rio Grande Railroad main line, at settlement locally known as Spring Glenn, 2 miles south of Helper, Carbon County, 1 mile above diversion dam of Price River Irrigation Co., and 4 miles below White Creek.

DRAINAGE AREA.—530 square miles.

RECORDS AVAILABLE.—February 21, 1904, to September 30, 1917.

GAGE.—Vertical staff on left bank; installed July 16, 1907, to replace the old chain gage washed out April 11, 1907; read by D. S. Rowley. A temporary gage was read June 23 to July 15, 1907. All gage heights beginning June 23, 1907, are referred to a datum 0.7 foot above that of original chain gage.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed of the stream composed of gravel and fine sand. Control is a riffle immediately below ford; shifts occasionally during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.43 feet at 9 p. m. June 25, determined by leveling from hub set at high-water mark (discharge determined from extension of rating curve, 8,500 second-feet); minimum discharge recorded, 30 second-feet, November 16, 27, December 1, and January 20–31.

1904–1917: Maximum stage occurred in 1917; minimum stage recorded, 3.1 feet (old chain gage) during December, 1905, and January, 1906 (discharge, 4 second-feet).

ICE.—Stage-discharge relation affected by ice for short periods; flow estimated from discharge measurements and observer's notes.

DIVERSIONS.—Main diversions from Price River are below station. The Mammoth reservoir of the Price River Irrigation Co. on Gooseberry Fork, about 40 miles above the station, had a capacity of about 10,000 acre-feet.

REGULATION.—Flow of river was affected by storage at Mammoth reservoir until after June 24 when dam broke.

ACCURACY.—Stage-discharge relation changed several times by freshets; affected by ice at intervals between November and March. Rating curve used February 25 to June 24 well defined between 20 and 1,300 second-feet; those used for remainder of year fairly well defined. Gage read to hundredths usually once a day, occasionally twice a day. Daily discharge ascertained by applying mean daily gage height to rating table except for periods when stage-discharge relation was affected by ice or shifting control. Mean daily discharge for June 25, 26, and July 29 determined by averaging the result obtained by applying to the rating table hourly gage height determined from rough hydrograph. Records fairly good.

Discharge measurements of Price River near Helper, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 6	J. J. Sanford	2.72	41.3	June 25	A. B. Purton	4.76	1,030
Mar. 1[a]	....do	2.54	30.2	July 16	L. W. Jordan	2.17	125
Apr. 29	A. B. Purton	3.84	408	Sept. 6	W. E. Dickinson	2.22	45.9
May 22	C. W. Bennett	4.98	1,240				

[a] Ice on control.

Daily discharge, in second-feet, of Price River near Helper, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	110	45	30	.....	.....	.....	92	383	1,090	299	76	44
2	121	45	39	.....	.....	.....	92	408	1,040	280	73	44
3	102	49	34	.....	.....	.....	99	360	1,040	262	65	42
4	92	45	37	.....	.....	60	88	360	1,140	228	60	42
5	99	45	37	.....	37	79	168	360	1,140	228	62	65
6	360	47	41	.....	41	73	168	360	1,180	213	60	46
7	108	45	.....	.....	40	88	383	383	1,180	198	62	50
8	72	39	.....	.....	37	65	383	462	1,180	198	60	50
9	66	45	.....	.....	46	67	462	434	1,220	198	44	50
10	204	46	29	.....	44	67	316	434	1,370	184	57	50
11	190	47	28	.....	44	67	383	550	1,370	171	55	185
12	72	.....	32	.....	45	70	462	582	1,220	166	53	47
13	58	.....	37	.....	64	67	360	760	1,140	158	53	45
14	61	.....	.....	.....	53	65	383	1,000	1,040	146	53	45
15	69	.....	.....	39	54	70	408	1,270	1,000	123	55	43
16	61	30	.....	39	76	79	225	1,470	960	123	55	43
17	58	37	32	40	65	73	242	1,570	1,000	128	60	43
18	58	39	39	35	54	67	225	1,570	1,000	115	60	43
19	56	39	39	32	55	67	168	1,570	960	112	57	41
20	54	39	37	30	56	.....	168	1,470	880	112	55	41
21	54	39	37	30	58	.....	242	1,470	800	108	53	41
22	54	37	37	30	62	.....	360	1,220	722	104	53	47
23	49	35	41	30	64	.....	582	1,270	685	108	50	132
24	48	34	37	30	65	.....	1,220	1,180	650	108	48	56
25	47	41	.....	30	117	.....	650	1,140	2,200	104	48	45
26	47	34	.....	30	91	.....	760	1,180	3,350	112	46	45
27	47	30	.....	30	65	73	550	1,090	388	108	46	43
28	47	35	.....	30	53	76	490	1,000	388	115	46	43
29	45	30	.....	30	.....	99	408	1,000	365	800	44	43
30	47	32	.....	30	.....	143	360	1,140	365	102	44	41
31	47	.....	.....	30	.....	118	.....	1,140	.....	95	44	.....

NOTE.—Mean discharge estimated because of ice Nov. 12–15, 38 second-feet; Dec. 7–9, 30 second-feet: Dec. 14–16, 34 second-feet: Dec. 25 to Jan. 14, 35 second-feet; Feb. 1–4, 32 second-feet; Mar. 1–3, 40 second-feet; and Mar. 20–26, 65 second-feet.

Monthly discharge of Price River near Helper, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	360	45	84.0	5,160
November	49	30	39.4	2,340
December	41	.....	34.8	2,140
January	40	30	33.4	2,050
February	117	.....	54.1	3,000
March	143	.....	71.2	4,380
April	1,220	88	363	21,600
May	1,570	360	922	56,700
June	3,350	365	1,070	63,700
July	800	95	178	10,900
August	76	44	54.7	3,360
September	185	41	53.2	3,170
The year	3,350	30	246	178,000

SAN RAFAEL RIVER BASIN.

HUNTINGTON CREEK NEAR HUNTINGTON, UTAH.

LOCATION.—In sec. 6, T. 17 S., R. 8 E., at the Cunha ranch, 7 miles northwest of Huntington, Emery County. Below all main tributaries except Fish Creek.

DRAINAGE AREA.—158 square miles.

RECORDS AVAILABLE.—May 3, 1909, to September 30, 1917.

GAGE.—Stevens continuous water-stage recorder on right bank installed September 11, 1917; inspected by J. P. Brockbank. Original gage, vertical staff on right bank at same site as present gage, but at independent datum used May 3, 1909, to October 6, 1912; inclined staff gage at same site and datum, October 7, 1912, to April 29, 1913; Stevens water-stage recorder on left bank, 100 feet upstream, set to read the same as previous gage, used April 30, 1913, to September 9, 1917.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; shifts occasionally during high stages.

EXTREMES OF DISCHARGE.—Maximum discharge during year occurred in June; water-stage recorder not in operation and quantity not determined; minimum discharge probably occurred in January; stage-discharge relation affected by ice and quantity not determined.

1909–1917: Maximum discharge, 1,100 second-feet, May 22 and 23, 1914; minimum discharge, 12 second-feet, March 20–23, 1912.

ICE.—Stage-discharge relation seriously affected by ice; discharge estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—Several small ditches divert from tributaries above the station.

REGULATION.—A small storage reservoir on Huntington Creek above the station controls distribution of flow to a slight extent.

ACCURACY.—Stage-discharge relation changed in June; affected by ice December 6 to March 20. Rating curve used October 1 to June 30 well defined between 30 and 600 second-feet; that used July 1 to September 9 fairly well defined between 50 and 200 second-feet; and that used September 11–30 well defined between 30 and 500 second-feet. Operation of water-stage recorder satisfactory except for November 12 to April 8, May 6–11, June 7–26, and July 12 to August 9, when staff gage was read to hundredths about once a week. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection or by interpolating between days when staff gage was read except for period when stage-discharge relation was affected by ice and the period June 7–26, which was estimated from hydrographic comparison with Huntington Creek near Castledale. Records obtained by use of rating table good; others fair.

Discharge measurements of Huntington Creek near Huntington, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 4	J. J. Sanford	2.58	45.2	May 23	C. W. Bennett	4.56	487
Mar. 4[a]	Sanford and Flagel	3.02	40.2	Sept. 8[b]	W. E. Dickinson	3.00	72.4
May 23	C. W. Bennett	4.56	476	Sept. 11[c]	do	3.42	143

[a] Stage-discharge relation affected by ice.
[b] New gage installed 100 feet downstream. Old gage read 3.15 feet.
[c] Old gage read 3.50 feet.

Daily discharge, in second-feet, of Huntington Creek near Huntington, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	95	36	40	.....	78	120	462	458	110	72
2	73	38	41	.....	76	125	532	448	105	72
3	64	38	42	.....	74	123	602	430	100	72
4	67	38	43	.....	72	121	642	423	103	72
5	61	40	41	.....	71	116	618	406	106	72
6	101	32	.....	.....	69	134	642	381	109	79
7	106	40	.....	.....	67	152	.....	361	111	82
8	69	37	.....	.....	66	170	.....	337	114	74
9	59	39	.....	.....	77	188	.....	320	117	74
10	89	37	.....	.....	76	207	.....	304	120	74
11	76	36	.....	.....	80	202	.....	224	125	94
12	55	30	.....	.....	88	196	.....	212	116	71
13	50	31	.....	.....	83	292	.....	201	114	69
14	60	33	.....	.....	89	546	.....	189	125	68
15	61	35	.....	.....	88	746	.....	178	129	64
16	52	36	.....	.....	83	810	.....	166	125	63
17	49	38	.....	.....	80	810	.....	155	122	69
18	46	39	.....	.....	77	810	.....	143	118	69
19	41	36	.....	.....	73	746	.....	141	108	59
20	42	34	.....	.....	73	704	.....	139	91	58
21	43	34	.....	44	79	594	.....	137	89	57
22	43	34	.....	44	86	546	.....	136	86	58
23	40	34	.....	44	101	504	.....	134	87	81
24	35	34	.....	44	125	442	.....	132	82	63
25	38	34	.....	49	150	468	.....	131	80	61
26	40	35	.....	54	175	493	.....	129	79	59
27	39	36	.....	59	148	426	622	127	76	57
28	38	37	.....	65	135	500	575	125	76	55
29	37	38	.....	70	123	583	557	124	74	55
30	37	39	.....	75	116	587	507	122	74	58
31	36	.....	.....	80	.....	496	.....	120	74	.....

NOTE.—Mean discharge estimated because of ice Dec. 6–16, 40 second-feet; Dec. 17–31, 30 second-feet; Jan. 1–31, 25 second-feet; Feb. 1–28, 30 second-feet; Mar. 1–20, 38 second-feet; and because of break in record June 7–26, 880 second-feet.

Monthly discharge of Huntington Creek near Huntington, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	106	35	56.2	3,460
November	40	30	35.9	2,140
December	.....	.....	35.4	2,180
January	.....	.....	25.0	1,540
February	.....	.....	30.0	1,670
March	80	.....	44.8	2,750
April	175	66	92.6	5,510
May	810	116	418	25,700
June	.....	462	779	46,400
July	458	120	227	14,000
August	129	74	101	6,210
September	94	55	67.7	4,030
The year	.....	.....	.....	116,000

HUNTINGTON CREEK NEAR CASTLEDALE, UTAH.

LOCATION.—In sec. 33, T. 18 S., R. 9 E., half a mile below county bridge on road to Green River, 5 miles above mouth of Cottonwood Creek, and 6 miles east of Castledale, Emery County.

DRAINAGE AREA.—325 square miles.

RECORDS AVAILABLE.—May 12, 1911, to September 30, 1917.

GAGE.—Stevens continuous water-stage recorder on right bank; inspected by Rex Peterson; installed May 2, 1913, at same datum as vertical staff gage which it replaced.

DISCHARGE MEASUREMENTS.—Made by wading or from cable just below gage.

CHANNEL AND CONTROL.—Bed composed of sand and small gravel. Banks fairly high; subject to erosion but not to overflow. Original artificial control which was formed by 2 by 12 inch planks, placed edgewise in a trench and anchored to pipes driven into stream bed, has been obliterated.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 8.1 feet at 5 p. m. October 10 (discharge, 1,240 second-feet, estimated from extending rating curve); minimum stage recorded, 1.24 feet, September 9 (discharge, 7 second-feet).

1911–1917: Maximum stage recorded, 11.3 feet, September 8, 1913, when dam above station broke (discharge estimated, 1,750 second-feet); minimum stage, 0.95 foot, September 10, 1915 (discharge, 2.5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—The station is below all diversions in Castle Valley.

REGULATION.—Flow affected by irrigation in Huntington district.

ACCURACY.—Stage-discharge relation changed October 6–10; affected by ice November 13 to March 30. Rating curve fairly well defined by discharge measurements between 10 and 300 second-feet, and by parallel curves up to 800 second-feet. Operation of water-stage recorder satisfactory except December to March, June 21 to July 20, and September 12–30, when hook gage was read to hundredths once a week. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection except for periods when stage-discharge relation was affected by ice or shifting control, and when water-stage recorder was not in operation for which it was estimated or interpolated, using hydrograph of Huntington Creek near Huntington as a guide. Discharge for October 6 and 10 determined by averaging results obtained by applying hourly gage height to rating table. Records obtained by use of rating table good; others fair.

Discharge measurements of Huntington Creek near Castledale, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 6[a]	J. J. Sanford	2.35	40.6	June 28	A. B. Purton	3.92	257
Mar. 3[a]	Sanford and Flagel	2.96	37.0	Sept. 6	W. E. Dickinson	1.34	9.7
May 24	C. W. Bennett	3.98	289				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Huntington Creek near Castledale, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	32	.....	33	88	282	198	18	12
2	30	32	.....	36	90	290	172	13	12
3	23	33	.....	36	76	335	147	12	11
4	22	33	.....	33	78	452	132	10	11
5	22	33	.....	36	67	353	117	10	11
6	361	32	.....	36	71	362	103	10	9
7	147	30	.....	26	76	462	88	11	10
8	47	30	.....	30	65	550	78	11	10
9	33	32	.....	33	62	778	68	16	7
10	481	39	.....	32	54	903	59	19	9
11	174	38	.....	30	69	803	49	17	126
12	60	33	.....	30	96	655	40	23	.....
13	60	.....	.....	33	137	631	30	25	.....
14	134	.....	.....	34	265	631	21	21	.....
15	78	.....	.....	33	538	704	20	18	15
16	49	.....	.....	32	703	778	19	17	.....
17	43	.....	.....	36	655	803	18	19	.....
18	42	.....	.....	30	703	778	18	19	.....
19	40	.....	.....	26	561	703	17	21	.....
20	39	.....	.....	28	494	607	16	20	.....
21	37	.....	.....	32	382	565	15	19	.....
22	35	.....	.....	35	362	523	15	19	.....
23	34	.....	.....	43	353	480	15	19	60
24	33	.....	.....	64	290	438	30	19	.....
25	32	.....	.....	88	257	395	23	19	.....
26	32	.....	.....	132	249	353	19	19	.....
27	33	.....	.....	132	226	314	16	17	.....
28	34	.....	.....	116	265	274	12	16	.....
29	32	.....	.....	104	317	249	17	13	.....
30	32	.....	.....	78	382	223	20	13	.....
31	32	.....	41	.....	317	.....	20	13	.....

NOTE.—Mean discharge estimated because of ice Nov. 13-30, 32 second-feet; Dec. 1-22, 35 second-feet; Dec. 23-31, 25 second-feet; Jan. 1-31, 20 second-feet; Feb. 1-28, 30 second-feet; and Mar. 1-30, 40 second-feet; and because of missing gage-height record, Sept. 12-14, 25 second-feet; Sept. 16-22, 15 second-feet; and Sept. 24-30, 35 second-feet.

Monthly discharge of Huntington Creek near Castledale, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	481	22	74.3	4,570
November	39	.....	32.4	1,930
December	.....	.....	32.1	1,970
January	.....	.....	20	1,230
February	.....	.....	30	1,670
March	.....	.....	40	2,460
April	132	26	48.9	2,910
May	703	54	269	16,500
June	903	223	522	31,100
July	198	15	52.0	3,200
August	25	10	16.6	1,020
September	126	7	24.3	1,450
The year	903	7	96.8	70,000

SAN RAFAEL RIVER NEAR GREEN RIVER, UTAH.

LOCATION.—In sec. 27, T. 22 S., R. 14 E., at county bridge near Tomlinson ranch, on road from Green River to Hanksville, 16 miles southwest of Green River, Emery County.

DRAINAGE AREA.—1,690 square miles.

RECORDS AVAILABLE.—May 5, 1909, to September 30, 1917.

GAGE.—Vertical staff on downstream side of right crib abutment of bridge; read by Mrs. L. Presset.

DISCHARGE MEASUREMENTS.—Made from highway bridge at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of mud and quicksand; shifting; control not well defined. Banks fairly high but left bank subject to overflow at extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.6 feet, October 8 (discharge, 7,300 second-feet); minimum stage recorded, 1 foot, December 10 (discharge, 14 second-feet).

1909–1917: Maximum stage occurred in 1917; water standing in pools during August and September, 1910, and August 13 to September 8, 1915.

ICE.—Stage-discharge relation seriously affected by ice; discharge estimated from observer's notes and weather records.

DIVERSIONS.—Below practically all diversions from San Rafael River. The main diversions in this basin are made from the tributaries, for irrigation in Castle Valley.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed in October and June; affected by ice December 29 to February 16. Rating curve used October 1–7 and July 9 to September 30 fairly well defined between 250 and 1,000 second-feet, and that used for remainder of year fairly well defined between 50 and 3,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage heights to rating table except for periods when stage-discharge relation was affected by ice; shifting-control method used October 8 and June 24 to July 8. Records fair.

Discharge measurements of San Rafael River near Green River, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 7	J. J. Sanford	1.34	41.6
Mar. 6	....do	1.72	91.9
June 23	A. B. Purton	7.50	2,980

Daily discharge, in second-feet, of San Rafael River near Green River, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	77	98	.....	.....	293	98	346	1,000	661	119	77
2	77	95	.....	.....	183	98	319	947	974	152	77
3	152	92	113	.....	98	113	293	1,470	661	135	77
4	152	90	113	.....	59	98	319	1,590	599	119	77
5	144	95	98	.....	129	113	246	1,350	541	77	90
6	127	84	95	.....	98	113	293	895	454	104	77
7	2,900	81	49	.....	92	98	269	1,290	1,000	104	90
8	7,300	81	26	.....	146	79	293	1,470	523	119	90
9	705	79	26	.....	126	84	319	1,870	472	104	90
10	1,730	79	14	.....	146	129	293	3,370	472	119	90
11	5,900	98	38	.....	129	113	293	3,370	436	104	90
12	750	91	59	.....	113	129	293	2,590	436	258	1,570
13	750	84	59	.....	126	146	375	2,290	402	152	402
14	1,940	66	71	.....	81	164	619	2,150	402	135	170
15	541	48	84	.....	84	203	1,530	2,150	370	119	170
16	541	38	71	.....	98	183	1,870	2,590	258	119	152
17	306	51	104	48	84	129	1,870	2,590	234	104	135
18	269	64	98	59	84	146	1,530	3,370	211	104	135
19	258	71	129	71	98	98	1,530	2,590	170	104	119
20	193	98	116	84	98	84	1,470	4,170	190	77	90
21	164	129	104	98	113	71	1,800	3,770	170	77	90
22	164	.....	119	113	98	84	1,170	3,530	190	90	1,440
23	146	.....	113	129	113	129	1,170	2,980	211	119	402
24	146	.....	129	113	113	269	1,170	2,940	370	104	152
25	146	71	146	437	113	375	1,000	2,510	190	90	119
26	146	.....	164	437	129	619	1,000	2,670	152	90	104
27	129	.....	113	437	293	505	895	1,730	152	90	90
28	119	.....	98	293	246	346	895	1,380	170	77	90
29	113	.....	84	.....	224	541	797	1,410	135	77	119
30	107	.....	71	.....	129	470	1,000	1,320	119	77	100
31	104	.....	59	.....	113	.....	1,230	.....	135	65	.....

NOTE.—Stage-discharge relation affected by ice, and discharge estimated, Dec. 29–31, as in table; Jan. 1–31, 20 second-feet; and Feb. 1–16, 30 second-feet. Discharge estimated because of no gage-height record, Nov. 22–24, 100 second-feet; Nov. 26 to Dec. 2, 70 second-feet; and Sept. 30, 100 second-feet.

Monthly discharge of San Rafael River near Green River, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	7,300	77	848	52,100
November	129	38	81.1	4,830
December	164	14	87.2	5,360
January	.....	.....	20	1,230
February	437	.....	100	5,550
March	293	59	131	8,060
April	619	71	194	11,500
May	1,870	246	855	52,600
June	4,170	895	2,250	134,000
July	1,000	119	370	22,800
August	258	65	109	6,700
September	1,570	77	219	13,000
The year	7,300	.....	438	318,000

COTTONWOOD CREEK NEAR ORANGEVILLE, UTAH.

LOCATION.—In sec. 9 or 10, T. 18 S., R. 7 E., at Robert Johnson's ranch, 5 miles northwest of Orangeville, Emery County.

DRAINAGE AREA.—240 square miles.

RECORDS AVAILABLE.—May 1, 1909, to September 30, 1917.

GAGE.—Inclined staff on left bank just below corral at ranch house and about 300 feet above cable; used March 22, 1910, to November 23, 1913; and May 24, 1914, to September 30, 1917; read by Robert Johnson. Records obtained November 24, 1913, to May 23, 1914, were referred to a different gage at independent datum installed November 20, 1913, at cable. From May 1, 1909, to August 21, 1909, stage was determined by measuring down from a nail in a tree at about the site of the present gage. August 22, 1909, an inclined staff was installed at the reference point; gage was washed out August 31, 1909, and from September 1, 1909, to March 22, 1910, the records were uncertain and unreliable. March 22 an inclined staff was installed at present site and at datum 0.8 foot lower than the datum used in 1909. An inclined staff was installed in 1911 about 400 feet below present gage, but no published records have been referred to it and it was destroyed by floods in the spring of 1913.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed rough; shifting. Banks fairly high but have been overflowed by the sudden floods, to which the stream is subject.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet June 21 (discharge, 1,880 second-feet); minimum stage recorded, 4.3 feet, November 13 and March 24 and 26 (discharge, 8 second-feet).

1909–1917: Maximum discharge recorded, 1,980 second-feet, September 7, 1913; minimum discharge recorded, 5 second-feet, September 21, 1910.

ICE.—Stage-discharge relation affected by ice; flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—Two or three small ditches divert water above station, but all the main ditches take out below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed October 10, during the winter, and June 28 to July 10; affected by ice November 14 to March 9. Rating curves poorly defined except that used March 10 to June 27, which is fairly well defined between 300 and 700 second-feet, and curve used July 11 to September 30, which is fairly well defined between 15 and 600 second-feet. Gage read to tenths four to six

times a week. Daily discharge ascertained by applying daily gage height to rating table or by interpolation, except for period when stage-discharge relation was affected by ice. For this period discharge was estimated from observer's notes, weather records, and two discharge measurements. Shifting-control method used October 10 and June 29 to July 10. Records poor October 1 to March 9; fair for remainder of year.

Discharge measurements of Cottonwood Creek near Orangeville, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 5[a]	J. J. Sanford	4.72	24.5	June 28	A. B. Purton	7.30	782
Mar. 3[b]	Sanford and Flagel	4.55	17.0	Sept. 7	W. E. Dickinson	5.38	41.3
May 25	C. W. Bennett	[c] 6.48	364				

[a] Stage-discharge relation affected by ice.
[b] Ice 18 inches thick below gage which causes backwater in afternoon.
[c] Determined from reading on lower gage; relation established by simultaneous readings.

Daily discharge, in second-feet, of Cottonwood Creek near Orangeville, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	18	.....	11	46	149	847	118	45
2	40	18	.....	8	51	166	847	108	45
3	40	18	.....	8	42	183	668	97	45
4	40	18	.....	10	34	200	613	79	45
5	40	18	.....	12	27	231	558	79	43
6	325	18	.....	13	34	262	459	79	40
7	51	18	.....	14	42	372	459	85	38
8	46	18	.....	18	46	507	396	91	38
9	40	18	.....	21	51	668	333	97	38
10	686	18	12	17	61	640	262	81	38
11	34	18	12	17	61	612	242	65	79
12	63	13	12	17	71	507	222	65	65
13	92	8	12	22	90	726	193	65	52
14	121	.....	12	27	110	1,030	193	65	38
15	73	.....	12	22	262	1,550	180	65	38
16	25	.....	12	17	230	1,480	166	65	38
17	25	.....	12	16	246	1,580	166	65	38
18	25	.....	12	14	262	1,680	166	65	38
19	18	.....	12	17	230	1,550	166	60	38
20	18	.....	12	27	215	1,550	180	54	38
21	18	.....	12	32	200	1,880	193	54	38
22	18	.....	12	37	200	1,550	167	54	38
23	18	.....	10	42	173	1,220	141	54	38
24	18	.....	8	56	161	1,240	167	54	38
25	18	.....	8	71	149	1,270	193	54	38
26	18	.....	8	66	128	1,290	141	51	38
27	18	.....	12	61	138	1,100	130	48	38
28	18	.....	14	51	149	786	118	45	38
29	18	.....	20	46	149	816	118	45	38
30	18	.....	27	42	149	847	118	45	38
31	18	.....	14	.....	149	.....	118	45	.....

NOTE.—Mean discharge estimated because of ice Nov. 14–19, 15 second-feet; Nov. 20 to Dec. 25, 25 second-feet; Dec. 26–31, 20 second-feet; Jan. 1 to Feb. 23, 12 second-feet; Feb. 24 to Mar. 9, 18 second-feet.

Monthly discharge of Cottonwood Creek near Orangeville, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	686	18	65.8	4,050
November			19.5	1,160
December			24.0	1,480
January			12.0	738
February			13.1	728
March		8	14.2	873
April	71	8	27.7	1,650
May	262	27	128.	7,870
June	1,880	149	921.	54,800
July	847	118	288.	17,700
August	118	45	67.6	4,160
September	79	38	41.9	2,490
The year	1,880	8	135.	97,700

FERRON CREEK (UPPER STATION) NEAR FERRON, UTAH.

LOCATION.—In sec. 1, T. 20 S., R. 6 E., a quarter of a mile below house at Peterson ranch (formerly Christensen's), 1½ miles above gristmill, and 5 miles northwest of Ferron, Emery County.

DRAINAGE AREA.—150 square miles.

RECORDS AVAILABLE.—May 6, 1911, to September 30, 1917.

GAGE.—Inclined staff on right bank; read by Charles Carlson; installed September 13, 1911, to replace the original vertical staff 165 feet upstream.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 15 feet upstream from gage.

CHANNEL AND CONTROL.—Banks high and not subject to overflow. Bed composed of sand and gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.30 feet at 7 p. m. June 17 (discharge from extended rating curve, 980 second-feet); minimum stage occurred during ice-affected period, not determined.

1911–1917: Maximum stage recorded, 5.50 feet at 4 p. m. June 1, 1914 (discharge, 1,100 second-feet); minimum discharge recorded, 1 second-foot, March 22 and 23, 1912.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—Above all diversions except a small ditch for the Peterson ranch.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water in June; affected by ice December 3 to March 24. Rating curve used until June 8 well defined between 40 and 350 second-feet; that used after June 18 well defined between 10 and 500 second-feet. Gage read to hundredths twice a day except October 22 to April 6 when it was read twice a week. Daily discharges ascertained by applying daily gage height to rating table except for periods when stage-discharge relation was affected by ice; shifting-control method used June 9–18. Records obtained by use of rating table good; others fair.

Discharge measurements of Ferron Creek (upper station) near Ferron, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 5[a]	J. J. Sanford	2.72	22.2	June 29	A. B. Purton	3.50	401
Mar. 2[a]	Sanford and Flagel	2.55	19.8	Sept. 7	W. E. Dickinson	.68	28.6
May 25	C. W. Bennett	3.08	242				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Ferron Creek (upper station) near Ferron, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	174	30	32	.....	18	123	234	419	54	28
2	33	29	27	.....	12	126	267	402	51	28
3	27	28	.....	.....	13	109	391	384	51	27
4	27	27	.....	.....	14	106	308	354	50	28
5	27	26	.....	.....	14	98	281	335	50	27
6	182	24	.....	.....	15	98	458	295	50	27
7	108	23	.....	.....	16	93	472	261	49	27
8	60	22	.....	.....	12	85	593	246	50	27
9	59	21	.....	.....	191	90	706	236	179	26
10	310	21	.....	.....	128	157	715	218	53	47
11	166	21	.....	.....	66	166	641	196	50	188
12	42	21	.....	.....	70	167	643	176	47	30
13	35	21	.....	.....	74	372	683	156	47	30
14	227	21	.....	.....	166	452	711	137	46	30
15	111	21	.....	.....	58	568	757	132	67	30
16	49	21	.....	.....	45	589	774	121	45	29
17	34	21	.....	.....	27	478	829	113	45	28
18	41	21	.....	.....	21	382	823	102	47	27
19	24	21	.....	.....	19	368	790	100	41	26
20	19	21	.....	.....	16	339	752	99	39	24
21	18	20	.....	.....	16	344	741	95	38	23
22	30	20	.....	.....	84	301	721	126	37	23
23	42	20	.....	.....	261	295	700	101	36	46
24	54	19	.....	.....	277	241	683	94	35	24
25	66	19	.....	31	277	236	662	91	34	23
26	39	17	.....	32	268	220	612	88	34	23
27	37	20	.....	33	231	231	562	82	34	22
28	35	23	.....	34	67	274	524	78	34	22
29	34	26	.....	35	138	335	480	87	33	22
30	33	29	.....	30	123	339	438	73	31	22
31	32	.....	.....	24	.....	263	.....	58	28	.....

NOTE.—Mean discharge estimated because of ice, Dec. 3–23, 20 second-feet; Dec. 24–31, 18 second-feet; Jan. 1–31, 10 second feet; Feb. 1–28, 16 second-feet; and Mar. 1–24, 20 second-feet.

Monthly discharge of Ferron Creek (upper station) near Ferron, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	310	18	70.2	4,320
November	30	17	22.5	1,340
December	.....	.....	20.1	1,240
January	.....	.....	10.0	615
February	.....	.....	16.0	889
March	.....	.....	22.5	1,380
April	277	12	91.9	5,470
May	589	85	260	16,000
June	829	234	598	35,600
July	419	58	176	10,800
August	179	28	47.9	2,950
September	188	22	32.8	1,950
The year	829	.....	114	82,600

GRAND RIVER BASIN.

NORTH FORK OF GRAND RIVER NEAR GRAND LAKE, COLO.

LOCATION.—In sec. 13, T. 3 N., R. 76 W., at old highway bridge 200 feet downstream from bridge on stage road to Grand Lake, Grand County. Nearest tributary, Grand Lake outlet, enters some distance below; no tributaries for several miles above.

DRAINAGE AREA.—101 square miles (measuerd on topographic map).

RECORDS AVAILABLE.—July 29, 1904, to September 30, 1909; September 20, 1910, to September 30, 1917.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by Mrs. Ethel M. Curry.

DISCHARGE MEASUREMENTS.—Made from old highway bridge or by wading.

CHANNEL AND CONTROL.—Channel rough and composed of boulders; gravity section which shifts slightly from year to year. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.7 feet at 6 p. m. June 23 (discharge, 1,620 second-feet); minimum stage, 3.4 feet during February and March (discharge, 27 second-feet).

ICE.—Stage-discharge relation only slightly affected by ice for short periods, as springs keep river open.

DIVERSIONS.—There are court decrees for the diversion of 699 second-feet from the headwaters above the station. Of this small amount 525 second-feet are for diversions across the divide into the headwaters of the Cache la Poudre River. Under this decree 7,430 acre-feet were diverted in 1917 between July 11 and September 22. There is also a reservoir decree for 19,000 acre-feet from the floodwater.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts slightly; slightly affected by ice. Rating curve used October 1 to December 31 well defined between 25 and 100 second-feet, and curve used January 1 to September 30 well defined between 50 and 1,100 second-feet. Gage read to hundredths once daily except during winter months, when it was read once every two days. Daily discharge ascertained by applying the gage reading for the day to the rating tables, and interpolating the discharge for days when gage was not read. Records excellent except during winter months, when they are fair.

Discharge measurements of North Fork of Grand River near Grand Lake, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 2	P. V. Hodges	3.85	70
Jan. 9	J. H. Keep	3.48	31.3
Aug. 15	S. B. Soulé	3.98	82

Daily discharge, in second-feet, of North Fork of Grand River near Grand Lake, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	69	55	40	41	29	28	28	84	175	1,170	175	62
2	72	55	40	41	29	28	28	71	175	1,100	163	60
3	72	55	40	40	29	28	28	71	203	1,030	145	58
4	72	56	41	39	29	28	27	71	250	890	120	56
5	69	53	41	38	29	27	27	69	290	685	110	52
6	65	55	43	37	29	28	28	71	226	620	100	60
7	67	56	43	35	29	28	27	69	250	588	97	71
8	65	58	43	33	29	28	27	67	335	555	97	62
9	63	60	43	32	29	28	28	67	440	440	90	60
10	63	55	41	31	29	28	28	74	685	440	84	58
11	63	55	41	31	29	27	28	90	1,030	555	84	60
12	65	55	40	31	28	27	28	145	620	495	84	58
13	67	55	40	31	28	27	28	210	750	440	84	60
14	69	55	40	31	28	27	29	290	890	385	84	64
15	72	55	40	31	29	27	29	360	960	335	81	60
16	76	55	40	31	29	28	32	555	1,240	290	79	58
17	80	55	41	30	29	28	41	525	1,400	290	81	56
18	80	55	40	29	28	28	69	495	1,470	290	84	54
19	63	55	40	29	28	28	64	440	1,540	250	84	52
20	62	55	40	29	28	28	69	440	1,400	250	81	50
21	60	47	40	28	28	27	71	440	1,240	242	76	50
22	58	47	40	28	28	27	116	290	1,470	242	74	50
23	63	46	40	28	28	27	145	250	1,620	234	71	52
24	74	46	40	29	28	27	210	210	1,400	234	71	54
25	63	44	41	29	27	27	203	210	1,470	234	69	56
26	63	43	41	29	27	27	196	210	1,100	250	74	50
27	62	40	41	30	27	27	189	196	1,400	242	81	50
28	60	38	41	30	28	28	145	175	1,400	175	87	50
29	58	41	41	30	.....	29	100	175	1,240	203	79	50
30	56	41	41	29	.....	28	84	175	1,240	196	67	50
31	55	.....	41	29	.....	28	.....	226	.....	175	64	.....

NOTE.—Nov. 13–19 stage-discharge relation affected by ice; discharge interpolated.

Monthly discharge of North Fork of Grand River near Grand Lake, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	80	55	66.0	4,060
November	60	38	51.4	3,060
December	43	40	40.8	2,510
January	41	28	31.9	1,960
February	29	27	28.4	1,580
March	29	27	27.6	1,700
April	210	27	71.7	4,270
May	555	67	220	13,500
June	1,620	175	930	55,300
July	1,170	175	436	26,800
August	175	64	91.0	5,600
September	71	50	56.1	3,340
The year	1,620	27	171	124,000

GRAND RIVER AT HOT SULPHUR SPRINGS,[1] COLO.

LOCATION.—In sec. 2, T. 1 N., R. 78 W., at bridge connecting Denver & Salt Lake Railroad station with town of Hot Sulphur Springs, Grand County.

DRAINAGE AREA.—946 square miles (measured on Hayden's atlas).

RECORDS AVAILABLE.—July 22, 1904, to September 30, 1909; September 23, 1910, to September 30, 1917.

GAGE.—Chain on downstream side of bridge; read by U. S. Forest Service. Prior to April 16, 1906, a staff gage set to a datum 6.07 feet lower was located 1,000 feet downstream.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

[1] Formerly known as Grand River at Sulphur Springs, Colo.

CHANNEL AND CONTROL.—Channel composed of well compacted gravel; control 150 feet downstream; permanent during 1917. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.45 feet 5 p. m. on June 23, and 8 a. m. on May 11 (discharge, 6,960 second-feet); minimum discharge, approximately 98 second-feet, occurred on February 1–2, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and records of precipitation and temperature.

DIVERSIONS.—Between this section and the mouth of North Fork there are court decrees for the diversion of 96 second-feet from Grand River; also a reservoir decree for 31,300 acre-feet from the floodwaters of the Grand.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Affected by ice during winter period. Rating curve well defined between 150 and 8,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except during period affected by ice when they are fair.

Discharge measurements of Grand River at Hot Sulphur Springs, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	P. V. Hodges	2.19	278	Feb. 15	J. H. Keep	*a* 3.17	122
Dec. 14	Fear and Keep	*a* 4.25	193	July 20	H. W. Fear	4.39	1,970
Jan. 11	J. H. Keep	*a* 3.04	154				

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Grand River at Hot Sulphur Springs, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	260	246	202	162	98	112	280	550	1,580	5,770	1,160	337
2	253	280	202	162	98	112	280	550	1,360	5,230	975	317
3	263	253	202	162	105	114	298	497	1,360	4,520	850	317
4	270	253	202	162	112	120	317	472	1,700	3,910	772	280
5	249	215	202	162	114	120	357	497	2,330	3,910	700	263
6	246	246	202	162	116	125	378	378	2,070	4,060	665	280
7	249	180	180	156	120	125	400	447	2,070	3,760	635	317
8	263	180	170	153	125	128	447	400	2,200	4,060	605	317
9	266	170	153	153	125	132	472	424	3,020	3,760	524	298
10	263	162	156	153	125	132	550	447	4,210	3,760	578	280
11	260	153	170	153	125	133	524	524	5,050	3,610	524	246
12	260	138	180	138	125	135	550	665	4,690	3,610	550	263
13	253	125	190	105	125	138	561	772	4,870	3,020	550	246
14	260	138	193	120	122	138	605	1,060	5,050	2,740	550	280
15	349	147	190	132	122	138	578	1,700	5,590	2,330	550	280
16	325	162	190	138	123	138	550	2,330	6,310	2,070	497	298
17	357	170	190	138	125	138	578	3,160	6,680	1,940	524	280
18	400	180	190	138	125	141	890	3,610	6,870	1,700	497	246
19	409	190	190	138	125	141	635	3,460	6,490	1,820	497	230
20	357	190	190	138	125	144	447	2,880	6,310	2,070	497	230
21	325	190	180	138	125	146	524	2,460	6,130	1,700	497	215
22	310	190	180	138	125	146	424	2,070	6,130	1,580	447	215
23	366	195	174	138	125	150	700	1,820	6,870	1,480	400	215
24	357	195	170	138	125	153	1,160	1,580	6,490	1,580	357	210
25	337	200	170	138	123	153	975	1,700	6,490	1,360	357	202
26	298	202	162	132	120	162	890	1,700	6,310	1,580	337	215
27	298	202	138	132	116	170	975	1,480	6,490	1,480	357	218
28	295	202	120	125	114	190	772	1,360	5,770	1,260	400	215
29	280	202	141	125	.....	215	700	1,260	5,590	1,160	424	202
30	277	202	162	114	.....	317	524	1,360	5,770	1,360	357	202
31	263	.....	162	105	.....	280	.....	1,210	.....	1,360	357	.....

NOTE.—Stage-discharge relation affected by ice Nov. 8 to Apr. 13; discharge based on temperature and gage-height record, discharge measurements, and observer's notes.

Monthly discharge of Grand River at Hot Sulphur Springs, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	409	246	297	18,300
November	280	125	192	11,400
December	202	120	178	10,900
January	162	105	140	8,610
February	125	98	120	6,660
March	317	112	151	9,280
April	1,160	280	578	34,400
May	3,610	378	1,380	84,800
June	6,870	1,360	4,730	281,000
July	5,770	1,160	2,700	166,000
August	1,160	337	548	33,700
September	337	202	257	15,300
The year	6,870	98	940	680,000

GRAND RIVER NEAR KREMMLING, COLO.

LOCATION.—In sec. 23, T. 1 N., R. 81 W., at entrance to Gore Canyon, 3 miles southwest of Kremmling, Grand County. Nearest tributary, Blue River, enters 1 mile below Kremmling.

DRAINAGE AREA.—2,380 square miles.

RECORDS AVAILABLE.—July 24, 1904, to September 30, 1917.

GAGE.—Friez water-stage recorder on right bank 200 feet above wagon bridge, used since October 15, 1915. Original gage, a chain on left bank, 100 feet above present location, installed July 24, 1904, and used until October 17, 1906; datum 0.80 foot lower than present. Inclined staff directly opposite chain gage, at present gage datum, used October 18, 1906, to July 27, 1910. Friez water-stage recorder installed near staff gage and at same datum used July 28, 1910, to October 14, 1915, except during winter months when staff gage was used.

DISCHARGE MEASUREMENTS.—Made from cable just above gage. Winter measurements made from bridge at head of rapids.

CHANNEL AND CONTROL.—Channel composed of sand and silt with scattering boulders; control is head of rapids 250 feet downstream; slightly shifting as silt is deposited and later scoured out by high water. Banks are high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year determined from recording gage chart, 17.9 feet at 3 p. m. June 19 (discharge, 15,200 second-feet); minimum discharge occurred during winter when stage-discharge relation is affected by ice. For 1917 minimum discharge of 300 second-feet occurred March 27.

ICE.—Stage-discharge relation affected by ice during most of winter of 1916–17.

DIVERSION.—There are court decrees for the diversion of 35 second-feet from Grand River between this station and that at Hot Sulphur Springs.

STORAGE.—Station is located at proposed Kremmling reservoir site. A dam built 230 feet above the river bed at the mouth of Gore Canyon will impound nearly 2,200,000 acre-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation slightly shifting; affected by ice during winter. Rating curve fairly well defined between 500 and 15,000 second-feet. Staff gage read to hundredths twice daily during January, February, and March. The remainder of year the operation of water-stage recorder was satisfactory except for short periods as explained in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting the gage-height graph or from two gage readings a day. Records good.

Discharge measurements of Grand River near Kremmling, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	P. V. Hodges	2.26	633	Feb. 17	J. H. Keep	a1.52	353
Dec. 16	Fear and Keep	a3.18	385	July 17	H. W. Fear	8.50	4,100
Jan. 13	J. H. Keep	1.76	504	Aug. 14	S. B. Soulé	4.41	1,440

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Grand River near Kremmling, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	678	678	352	390	365	390	860	1,680	4,580	12,300	2,490	940
2	695	645	378	390	365	390	800	1,680	4,050	11,500	2,190	905
3	695	678	450	390	380	390	600	1,680	5,200	10,100	1,980	870
4	695	660	465	396	390	378	480	1,530	6,000	8,800	1,830	835
5	678	630	450	399	385	378	435	1,580	6,100	8,200	1,780	835
6	660	615	450	402	378	405	465	1,410	5,660	7,960	1,680	800
7	645	585	435	405	370	390	570	1,490	5,160	7,600	1,630	835
8	645	480	378	405	365	352	660	1,410	5,360	7,720	1,530	905
9	645	630	378	408	365	390	1,050	1,330	7,000	8,200	1,450	905
10	630	660	378	414	365	378	1,530	1,410	9,310	7,840	1,410	835
11	615	630	378	420	365	378	1,730	1,580	11,600	7,240	1,410	835
12	615	435	380	420	365	378	2,130	1,830	12,200	6,760	1,410	800
13	615	340	380	420	365	378	2,550	2,190	11,900	5,990	1,410	835
14	630	346	380	378	365	352	2,430	2,850	12,200	5,260	1,450	835
15	870	352	380	365	365	365	1,930	4,130	13,000	4,860	1,490	870
16	870	424	385	378	360	365	1,450	5,660	13,600	4,310	1,450	870
17	870	495	380	390	352	340	1,530	7,120	14,400	4,310	1,410	835
18	975	540	380	365	370	340	2,310	8,200	14,800	3,650	1,410	765
19	1,090	480	380	365	380	340	1,880	8,440	15,000	3,570	1,370	730
20	940	465	380	370	405	352	1,330	7,840	14,800	3,810	1,370	678
21	835	450	380	378	435	352	1,330	6,760	14,200	3,570	1,330	645
22	835	390	380	365	420	365	1,980	5,460	14,000	3,270	1,250	630
23	905	405	380	378	420	352	2,990	4,760	14,100	3,130	1,170	615
24	905	420	378	378	402	328	3,340	4,580	14,200	3,270	1,130	600
25	835	465	365	390	405	340	3,060	4,670	13,900	3,130	1,050	585
26	765	340	365	405	405	352	2,730	4,580	13,900	3,130	1,050	585
27	765	378	360	390	390	300	2,850	4,220	13,700	3,060	1,010	600
28	730	378	352	385	365	328	2,550	3,810	13,300	2,790	975	600
29	765	390	352	380	.....	405	2,190	3,810	12,700	2,610	1,090	600
30	730	390	360	378	.....	835	1,830	3,890	12,400	2,670	1,050	615
31	702	.....	365	365	.....	900	.....	4,220	.....	2,730	975	.....

NOTE.—Oct. 31, Nov. 14, 16–23 discharge interpolated. Apr. 1–4, June 3–4, discharge based on comparative hydrograph of Grand at Glenwood Springs. Water-stage recorder not working for the above days of missing gage heights. Stage-discharge relation affected by ice Dec. 9–31, Jan. 2–11, 13, 19–20, 28–29, Feb. 2–3, 5, 7, 9–19, Mar. 31. Discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Monthly discharge of Grand River near Kremmling, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,090	615	817	50,200
November	678	340	492	29,300
December	465	352	386	23,700
January	420	365	389	23,900
February	435	352	381	21,200
March	900	300	396	24,300
April	3,340	435	1,720	102,000
May	8,440	1,330	3,740	230,000
June	15,000	4,050	10,900	649,000
July	12,300	2,610	5,590	344,000
August	2,490	975	1,430	87,900
September	940	585	760	45,200
The year	15,000	300	2,260	1,630,000

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

LOCATION.—In front of electric power house at Glenwood Springs, Garfield County. No Name Creek enters Grand River about 2 miles above station, and Roaring Fork half a mile below.

DRAINAGE AREA.—4,520 square miles (measured on Nell's map of Colorado).

RECORDS AVAILABLE.—January 1, 1900, to September 30, 1917; also May 12 to July 17, 1899, at point just above Roaring Fork.

GAGE.—Friez water-stage recorder on right bank in front of power house. Since 1902 a number of water-stages recorders referred to datum of staff gage installed in 1900, have been used. Chain gage at railroad bridge, just above mouth of Roaring Fork, used previous to 1900.

DISCHARGE MEASUREMENTS.—Made from cable beneath the State Street Bridge, one-third mile below the gage.

CHANNEL AND CONTROL.—Channel composed of well-compacted gravel on which silt is deposited; control is riffle 300 feet downstream and will shift slightly. Banks are not overflowed except at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 12.4 feet at noon June 19 (discharge, 29,400 second-feet); minimum stage 2.40 feet at 7 a. m. November 9 (discharge, 244 second-feet).

ICE.—Stage-discharge relation not affected by ice. Hot water from springs keeps river open.

DIVERSIONS.—Between this station and the one near Kremmling there are court decrees for a diversion of 13 second-feet of water from Grand River for irrigation, 1,250 second-feet absolute for power, and 14,400 second-feet conditional for power. The water diverted under the absolute decree is returned to the river above Glenwood Springs. The conditional diversion has not been made.

REGULATION.—The Shoshone power plant of the Colorado Power Co. 6 miles upstream controls the flow during the day at low water, but has insufficient pondage to control it for more than a few hours.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve used October 1 to November 30 fairly well defined between 500 and 1,900 second-feet and curve used December 1 to September 30 well defined between 500 and 30,000 second-feet. The operation of water-stage recorder was satisfactory throughout the year except for few days when out of order. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging the bihourly discharge. Records excellent.

Discharge measurements of Grand River at Glenwood Springs, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 17	P. V. Hodges	4.40	1,800
Feb. 14	T. J. Watkins	3.29	655
June 18	H. W. Fear	12.16	28,300

Daily discharge, in second-feet, of Grand River at Glenwood Springs, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,360	1,340	779	648	692	669	1,240	3,110	8,720	20,800	4,490	1,740
2	1,430	1,340	880	683	609	655	1,380	2,930	8,060	19,500	3,920	1,740
3	1,450	1,340	880	739	753	690	1,130	2,930	7,740	17,400	3,500	1,740
4	1,460	1,340	970	824	753	560	1,110	2,840	9,060	15,700	3,300	1,620
5	1,430	1,280	1,040	669	768	648	1,090	2,840	10,800	13,900	3,110	1,500
6	1,400	1,270	1,070	634	760	690	1,080	2,840	10,800	13,500	2,930	1,500
7	1,410	1,260	1,050	524	746	655	1,010	2,600	10,100	12,700	2,840	1,380
8	1,490	1,240	707	524	690	662	1,330	2,600	10,100	12,700	2,680	1,560
9	1,500	910	619	524	718	697	1,680	2,600	12,700	13,100	2,450	1,740
10	1,490	1,220	560	524	746	739	2,180	2,450	17,000	12,700	2,450	1,620
11	1,500	1,340	709	524	648	648	2,680	2,680	20,400	12,300	2,450	1,560
12	1,500	1,230	670	520	711	690	2,930	2,930	21,700	11,200	2,450	1,620
13	1,470	950	790	600	739	704	3,710	3,500	21,700	10,100	2,450	1,620
14	1,450	626	863	683	732	683	3,710	4,490	21,700	9,060	2,520	1,680
15	1,630	633	670	732	683	718	3,710	6,800	23,400	8,390	2,600	1,740
16	1,880	659	819	718	683	676	2,930	9,400	25,100	7,740	2,600	1,800
17	1,750	894	702	732	760	739	2,450	12,300	26,800	7,110	2,380	1,620
18	1,820	1,060	731	704	739	627	2,760	14,400	28,100	6,200	2,380	1,500
19	1,880	1,100	848	746	753	648	3,300	15,200	28,600	6,200	2,310	1,500
20	1,940	1,140	864	800	718	718	2,680	14,800	28,100	6,200	2,310	1,440
21	1,820	1,090	856	807	753	725	2,180	12,700	26,800	6,200	2,310	1,380
22	1,690	958	832	768	718	912	2,450	10,800	26,000	5,910	2,240	1,330
23	1,630	878	912	684	739	704	4,030	9,400	26,400	5,500	2,120	1,320
24	1,630	918	771	691	784	725	5,360	8,720	26,000	5,360	1,920	1,330
25	1,690	886	759	784	784	711	5,630	8,720	25,600	5,500	1,920	1,300
26	1,630	906	721	824	880	718	5,230	8,720	25,100	5,360	1,920	1,240
27	1,510	928	690	812	808	683	5,100	8,390	24,300	5,100	1,860	1,330
28	1,510	950	670	778	753	792	4,980	7,740	23,000	4,980	1,920	1,330
29	1,450	910	650	762	.....	1,380	4,260	7,740	21,700	4,490	1,980	1,440
30	1,450	840	632	795	.....	1,860	3,600	7,740	21,700	4,610	1,980	1,280
31	1,450	.....	614	768	.....	1,560	.....	8,060	.....	4,730	1,920	.....

NOTE.—No gage-height record Nov. 26–27, Dec. 28–30, and Jan. 11–13, discharge from comparison with Grand at Kremmling. Dec. 1, 4–9, 11–18, 24–26, Jan. 21, 23–24, 26–31, and Feb. 1–2, discharge determined by averaging bihourly discharge.

Monthly discharge of Grand River at Glenwood Springs, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,940	1,360	1,570	96,500
November	1,340	626	1,050	62,500
December	1,070	560	785	48,300
January	824	520	694	42,700
February	880	609	736	40,900
March	1,860	560	783	48,100
April	5,630	1,010	2,900	173,000
May	15,200	2,450	6,870	422,000
June	28,600	7,740	19,900	1,180,000
July	20,800	4,490	9,490	584,000
August	4,490	1,860	2,520	155,000
September	1,800	1,240	1,520	90,400
The year	28,600	520	4,070	2,940,000

GRAND RIVER NEAR PALISADE, COLO.

LOCATION.—In sec. 2, T. 11 S., R. 98 W., at State Bridge, 2 miles above Palisade, Mesa County. Nearest important tributary, Plateau Creek, enters 6 miles above.

DRAINAGE AREA.—8,550 square miles (measured on Hayden's atlas).

RECORDS AVAILABLE.—April 9, 1902, to September 30, 1917.

GAGE.—Chain on downstream side of bridge near midspan; read by Mrs. Inez Nelson.

DISCHARGE MEASUREMENTS.—Made from new bridge 2 miles below gage.

CHANNEL AND CONTROL.—No data as only computed records are furnished.

EXTREMES OF DISCHARGE.—No data.

ICE.—Stage-discharge relation affected by ice. Data insufficient to warrant daily discharge determinations.

DIVERSIONS.—Between Palisade and the Glenwood Springs station there are court decrees for the diversion of 1,828 second-feet from Grand River, of which 628 second-feet are for irrigation and 1,200 second-feet for pumping. The proposed high-line canal of the United States Reclamation Service will divert 700 second-feet 5 miles above Palisade station.

REGULATION. None.

COOPERATION.—Complete records furnished by Reclamation Service.

Discharge measurements of Grand River near Palisade, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	J. C. Page	13.5	2,940	July 25	Blackmer and Owens	16.5	9,880
12	do	14.2	3,970	Aug. 23	R. A. Blackmer	13.8	3,150
21	Page and Blackmer	14.1	3,710	Sept. 26	do	13.1	2,230
June 22	do	23.4	39,300				
July 12	Robertson and Blackmer	19.2	20,900				

Daily discharge, in second-feet, of Grand River near Palisade, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	*May.	June.	July.	Aug.	Sept.
1	2,460	2,860	1,820	1,880	1,760	2,540	7,020	16,800	36,400	8,480	2,620
2	2,540	2,860	2,000	1,820	1,530	2,180	6,470	16,000	33,100	7,590	2,390
3	2,940	2,780	1,760	1,940	1,580	2,320	6,470	15,800	32,200	6,600	2,250
4	4,180	2,700	2,000	1,940	1,420	1,940	6,470	18,000	38,700	6,080	2,390
5	2,940	2,700	2,060	1,940	1,480	1,880	6,210	20,800	26,000	5,480	2,180
6	2,620	2,700	2,250	1,480	1,580	1,940	5,840	21,600	24,800	5,250	2,120
7	5,840	2,620	2,250	1,700	1,530	2,000	5,600	21,000	23,800	5,030	2,120
8	4,390	2,540	1,940	1,760	1,580	2,060	5,480	21,000	22,100	4,700	2,120
9	3,780	2,460	1,270	1,700	1,580	2,460	5,480	24,500	22,800	4,280	2,250
10	3,880	2,120	1,270	1,820	1,640	3,210	5,480	31,300	22,800	3,980	2,390
11	8,790	2,390	1,370	1,700	1,640	3,680	5,840	36,100	21,900	4,180	3,030
12	4,080	2,460	1,580	1,820	1,530	4,390	6,740	37,900	20,500	4,180	3,210
13	3,680	2,320	1,530	1,880	1,530	5,140	7,440	38,200	18,800	4,180	3,030
14	3,580	1,880	1,700	1,700	1,530	5,960	9,580	38,800	17,200	4,180	3,030
15	4,390	1,530	1,760	1,880	1,580	5,140	13,800	40,800	16,000	4,180	3,030
16	3,980	1,640	1,420	1,640	1,530	5,140	19,000	44,200	14,500	4,080	3,120
17	3,980	1,880	1,700	1,760	1,480	4,390	23,300	46,400	13,400	3,980	3,030
18	4,080	2,180	1,940	1,940	1,530	4,390	26,300	48,100	12,200	3,780	2,860
19	4,080	2,250	1,880	1,940	1,480	5,140	27,900	50,000	11,700	3,780	2,780
20	4,180	2,180	2,000	1,940	1,640	4,600	26,800	50,000	11,500	3,580	2,620
21	3,980	2,250	2,000	2,000	1,640	3,780	24,800	46,600	11,400	3,580	2,540
22	3,780	2,180	2,000	1,820	1,940	3,780	21,000	45,000	10,900	3,390	2,390
23	3,580	2,000	2,000	1,820	1,760	5,140	18,800	45,400	10,100	2,620	2,390
24	3,580	2,000	2,000	1,700	1,480	7,880	18,200	45,000	9,900	2,940	2,320
25	3,580	2,000	1,940	1,700	1,530	9,100	18,400	44,700	10,600	2,700	2,250
26	3,580	2,000	1,760	.....	1,580	9,580	17,800	44,700	10,200	2,620	2,250
27	3,210	1,880	1,470	.....	1,480	11,500	16,600	43,600	10,600	2,620	2,250
28	3,210	2,060	1,270	.....	1,580	10,500	15,800	42,200	9,580	2,860	2,320
29	3,210	2,000	1,420	.....	2,320	9,900	15,600	38,900	8,640	2,860	2,460
30	3,030	1,940	1,370	.....	3,880	7,740	16,000	38,900	9,100	2,940	2,460
31	2,940	.....	1,470	.....	4,500	.....	17,200	.....	9,100	2,780	.....

NOTE.—Ice present about Jan. 26 to Feb. 28. Figures have been changed slightly to comply with rule of computation followed by U. S. Geological Survey.

Monthly discharge of Grand River near Palisade, Colo. for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	8,790	2,460	3,810	234,000
November	2,860	1,530	2,250	134,000
December	2,250	1,270	1,750	108,000
Jan. 1–25	2,000	1,480	1,810	89,800
March	4,500	1,420	1,770	109,000
April	11,500	1,880	4,980	296,000
May	27,900	5,480	13,800	848,000
June	50,000	15,800	35,700	2,120,000
July	36,400	8,640	17,800	1,090,000
August	8,480	2,620	4,180	257,000
September	3,210	2,120	2,540	151,000

GRAND RIVER NEAR FRUITA, COLO.

LOCATION.—In sec. 20, T. 1 N., R. 2 W. New Mexico principal meridian, at highway bridge 1½ miles south of Fruita, Mesa County. Nearest important tributary, Little Salt Wash, enters 1 mile below station; Gunnison River enters at Grand Junction, 12 miles above.

DRAINAGE AREA.—16,800 square miles (measured on Hayden's atlas).

RECORDS AVAILABLE.—Flood records during 1908, 1909, and 1910; continuous records April 1, 1911, to September 30, 1917.

GAGE.—Chain on downstream side of left span; read by L. C. Jones. Prior to May 3, 1911, gage was vertical staff attached to center pier, datum 0.05 foot lower.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Channel composed of silt and gravel which will shift during high water; control is riffle 600 feet downstream; somewhat shifting. Banks are high and are not overflowed, except at stages above 14 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.95 feet at 8 a. m. June 20, and 8 a. m. June 15 (discharge, 63,400 second-feet); minimum stage occurs during the winter when stage-discharge relation is affected by ice.

ICE.—Stage-discharge relation seriously affected by ice; daily discharge not determined during winter.

DIVERSIONS.—Between the Palisade station and Fruita there are court decrees for diversions of 788 second-feet from Grand River.

REGULATION.—None.

COOPERATION.—Daily gage heights furnished by U. S. Weather Bureau.

ACCURACY.—Stage-discharge relation shifted during 1917.—Rating curve fairly well defined below 20,000 second-feet; above it is somewhat uncertain owing to scour and fill during high water and may be 10 to 15 per cent in error, giving results too small. Gage read to tenths twice daily. Daily discharge ascertained by applying mean of two readings to rating table. Records good below 20,000 second-feet and fair above.

Discharge measurements of Grand River near Fruita, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 20	P. V. Hodges	5.00	6,630
June 14	H. W. Fear	13.41	46,900

Daily discharge, in second-feet, of Grand River near Fruita, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,610	4,850	3,290	.....	5,250	11,000	23,900	43,300	12,800	3,200
2	4,110	4,660	3,140	.....	3,940	10,700	22,800	41,100	11,000	3,040
3	4,290	4,660	3,290	.....	3,770	12,100	22,200	38,800	9,400	3,040
4	5,660	4,660	3,450	.....	3,450	11,700	24,500	35,900	7,940	3,040
5	4,470	4,470	3,290	.....	3,290	11,400	28,900	34,500	8,080	3,200
6	4,290	4,290	3,450	.....	3,290	10,700	32,400	31,000	7,540	3,200
7	8,000	4,470	3,290	.....	3,450	10,300	31,000	29,600	7,400	3,040
8	8,270	4,290	3,450	.....	3,450	10,000	31,000	28,200	6,880	2,730
9	7,220	3,940	3,610	.....	3,770	10,000	35,200	27,600	5,780	2,730
10	7,470	3,940	.....	.....	5,450	9,710	45,500	27,600	4,940	2,880
11	14,000	4,110	.....	.....	6,080	10,000	52,200	26,300	5,640	3,540
12	9,120	4,290	.....	.....	6,300	11,000	52,200	25,000	5,880	3,910
13	7,220	3,770	.....	2,560	7,470	13,200	52,200	23,900	6,630	3,910
14	6,890	3,610	.....	2,560	8,330	15,600	51,400	21,200	6,880	4,300
15	7,730	3,290	.....	2,700	9,120	22,200	54,400	20,600	7,140	4,100
16	6,980	3,450	.....	2,560	8,550	31,700	57,300	17,800	6,130	3,910
17	6,750	3,610	.....	2,560	6,520	38,100	59,600	16,000	5,640	3,910
18	6,980	3,610	.....	2,430	6,750	41,800	61,000	15,200	5,170	3,910
19	6,750	3,770	.....	2,700	6,980	43,300	61,800	14,800	5,640	3,540
20	6,750	3,940	.....	2,430	6,980	41,100	62,500	14,400	4,940	3,370
21	6,750	3,940	.....	2,700	6,300	38,100	58,100	14,400	4,720	3,200
22	6,300	3,610	.....	2,990	6,080	33,100	57,300	13,600	4,100	3,200
23	5,870	3,610	.....	2,990	8,550	29,600	56,600	12,900	3,720	3,040
24	5,870	3,450	.....	2,700	12,100	28,900	55,900	12,100	3,720	2,880
25	5,870	3,450	.....	2,560	12,100	28,200	55,100	13,600	3,370	3,040
26	5,870	3,290	.....	2,840	15,200	26,900	53,600	14,400	3,370	3,040
27	5,660	3,290	.....	2,990	15,600	25,000	52,200	14,400	3,200	3,200
28	5,660	3,290	.....	2,700	16,500	23,300	51,400	13,600	3,370	3,370
29	5,450	3,610	.....	3,610	14,800	22,800	47,700	12,900	3,540	3,370
30	5,250	3,290	.....	5,050	12,900	23,900	44,800	12,100	3,540	3,040
31	5,050	.....	.....	4,660	.....	24,500	.....	13,200	3,370	.....

NOTE.—Stage-discharge relation affected by ice Dec. 10 to Mar. 12. Rating table applied indirectly Aug. 1 to Sept. 30.

Monthly discharge of Grand River near Fruita, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	14,000	3,610	6,460	397,000
November	4,850	3,290	3,880	231,000
December	.....	.....	3,150	194,000
January	.....	.....	2,700	166,000
February	.....	.....	2,600	144,000
March	.....	.....	2,820	173,000
April	16,500	3,290	7,760	462,000
May	43,300	9,710	21,900	1,350,000
June	62,500	22,200	46,500	2,770,000
July	43,300	12,100	21,900	1,350,000
August	12,800	3,200	5,850	360,000
September	4,300	2,730	3,330	198,000
The year	62,500	.....	10,800	7,800,000

NOTE.—Discharge Dec. 10 to Mar. 12 estimated from study of hydrographs of Grand at Glenwood Springs. Discharge Dec. 10-31, 3,060 second-feet; Jan. 1-31, 2,700 second-feet; Feb. 1 to Mar. 12, 2,600 second-feet.

GRAND RIVER NEAR CISCO, UTAH.

LOCATION.—About sec. 7, T. 23 S., R. 24 E., at Dewey ferry, three-quarters of a mile below mouth of Dolores River, 90 miles above junction of Green and Grand rivers, and 14 miles southeast of Cisco, Grand County.

DRAINAGE AREA.—23,800 square miles.

RECORDS AVAILABLE.—At present site November 10, 1914, to September 30, 1917, when station was discontinued; 25 miles downstream at Moab, October 1, 1913, to November 10, 1914; flow about same at both places.

GAGE.—Stevens continuous water-stage recorder on left bank 500 feet above ferry cable, and about one-fourth mile above suspension highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Channel straight for several hundred feet above and below station. Left bank high and not subject to overflow; right bank fairly high and will probably not be overflowed. Bed at the gage composed of sand and gravel. Control probably about a quarter of a mile below the gage; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 19.7 feet at 9 p. m. June 19 (discharge, 76,800 second-feet); minimum discharge occurred during ice-affected period, flow not determined.

1915–1917: Maximum stage occurred in 1917; minimum stage recorded, 1.55 feet, September 10, 1915 (discharge, 1,460 second-feet).

ICE.—Stage-discharge relation affected by ice; flow estimated from observer's notes and discharge measurements.

DIVERSIONS.—Below practically all diversions. A large amount of water is diverted in Colorado for irrigation.

REGULATION.—Station is too far below to be affected, except in a general way, by regulation in Colorado.

ACCURACY.—Stage-discharge relation permanent; affected by ice January 8 to March 10. Rating curve well defined between 2,000 and 70,000 second-feet. Operation of water-stage recorder satisfactory except from December 8 to March 5 and a few 3 to 6 day intervals when staff gage was read to half-tenths occasionally. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection except for period when stage-discharge relation was affected by ice and for breaks in gage-heights record as shown in footnote to daily-discharge table. Records good.

Discharge measurements of Grand River near Cisco, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 8	J. J. Sanford	2.83	3,028	June 24	A. P. Purton	18.15	66,900
Mar. 5[a]	do	4.36	3,162	July 27	R. P. Flagel	6.84	14,400

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Grand River near Cisco, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,980	.....	2,840	.....	6,080	12,300	.....	53,700	13,100	3,870
2	4,310	.....	2,840	.....	5,830	12,800	.....	51,200	12,100	3,660
3	3,870	.....	2,840	.....	5,220	.....	.....	46,400	.....	3,660
4	5,580	.....	2,840	.....	4,980	.....	24,200	41,600	.....	3,550
5	5,340	.....	2,940	3,200	4,640	.....	30,900	37,900	.....	3,340
6	5,580	4,090	2,970	.....	3,980	.....	36,900	35,000	8,270	3,240
7	11,800	.....	3,000	.....	3,660	12,500	34,600	33,200	8,270	3,440
8	12,100	.....	3,040	.....	3,550	11,100	41,600	31,800	7,980	3,440
9	8,270	.....	2,200	.....	3,660	11,100	53,700	30,400	7,410	3,040
10	10,800	.....	2,290	.....	4,640	10,800	57,600	30,900	6,600	3,240
11	14,200	.....	2,290	2,940	5,340	10,800	61,400	29,500	6,340	4,760
12	10,800	.....	2,030	2,940	6,080	12,100	65,200	28,600	6,340	5,340
13	.....	.....	2,840	2,940	7,410	14,200	.....	26,400	6,600	4,640
14	.....	.....	3,040	2,840	9,180	17,300	.....	24,600	7,690	4,530
15	.....	.....	2,940	.....	10,800	22,000	.....	21,600	8,270	4,640
16	6,600	.....	2,840	.....	9,820	23,200	.....	20,300	7,690	4,640
17	6,600	.....	2,750	.....	8,570	46,400	.....	18,600	6,860	4,530
18	6,340	.....	2,840	.....	7,690	53,200	71,200	16,500	6,340	4,420
19	6,340	.....	2,940	2,940	7,690	54,700	73,200	15,300	6,340	4,200
20	6,340	.....	2,840	2,940	7,690	53,200	.....	15,300	6,340	4,090
21	6,080	2,940	2,750	3,040	6,600	48,300	.....	14,900	5,830	3,870
22	5,830	2,940	3,040	3,040	6,600	39,300	.....	14,900	5,340	3,760
23	5,460	2,840	2,940	3,140	8,570	32,300	.....	13,800	4,980	3,660
24	5,340	3,040	.....	3,140	12,800	31,400	66,200	13,100	4,760	3,760
25	5,340	3,040	.....	3,040	16,500	30,400	.....	13,500	4,420	3,550
26	5,460	3,040	.....	3,040	19,000	28,300	.....	14,900	4,090	3,550
27	5,100	2,840	.....	3,240	19,800	26,300	.....	14,600	4,200	3,550
28	.....	2,840	.....	3,140	19,000	24,200	60,700	14,600	3,760	3,550
29	.....	2,840	.....	3,340	17,700	.....	57,200	13,100	3,870	3,550
30	.....	2,840	.....	4,090	14,200	.....	55,200	12,800	3,980	3,550
31	.....	.....	.....	5,580	.....	.....	.....	13,800	3,980	.....

NOTE.—Discharge interpolated because of missing gage-height record Oct. 13–15, 8,700 second-feet; Oct. 28–31, 5,000 second-feet; Nov. 1–5, 4,300 second-feet; Nov. 7–20, 3,500 second-feet; Mar. 6–10, 3,070 second-feet; Mar. 15–18, 2,890 second-feet; May 3–6, 12,600 second-feet; June 13–17, 68,200 second-feet; June 20–23, 69,700 second-feet; June 25–27, 63,400 second-feet; and Aug. 3–5, 10,400 second-feet; mean discharge estimated because of ice or missing gage-height record, Dec. 24–31, 2,500 second-feet; Jan. 1–31, 2,000 second-feet; Feb. 1–28, 2,500 second-feet; Mar. 1–4, 3,000 second-feet; and May 29 to June 3, 22,000 second-feet.

Monthly discharge of Grand River near Cisco, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	14,200	3,870	6,890	424,000
November	.....	.....	3,460	206,000
December	.....	.....	2,710	167,000
January	.....	.....	2,000	123,000
February	.....	.....	2,500	139,000
March	5,580	.....	3,140	193,000
April	19,800	3,550	8,910	530,000
May	54,700	10,800	24,700	1,520,000
June	73,200	.....	55,500	3,300,000
July	53,700	12,800	24,600	1,510,000
August	13,100	3,760	6,870	422,000
September	5,340	3,040	3,890	231,000
The year	73,200	.....	12,100	8,760,000

FRASER RIVER NEAR ARROW, COLO.

LOCATION.—In sec. 4, T. 2 S., R. 75 W., one-fourth mile from Vasquez siding on Denver & Salt Lake Railroad, in Arapahoe National Forest, and 1½ miles southwest of Arrow, Grand County. Nearest tributary enters half a mile above.

DRAINAGE AREA.—37 square miles at present location of station (measured on special map); 28 square miles at site, 1 mile upstream.

RECORDS AVAILABLE.—September 23, 1910, to September 30, 1917.

GAGE.—Friez water-stage recorder on left bank about 1 mile below bridge on road to Arrow. Prior to June 3, 1916, and from December 12, 1916, to May 26, 1917, vertical staff attached to downstream side of bridge was used.

DISCHARGE MEASUREMENTS.—Made from footlog bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of boulders and coarse gravel. Slightly shifting during high water. No well-defined control. Banks are not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 2.15 feet at 7.30 p. m. June 23 (discharge, 346 second-feet); minimum discharge of 4 second-feet occured February 2.

ICE.—Stage-discharge relation not seriously affected by ice except for short periods early in winter. Ice forms complete cover and water flows freely beneath it.

DIVERSIONS.—There is court decree for diversion of 53 second-feet across divide from headwaters of Fraser River into headwaters of Clear Creek. During 1917 approximately 570 acre-feet were diverted under this decree, all between July 7 and August 25. Below station there are court decrees for 74 second-feet for irrigation and 61 second-feet for placer and power.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation practically permanent; slightly affected by ice during winter period. Rating curve used December 12 to May 26 well defined between 5 and 75 second-feet, and curve used the remainder of year is well defined between 15 and 200 second-feet, and poorly defined above 200 second-feet. Staff gage read to hundredths once daily December 12 to May 26. The operation of water-stage recorder was satisfactory during the remainder of the year except for short periods when not running. Daily discharge ascertained by applying to rating tables one gage reading a day, or mean daily gage heights determined by inspecting gage-height graph. Records excellent for medium and low stage during open-water period and good for remainder of time.

Discharge measurements of Fraser River near Arrow, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 12	Fear and Keep	[a] 0.50	12.2	May 27	Follansbee and Keep	0.64	39.6
Jan. 1	J. H. Keep	[a] [b] .73	9.1	June 28	Robert Follansbee	1.93	307
Feb. 13	do	[b] .69	7.8	29	do	1.71	235
May 27	Follansbee and Keep	[b] .99	33.9	July 20	H. W. Fear	.98	95

[a] Stage-discharge relation affected by ice.
[b] Made from original gage 1 mile upstream.

Daily discharge, in second-feet, of Fraser River near Arrow, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20	20	.....	7	5	6	6	18	42	254	73	29
2	20	21	.....	7	4	6	6	14	46	232	66	28
3	20	19	.....	9	5	5	5	16	52	210	62	27
4	20	18	.....	7	6	6	5	19	62	206	62	25
5	19	20	.....	9	6	6	6	13	67	201	54	24
6	19	17	.....	8	5	6	6	12	59	195	51	26
7	20	.....	.....	7	8	5	6	11	66	197	46	28
8	19	.....	.....	9	8	6	7	11	87	193	46	24
9	18	.....	.....	9	9	6	8	11	121	178	45	20
10	18	.....	.....	9	8	6	6	15	170	180	44	18
11	17	.....	.....	9	7	6	6	18	182	168	42	20
12	18	.....	13	7	6	7	5	22	188	155	45	18
13	17	.....	10	7	6	5	6	23	230	145	42	17
14	17	.....	13	7	6	6	8	24	234	137	43	21
15	17	.....	7	7	5	6	8	29	261	122	42	17
16	20	.....	6	6	5	6	7	80	270	106	45	17
17	20	.....	7	6	6	6	8	88	286	100	46	16
18	20	.....	9	7	6	6	11	84	306	94	47	16
19	17	.....	9	7	5	6	6	88	302	104	48	16
20	17	.....	9	9	5	7	5	15	283	100	49	16
21	18	.....	9	7	6	7	7	16	293	91	50	15
22	18	.....	9	7	6	6	11	18	316	85	51	15
23	19	.....	7	7	6	5	18	22	320	94	52	15
24	17	.....	9	6	7	5	16	26	311	89	46	15
25	17	.....	9	7	6	5	14	30	311	109	42	15
26	16	.....	7	9	6	5	20	34	311	117	43	16
27	19	.....	10	7	6	6	21	41	297	102	37	16
28	21	.....	7	7	6	6	17	42	286	98	34	16
29	22	.....	7	7	.....	6	16	42	283	92	32	16
30	20	.....	7	6	.....	6	16	43	276	85	30	15
31	20	.....	9	6	.....	5	.....	43	.....	80	29	.....

NOTE.—Stage-discharge relation affected by ice Oct. 20–22; discharge interpolated. No gage-height record Jan. 6, Feb. 4, 11, 25, Mar. 4, 9–10, 18, 25, Apr. 1, 8, 13, 15, 29, May 6, 11, 13, 21, 23–25, July 1–2, 15, 29, Aug. 10, 17–22, Sept. 16–21; discharge interpolated.

Monthly discharge of Fraser River near Arrow, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	22	16	18.7	1,150
November 1–6	21	17	19.2	228
December 12–31	13	6	8.6	341
January	9	6	7.4	455
February	9	4	6.1	339
March	7	5	5.8	357
April	21	5	9.6	571
May	43	11	31.2	1,920
June	320	42	211	12,600
July	254	80	139	8,550
August	73	29	46.6	2,870
September	29	15	19.2	1,140

WILLIAMS FORK NEAR SCHOLL, COLO.

LOCATION.—In sec. 3, T. 2 S., R. 78 W., at Horsehoe ranger station in Arapahoe National Forest, 5 miles southeast of Scholl, Grand County. Nearest important tributary, Keyser Creek, enters from east three-quarters of a mile above station.

DRAINAGE AREA.—141 square miles (measured on forest atlas).

RECORDS AVAILABLE.—September 22, 1910, to June 30, 1912; April 27, 1913, to May 31, 1917.

GAGE.—Vertical staff in pool near right bank 100 feet below bridge; read by forest ranger.

DISCHARGE MEASUREMENTS.—Made from cable 400 feet above gage or by wading.

CHANNEL AND CONTROL.—Channel rough and composed of boulders; control 25 feet below gage; will shift slightly; banks will not be overflowed except during extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 2.8 feet at 5 p. m. May 21 (discharge, 618 second-feet); minimum stage, 1.00 foot March 31 and April 1 (discharge, 30 second-feet).

ICE.—Stage-discharge relation somewhat affected by ice; data insufficient to determine daily discharge.

DIVERSIONS.—There are court decrees for the diversion of 858 second-feet from Williams Fork above the station. Of this amount 700 second-feet are to be diverted to the eastern slope, but this diversion has not been made.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined between 20 and 600 second-feet. Gage read to hundredths daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair.

Discharge measurements of Williams Fork near Scholl, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 4	P. V. Hodges	1.41	68
Jan. 15	J. H. Keep	1.32	56

Daily discharge, in second-feet, of Williams Fork, near Scholl, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	72	82	59	47	45	39	30	85
2	74	80	60	49	45	39	31	75
3	72	77	59	50	45	39	31	70
4	71	75	59	52	45	38	31	70
5	82	77	59	53	44	38	31	70
6	82	72	60	54	44	38	31	80
7	82	69	59	57	43	38	32	70
8	82	69	60	59	43	38	34	70
9	82	69	61	57	43	37	34	79
10	80	69	61	57	43	37	34	190
11	79	68	60	59	43	37	35	228
12	79	68	59	59	43	36	35	228
13	79	65	59	59	42	36	36	228
14	79	64	60	56	42	36	38	286
15	90	62	57	57	42	35	38	309
16	88	61	57	55	42	35	39	384
17	92	61	57	55	41	35	39	384
18	100	59	57	56	41	35	40	469
19	94	59	56	54	41	34	43	469
20	89	59	57	55	41	34	44	498
21	80	58	57	54	41	32	44	558
22	74	58	56	53	40	32	44	412
23	74	57	55	52	40	32	221	384
24	75	56	55	50	40	32	221	384
25	79	59	54	50	40	32	224	358
26	83	57	50	47	40	31	224	358
27	83	57	48	47	39	31	210	.....
28	85	57	45	47	39	31	177	.....
29	85	56	44	47	.....	31	157	.....
30	83	56	44	45	.....	30	105	.....
31	83	.....	45	45	.....	30	.....	.....

NOTE.—No gage-height record Oct. 6-8, 15-21, Nov. 15, 19, 21-23, Dec. 4, 8, 22-31, Jan. 1-6, Feb. 15-24, Mar. 4-5, 25-27, 30, and Apr. 30 to May 8; discharge based on comparative hydrograph of Williams Fork near Parshall.

Monthly discharge of Williams Fork near Scholl, Colo., for the year ending Sept. 30, 1917:

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	100	71	81.7	5,020
November	82	56	64.5	3,840
December	61	44	55.8	3,430
January	59	45	52.8	3,250
February	45	39	42.0	2,330
March	39	30	34.8	2,140
April	224	30	77.8	4,630
May 1-26	558	70	261	13,500
The period	558	30	80.7	38,100

WILLIAMS FORK NEAR PARSHALL, COLO.[1]

LOCATION.—About sec. 36, T. 1 N., R. 79 W., at highway bridge at Field's ranch, 4 miles above mouth of river and 4 miles south of Parshall, Grand County. Nearest tributary, Battle Creek, enters from west 2 miles below.

DRAINAGE AREA.—185 square miles (measured on forest atlas).

RECORDS AVAILABLE.—July 25, 1904, to September 30, 1917.

GAGE.—Vertical staff on downstream side of bridge pier; read by F. A. Field.

DISCHARGE MEASUREMENTS.—Made from bridge, or by wading.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and small boulders; will shift; control is gravel bar 50 feet downstream; will shift during high water. Water will flow through small overflow channel beginning at stage of 4.1 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 5.2 feet at 7.30 a. m. June 18 (discharge, 1,690 second-feet); minimum discharge, 32 second-feet February 2.

ICE.—The main channel is kept open by springs, but ice forms along the banks, and slush ice frequently forms. The morning readings are usually affected by backwater from ice, but the afternoon readings usually are unaffected.

DIVERSIONS.—There are court decrees for the diversion of 558 second-feet from Williams Fork between the station near Scholl and that near Parshall. There are also two storage decrees for 80,700 acre-feet and 1,420 acre-feet, respectively, from Williams Fork. These reservoirs have not yet been constructed.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to June 16, and curve used June 17 to September 30 well defined between 50 and 800 second-feet and poorly defined above 800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for periods during which stage-discharge relation was affected by shifting control or by ice. Records good except for flood periods, for which they are fair.

Discharge measurements of Williams Fork near Parshall, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	P. V. Hodges	3.02	82	Feb. 16	J. H. Keep	2.75	45.4
Dec. 15	Fear and Keep	a3.11	61	July 18	H. W. Fear	3.84	437
Jan. 17	J. H. Keep	a3.60	59	Aug. 15	S. B. Soule	3.22	185

a Stage-discharge relation affected by ice.

[1] Formerly called Williams Fork near Sulphur Springs, Colo.

Daily discharge, in second-feet, of Williams Fork near Parshall, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	89	78	52	56	34	40	66	89	266	1,200	238	94
2	93	78	52	57	32	40	64	88	285	1,000	206	85
3	91	82	54	58	34	40	57	88	270	1,000	192	85
4	91	77	44	59	36	42	61	89	331	950	178	80
5	88	76	38	59	40	44	64	86	475	950	178	85
6	88	76	37	59	38	42	61	103	440	905	178	81
7	86	73	38	59	34	44	64	86	375	950	178	85
8	94	71	38	58	34	44	68	83	427	950	166	85
9	88	84	40	57	38	43	71	77	750	860	146	85
10	84	76	44	56	40	43	61	71	940	815	142	80
11	84	61	46	52	45	45	56	98	1,010	770	139	74
12	82	52	50	50	45	45	66	98	1,020	770	153	83
13	82	46	54	50	45	45	80	142	1,140	730	178	83
14	80	47	59	52	45	45	61	248	1,210	690	178	81
15	100	55	61	54	45	45	66	388	1,340	650	178	80
16	98	50	61	57	45	45	52	475	1,410	575	151	81
17	102	50	61	59	45	45	74	630	1,470	508	151	86
18	114	53	61	54	45	45	91	630	1,690	475	148	85
19	107	57	61	50	45	45	73	630	1,470	415	153	76
20	102	59	61	50	45	45	83	510	1,420	388	153	74
21	100	61	61	50	44	45	89	382	1,420	388	144	80
22	98	61	61	50	44	45	175	326	1,360	360	119	78
23	102	65	61	56	44	45	195	320	1,420	360	112	71
24	103	58	61	56	42	45	225	320	1,420	315	110	68
25	89	56	61	53	44	44	234	353	1,360	315	104	71
26	88	50	57	50	43	44	234	331	1,360	295	106	74
27	82	48	52	45	40	46	225	252	1,470	275	126	78
28	88	50	50	40	40	52	169	218	1,300	275	135	71
29	80	50	52	40	.....	44	118	195	1,200	275	121	77
30	82	48	54	36	.....	56	114	188	1,250	275	117	48
31	82	.....	54	36	.....	60	.....	342	.....	256	104	.....

NOTE.—Discharge Oct. 1 to Nov. 15, June 11–16, computed by indirect method for shifting control. Stage-discharge relation affected by ice Nov. 11–13, 16–20, 25–26, 28–Dec. 7–Jan. 25, 27, 31–Feb. 4, 6–22 25–Mar. 4, 6–24; discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Monthly discharge of Williams Fork near Parshall, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	114	80	91.5	5,630
November	84	46	61.6	3,670
December	61	37	52.8	3,250
January	59	36	52.2	3,210
February	45	32	41.1	2,280
March	60	40	45.1	2,770
April	234	52	104	6,190
May	630	71	256	15,700
June	1,690	266	1,040	61,900
July	1,200	256	611	37,600
August	238	104	151	9,280
September	94	68	79.7	4,740
The year	1,690	32	216	156,000

BLUE RIVER AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at highway bridge on outskirts of Dillon, in Summit County, on edge of Leadville National Forest. Nearest tributaries, Snake River, which enters a short distance below station, and Tenmile Creek, which also enters below.

DRAINAGE AREA.—110 square miles (measured on forest atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1917.

GAGE.—Vertical staff on right abutment of bridge facing channel; read by J. H. Woodward.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of compact gravel upon which lodges the tailing slimes from hydraulic dredges near Breckenridge. Control is riffle 50 feet downstream which shifted during high water of 1917. Banks are high and will not be overflowed. Point of zero flow, 0.4 foot (+.1).

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.9 feet at 7 a. m. June 18 (discharge, 950 second-feet); minimum discharge, 23 second-feet during March.

ICE.—Stage-discharge relation affected by ice for short periods. Discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

DIVERSIONS.—There are court decrees for the diversion of 2.3 second-feet for irrigation from Blue River above station and 63 second-feet below, exclusive of a decree for 350 second-feet for the Green Mountain canal which has not been built. In addition there are placer decrees for diversions of 118 second-feet from the Blue near Breckenridge. There is an unadjudicated diversion from the headwaters of the Blue across Boreas Pass to Tarryall Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifted during high water; affected by ice during winter. Rating curve used October 1 to June 15, and curve used June 16 to September 30 well defined between 30 and 700 second-feet, and poorly defined above 700 second-feet. Gage read to hundredths twice daily except during winter, when it was read once daily. Daily discharge ascertained by applying one daily gage reading or the mean of two daily gage readings to the rating table, except for periods during which the stage-discharge relation was affected by shifting control of ice. Records good except for flood periods, for which they are fair.

Discharge measurements of Blue River at Dillon, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	P. V. Hodges	1.63	57	Feb. 17	T. J. Watkins	[a] 1.37	26.5
Dec. 22	J. H. Keep	1.51	40.2	June 26	H. W. Fear	3.33	811
Jan. 25	do	1.37	34.3	Aug. 15	do	2.05	143

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Blue River at Dillon, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	60	50	42	40	37	23	76	78	225	650	236	84
2	60	50	44	40	36	23	73	80	208	600	217	81
3	59	50	44	40	36	23	68	76	245	578	200	78
4	59	49	44	40	36	23	70	81	285	578	187	75
5	58	51	44	40	36	23	80	73	305	532	181	75
6	58	53	44	40	36	23	32	78	305	488	170	76
7	56	51	40	40	34	23	25	78	305	488	167	78
8	58	50	40	40	33	24	39	73	345	650	152	78
9	57	49	42	40	33	25	86	73	458	650	150	72
10	56	47	44	40	31	25	80	75	592	600	148	66
11	56	47	46	42	31	24	70	80	690	532	138	64
12	58	45	47	40	31	23	68	83	690	465	138	61
13	57	46	48	40	30	23	39	106	690	465	138	58
14	55	44	48	40	30	23	42	170	740	442	135	58
15	59	44	48	40	30	23	42	265	740	420	132	58
16	62	44	48	39	28	25	32	325	900	398	138	53
17	65	44	48	39	26	27	46	345	850	355	132	53
18	69	44	48	39	27	25	64	390	900	335	135	53
19	65	44	48	37	27	35	49	390	900	355	138	53
20	56	40	48	36	28	36	49	390	850	335	138	53
21	57	38	45	36	30	45	41	325	800	315	138	53
22	58	36	45	36	30	46	66	265	800	315	115	53
23	58	36	45	36	28	51	86	265	800	315	115	53
24	59	36	46	36	27	69	80	285	750	315	106	53
25	60	36	43	34	26	27	108	265	750	315	104	53
26	56	36	40	39	25	47	131	245	700	335	95	53
27	52	36	40	39	25	46	116	245	800	315	93	53
28	50	36	40	39	24	47	111	225	700	295	98	53
29	55	38	40	39	.....	64	88	225	700	295	98	53
30	53	40	42	39	.....	81	84	225	700	275	95	53
31	51	.....	42	39	.....	69	.....	225	.....	255	87	.....

NOTE.—Discharge Oct. 1 to June 15 computed by indirect method for shifting control. Stage-discharge relation affected by ice Nov. 8, Nov. 14–Dec. 14, Feb. 9–Mar. 15; discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Monthly discharge of Blue River at Dillon, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	69	50	57.8	3,550
November	53	36	43.7	2,600
December	48	40	44.3	2,720
January	42	34	38.8	2,390
February	37	24	30.4	1,690
March	81	23	35.2	2,160
April	131	25	68.0	4,050
May	390	73	197	12,100
June	900	208	624	37,100
July	650	255	428	26,300
August	236	87	139	8,550
September	84	53	61.9	3,680
The year	900	23	148	107,000

SNAKE RIVER AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at highway bridge 100 yards above mouth of river at Dillon, Summit County. Nearest tributary, a small stream, enters from north 1 mile above.

DRAINAGE AREA.—92 square miles (measured on forest atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1917.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by J. H. Woodward. Prior to April 26, 1913, gage was located 2 feet farther upstream, and although referred to same datum water piled up on gage during high water, giving a higher reading for same discharge.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading just below gage.

CHANNEL AND CONTROL.—Channel composed of small boulders, rough but permanent; control 50 feet downstream shifted after high water of 1917. Banks will not be overflowed. Point of zero flow 0.1 foot (±0.1).

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.9 feet at 6 p. m. June 24 (discharge, 840 second-feet); minimum discharge, 9 second-feet March 17.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and records of gage heights and temperature.

DIVERSIONS.—The Snake River ditch of the Summit County Power Co. diverts approximately 30 second-feet from Snake River above Dillon (see record below). There is also an irrigation decree for 4.5 second-feet above Dillon.

REGULATION.—(See diversions.)

ACCURACY.—Stage-discharge relation slightly shifting after high water; affected by ice during winter. Rating curve well defined between 10 and 550 second-feet. Gage read to hundredths twice daily except during winter when it was read once daily. Daily discharge ascertained by applying one daily gage reading or mean of two daily gage readings to rating table. Records excellent except for periods during which stage-discharge relation was affected by ice, for which they are fair.

Snake River ditch: Stage-discharge relation practically permanent. Rating curve fairly well defined between 18 and 40 second-feet. Gage read to tenths once daily. Daily discharge ascertained by applying one daily gage height to the rating table. Records fair.

Discharge measurements of Snake River at Dillon, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	P. V. Hodges	0.62	11.1	Feb. 17	T. J. Watkins	0.59	14.0
Dec. 22	J. H. Keep	.60	13.3	June 27	H. W. Fear	2.36	515.
Jan. 24	do	*a*.86	19.0				

a Stage-discharge relation affected by ice.

Discharge measurements of Snake River ditch at Dillon, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	P. V. Hodges		30.0	June 27	H. W. Fear	1.39	27.7
Jan. 25	J. H. Keep		10.5	Aug. 15	do	1.58	39.4

Daily discharge, in second-feet, of Snake River at Dillon, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	14	17	13	15	12	13	12	46	60	540	111	24
2	14	16	14	14	12	13	12	50	58	430	100	23
3	13	14	13	14	13	13	12	45	70	380	92	21
4	12	14	13	13	14	13	12	38	94	380	81	20
5	12	14	13	14	14	13	12	38	103	355	76	21
6	12	13	14	14	15	12	12	39	96	355	76	24
7	12	13	11	14	15	12	12	38	83	285	72	24
8	12	13	11	14	14	12	12	39	109	355	68	24
9	11	16	11	14	13	12	17	43	196	405	70	20
10	11	14	11	14	15	12	16	46	330	430	76	18
11	11	14	12	14	16	12	16	46	355	380	74	16
12	11	12	12	14	14	12	17	47	380	285	74	16
13	12	12	12	14	14	13	22	55	405	254	69	16
14	13	12	12	14	14	13	22	69	485	232	64	16
15	14	13	13	14	14	12	20	105	540	220	66	16
16	16	15	14	13	14	12	25	107	690	200	64	16
17	19	18	14	13	14	9	44	116	720	186	63	16
18	18	16	13	13	14	12	52	128	720	179	62	16
19	14	16	14	13	16	12	39	128	720	179	58	14
20	20	16	14	14	14	11	35	126	630	179	62	14
21	27	15	12	14	14	12	35	81	600	162	55	14
22	16	14	13	13	14	11	55	79	720	153	47	14
23	14	13	14	14	14	14	76	83	660	159	44	14
24	14	12	14	13	14	12	72	79	750	172	39	14
25	14	12	13	13	14	13	51	79	630	182	38	14
26	19	13	12	14	13	13	58	72	690	182	33	13
27	22	12	12	14	12	14	53	68	600	159	35	13
28	17	12	12	14	14	14	47	68	600	150	37	13
29	14	12	12	14	.....	12	45	66	600	134	33	13
30	16	13	12	14	.....	12	45	58	570	136	29	13
31	16	.....	14	13	.....	12	.....	58	.....	128	26	.....

NOTE.—Discharge Oct. 1–Nov. 30 and Feb. 1–Mar. 15 computed by indirect method for shifting control. Stage-discharge relation affected by ice Nov. 6–8, 10–16, 18–26, 28–30, Dec. 7–15, 25–30, Jan. 14, 24, 31–Feb. 3, 7–8 and Mar. 2–7; discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Daily discharge, in second-feet, of Snake River ditch near Dillon, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	June.	July.	Aug.	Sept.	Day.	Oct.	June.	July.	Aug.	Sept.
1	31	.....	28	28	22	16	37	28	35	28	22
2	31	.....	28	28	22	17	37	16	28	28	22
3	31	.....	22	28	22	18	37	22	28	28	22
4	31	.....	28	28	22	19	37	22	28	28	22
5	31	.....	28	22	22	20	37	22	28	28	22
6	31	.....	22	28	22	21	37	22	28	28	22
7	31	.....	22	28	22	22	31	22	35	22	22
8	31	.....	28	28	22	23	31	22	28	28	22
9	31	.....	28	28	22	24	26	28	28	28	22
10	31	35	28	28	22	25	26	28	28	28	22
11	31	35	28	28	22	26	26	22	28	22	22
12	31	28	28	28	22	27	26	28	22	22	22
13	31	35	35	28	22	28	26	28	28	22	22
14	31	28	35	28	22	29	26	28	28	22	22
15	37	35	35	28	22	30	26	28	28	22	22
						31	26	.....	28	22	.....

NOTE.—Gage not read from Nov. 1 to June 14. Flow in ditch practically all of the time; discharge measurement Jan. 25 showed a flow of 10 second-feet.

Monthly discharge of Snake River at Dillon, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	27	11	14.8	910
November	18	12	13.9	827
December	14	11	12.7	781
January	15	13	13.7	842
February	16	12	13.9	772
March	14	9	12.3	756
April	76	12	31.9	1,900
May	128	38	69.0	4,240
June	750	58	442	26,300
July	540	128	256	15,700
August	111	26	61.1	3,760
September	24	13	17.0	1,010
The year	750	9	79.9	57,800

Monthly discharge of Snake River ditch near Dillon, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	37	26	31.1	1,910
June 10-30	35	16	26.8	1,120
July	35	22	28.4	1,750
August	28	22	26.5	1,630
September	22	22	22.0	1,310

TENMILE CREEK AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at highway bridge 300 yards above mouth of creek, in Dillon, Summit County. Nearest tributary, Canyon Creek, enters from west 4 miles above.

DRAINAGE AREA.—113 square miles (measured on forest atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1917.

GAGE.—Vertical staff on downstream side of center pier; read by J. H. Woodward. Prior to June 10, 1914, gage was located at side of pier where during high stages the water piled up on the gage, giving a higher reading for the same discharge.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading near gage.

CHANNEL AND CONTROL.—Channel composed of small boulders; rough but permanent; control 50 feet downstream is permanent. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.25 feet at 6 p. m. June 16 (discharge, 1,530 second feet); minimum discharge, 17 second-feet March 22 and 23.

ICE.—Stage-discharge relation seriously affected by ice; daily discharge estimated by comparison with Snake and Blue rivers.

DIVERSIONS.—There are court decrees for the diversion of 11 second-feet from Tenmile Creek above station.

REGULATION.—None so far as known.

ACCURACY.—Stage-discharge relation permanent; seriously affected by ice during winter period. Rating curve well defined between 20 and 900 second-feet. Gage read to hundredths twice daily except during winter, when it was read once daily. Daily discharge ascertained by applying one daily gage reading or mean of two daily gage readings to rating table. Records excellent except for periods during which stage-discharge relation was affected by ice, for which they are fair.

Discharge measurements of Tenmile Creek at Dillon, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	P. V. Hodges	1.83	46.1	Feb. 17	T. J. Watkins	1.30	19.2
Dec. 22	J. H. Keep	[a] 2.27	41.8	June 26	H. W. Fear	3.48	8.72
Jan. 25	do	1.63	31.1				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Tenmile Creek at Dillon, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	45	40	40	32	27	19	27	87	177	865	151	54
2	51	39	40	32	23	18	26	81	194	670	135	51
3	49	46	40	32	22	18	27	70	308	632	127	50
4	49	45	40	32	21	19	27	70	422	595	118	50
5	46	46	40	32	21	19	28	73	390	560	121	50
6	46	44	40	32	21	20	28	73	302	490	118	52
7	48	29	35	32	21	20	28	73	330	490	105	52
8	55	32	26	32	21	20	28	75	525	622	101	52
9	50	35	26	32	21	19	29	75	825	622	96	50
10	49	40	28	32	21	19	32	85	1,060	595	98	50
11	48	44	29	31	20	19	28	79	985	490	93	50
12	49	39	30	29	20	18	27	87	985	455	87	50
13	49	29	34	27	19	18	34	105	1,020	390	87	50
14	49	25	37	25	19	18	34	185	1,140	390	93	50
15	52	32	37	25	19	18	34	319	1,230	330	93	50
16	58	39	39	27	19	18	31	455	1,400	297	98	50
17	58	40	40	28	19	18	37	560	1,230	292	89	50
18	64	44	42	32	19	18	43	560	1,230	270	85	48
19	56	44	42	33	20	18	44	455	1,230	265	91	44
20	40	44	42	33	20	18	45	422	1,060	265	81	41
21	33	44	42	33	20	18	40	319	985	225	79	40
22	42	42	42	33	20	17	55	216	1,140	225	73	40
23	54	42	35	32	21	17	79	207	1,140	240	66	40
24	55	42	33	32	21	18	77	212	1,230	230	64	40
25	55	42	29	31	21	19	108	212	1,060	225	60	40
26	44	42	27	32	21	20	124	212	1,060	245	58	40
27	36	42	26	32	21	20	115	207	985	225	58	40
28	40	42	24	32	20	22	103	190	985	212	66	40
29	45	42	27	31	.....	28	101	181	945	194	66	40
30	40	42	29	29	.....	28	89	181	945	181	59	40
31	46	.....	32	28	.....	28	.....	177	.....	170	55	.....

NOTE.—Stage-discharge relation affected by ice Nov. 8–Dec. 25, Dec. 25–Jan. 18, Feb. 2–17, Feb. 28–Mar. 28; discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Monthly discharge of Tenmile Creek at Dillon, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	64	33	48.4	2,980
November	46	25	39.9	2,370
December	42	24	34.6	2,130
January	33	25	30.8	1,890
February	27	19	20.6	1,140
March	28	17	19.6	1,210
April	124	26	50.9	3,030
May	560	70	203	12,500
June	1,400	177	884	52,600
July	865	170	386	23,700
August	151	55	89.4	5,500
September	54	40	46.5	2,770
The year	1,400	17	154	112,000

EAGLE RIVER AT REDCLIFF, COLO.

LOCATION.—In sec. 29, T. 6 S., R. 80 W., at footbridge in town of Redcliff, Eagle County. Nearest tributary, Turkey Creek, enters 100 yards below; Homestake Creek enters 1 mile below.

DRAINAGE AREA.—74 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 8, 1911, to September 30, 1917.

GAGE.—Chain on downstream side of footbridge; read by forest ranger. Staff gage in same section and referred to same datum read during high water.

DISCHARGE MEASUREMENTS.—Made from highway bridge 800 feet above station or by wading.

CHANNEL AND CONTROL.—Channel composed of boulders and is very rough; control short distance below gage, shifting between narrow limits. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 3.6 feet at 5.30 a. m. June 16 (discharge, 705 second-feet); minimum stage, 0.37 foot at 8 a. m. November 10 (discharge, 6 second-feet).

ICE.—Stage-discharge relation not affected by ice except for occasional short periods.

DIVERSIONS.—There are court decrees for the diversion of 6 second-feet from Eagle River above station, and also an old placer decree for diversion to the Arkansas basin of 18.5 second-feet from Piney Creek, a tributary. 2,460 acre-feet diverted during 1917.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts between narrow limits; affected by ice for few days during winter. Rating curve fairly well defined between 5 and 500 second-feet. Gage read to hundredths twice daily but there are many days with no record. Daily discharge ascertained by applying mean daily gage height to rating table and by interpolation for days when gage was not read. Records good.

Discharge measurements of Eagle River at Redcliff, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	P. V. Hodges	0.88	21.4	May 18	Robert Follansbee	2.30	296
Dec. 19	J. H. Keep	.84	17.1	June 23	H. W. Fear	2.83	441
Jan. 22	do	.67	19.1				

Daily discharge, in second-feet, of Eagle River at Redcliff, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	21	20	16	17	14	13	23	69	168	220	49	21
2	21	20	19	17	14	14	19	81	168	193	42	20
3	21	17	19	17	15	14	17	73	187	193	40	20
4	20	14	18	17	16	13	18	60	206	180	39	19
5	21	11	18	16	16	13	13	60	364	168	35	17
6	22	9	19	16	15	15	20	59	260	168	31	20
7	21	7	18	17	14	15	16	58	246	168	28	20
8	20	7	17	19	16	15	23	58	333	168	26	19
9	19	9	19	16	17	15	30	55	427	168	28	20
10	20	6	19	13	17	14	37	52	496	156	30	20
11	21	15	19	15	16	14	37	55	565	144	29	17
12	23	17	19	15	17	14	45	69	530	122	30	18
13	21	19	19	15	16	15	60	96	565	122	31	17
14	23	13	19	15	16	16	92	122	565	106	29	19
15	25	16	19	16	15	15	70	168	565	96	27	17
16	26	19	19	16	15	14	48	206	635	87	26	17
17	26	18	18	16	16	16	53	303	618	85	30	17
18	25	18	18	15	15	16	55	288	600	81	29	17
19	25	18	18	15	15	17	52	303	565	69	28	16
20	25	19	18	16	16	16	43	236	530	85	26	15
21	25	18	18	16	15	16	77	168	478	71	26	16
22	25	16	19	16	16	16	110	168	460	70	22	16
23	25	17	19	16	14	14	144	156	427	69	21	16
24	24	14	19	15	14	15	122	168	396	73	20	15
25	24	12	18	14	14	15	110	168	364	69	21	16
26	19	14	18	16	15	15	114	168	348	80	21	16
27	20	17	18	15	14	16	133	168	303	72	21	16
28	20	19	17	14	12	18	102	168	274	65	27	15
29	20	16	18	14	.....	22	82	168	274	62	24	15
30	21	16	18	14	.....	24	63	180	246	59	23	15
31	21	.....	18	14	.....	27	.....	193	.....	55	21	.....

NOTE.—Stage-discharge relation affected by ice Jan. 21–22, Jan. 31–Feb. 1; discharge interpolated.

Monthly discharge of Eagle River at Redcliff, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	26	19	22.3	1,370
November	20	6	15.0	893
December	19	16	18.3	1,130
January	19	13	15.6	959
February	17	12	15.2	844
March	27	13	15.9	978
April	144	13	60.9	3,620
May	303	52	140	8,610
June	635	168	405	24,100
July	220	55	114	7,010
August	49	20	28.4	1,750
September	21	15	17.4	1,040
The year	635	6	72.2	52,300

EAGLE RIVER AT EAGLE, COLO.

LOCATION.—At highway bridge at Eagle, Eagle County. Nearest tributary, Brush Creek, enters three-fourths mile below.

DRAINAGE AREA.—630 square miles (measured on forest atlas).

RECORDS AVAILABLE.—January 17, 1911, to September 30, 1917. March 12, 1905, to February 10, 1907, station was maintained short distance below mouth of Brush Creek.

GAGE.—Chain on downstream side of bridge; read by D. L. Wedmore. Prior to August, 1915, vertical staff fastened to right abutment was used. This gage was referred to same datum as present gage, and also as Weather Bureau gage near by.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of boulders and is very rough but fairly permanent. No well-defined control. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.05 feet at 8.10 a. m. June 18 (discharge, 6,370 second-feet); minimum discharge occurred during winter when record was discontinued.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Between Eagle and the station at Redcliff there are court decrees for diversion of 380 second-feet from Eagle River, of which 300 second-feet is for power. Below Eagle there are decrees for 22 second-feet from Eagle River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 150 and 5,000 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage reading to rating table. Records good except for high water, for which they may be only fair, due to error in basing mean daily stage on one gage reading.

Discharge measurements of Eagle River at Eagle, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 7	P. V. Hodges	0.68	267
June 22	H. W. Fear	4.88	4,730

Daily discharge, in second-feet, of Eagle River at Eagle, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	190	265	.....	163	485	988	4,480	785	261
2	201	246	.....	143	608	1,120	4,060	785	261
3	195	246	.....	163	748	1,310	3,920	710	261
4	211	227	.....	142	710	1,860	3,500	640	301
5	217	227	.....	147	485	2,220	3,240	640	301
6	246	221	.....	180	428	1,980	2,850	575	301
7	246	214	.....	149	428	1,980	2,720	575	301
8	246	211	.....	175	545	2,220	2,980	575	301
9	246	198	.....	231	380	2,980	2,850	515	301
10	246	190	.....	375	455	4,060	2,720	515	301
11	227	185	.....	273	428	4,620	2,720	455	341
12	227	185	.....	250	485	4,060	2,590	455	341
13	224	182	.....	355	575	3,780	2,340	515	341
14	224	.....	.....	310	825	4,620	2,220	515	390
15	227	.....	.....	336	1,310	5,740	2,100	455	390
16	227	.....	.....	297	1,740	6,020	1,860	455	390
17	246	.....	.....	301	2,220	6,300	1,740	455	341
18	265	.....	.....	250	2,590	6,300	1,740	455	297
19	285	.....	.....	332	2,460	6,300	1,620	455	297
20	305	.....	.....	370	2,340	6,020	1,510	455	257
21	328	.....	.....	281	2,100	5,180	1,510	455	254
22	328	.....	.....	428	1,510	4,620	1,510	350	254
23	328	.....	.....	640	1,510	5,320	1,410	350	217
24	328	.....	.....	675	1,510	5,320	1,310	305	254
25	305	.....	.....	710	1,410	5,320	1,210	305	254
26	305	.....	.....	675	1,310	5,460	1,120	305	254
27	305	.....	133	785	1,310	5,320	1,030	305	217
28	285	.....	142	710	1,080	5,040	1,030	350	217
29	285	.....	182	675	1,080	4,760	945	305	217
30	285	.....	217	545	1,620	4,760	945	305	217
31	265	.....	201	.....	1,310	.....	865	305	.....

NOTE.—Discharge Sept. 1-30 computed by indirect method for shifting control.

Monthly discharge of Eagle River at Eagle, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	328	190	260	16,000
November 1-13	265	182	215	5,540
March 27-31	217	133	175	1,740
April	785	142	369	22,000
May	2,590	380	1,160	71,300
June	6,300	988	4,190	249,000
July	4,480	865	2,150	132,000
August	785	305	470	28,900
September	390	217	288	17,100

TURKEY CREEK AT REDCLIFF, COLO.

LOCATION.—In sec. 19, T. 6 S., R. 80 W., at highway bridge in Redcliff, Eagle County, 800 feet above mouth of creek.

DRAINAGE AREA.—27 square miles (measured on forest atlas).

RECORDS AVAILABLE.—June 30, 1913, to September 30, 1917.

GAGE.—Chain attached to guard rail of bridge. Prior to November 9, 1915, vertical staff on downstream side of left abutment referred to same datum was used.

DISCHARGE MEASUREMENTS.—Made from single span bridge or by wading near by.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and small boulders and will shift; no well-defined control. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.9 feet at 7.30 p. m. June 18 (discharge, 364 second-feet); minimum stage, 0.8 foot at 9 a. m. January 8 (discharge, 4 second-feet).

ICE.—Stage-discharge relation not affected by ice except for a few days.

DIVERSIONS.—There is court decree for diversion of 5.5 second-feet from Turkey Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts between narrow limits; affected by ice for few days during winter. Rating curve well defined between 5 and 330 second-feet. Gage read to hundredths twice daily, but there are many days when there is no record. Daily discharge ascertained by applying mean daily gage height to rating table and by interpolation for days when gage was not read. Records good.

Discharge measurements of Turkey Creek at Redcliff, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	P. V. Hodges	1.00	9.4	May 18	Robert Follansbee	2.01	92
Dec. 19	J. H. Keep	.91	10.7	June 23	H. W. Fear	3.65	325
Jan. 21	do	1.00	7.4				

Daily discharge, in second-feet, of Turkey Creek at Redcliff, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.0	6.8	6.4	6.4	4.4	4.8	6.6	16	35	204	18	8.9
2	9.0	5.8	6.8	6.1	4.6	4.4	7.0	12	39	183	18	8.6
3	9.0	5.6	7.2	5.8	4.5	4.6	5.2	13	60	169	18	8.3
4	9.2	5.4	6.8	5.5	4.5	4.5	6.6	16	80	149	17	8.0
5	8.9	5.2	6.5	5.2	4.4	4.4	8.6	16	79	129	16	7.8
6	8.9	5.0	6.2	5.2	4.4	4.4	4.8	14	80	122	16	7.8
7	9.5	4.8	5.9	4.6	4.4	4.4	5.6	12	79	116	16	8.0
8	9.5	6.6	5.6	4.0	4.2	4.8	7.0	13	89	98	14	7.8
9	9.5	4.6	5.4	4.2	4.8	4.6	8.3	12	129	79	14	7.7
10	9.5	4.6	5.4	4.6	4.4	4.5	8.6	12	163	68	15	7.6
11	8.9	4.6	5.5	4.8	4.6	4.5	9.2	12	197	67	14	7.2
12	11	4.5	5.5	5.0	4.8	4.4	9.5	13	211	67	14	7.2
13	8.9	4.5	5.5	4.8	5.0	4.8	10	22	240	64	14	7.4
14	9.1	4.5	5.5	4.8	4.6	4.8	12	32	255	55	13	7.6
15	9.3	5.2	5.6	4.4	4.6	4.4	11	33	255	49	13	7.6
16	9.5	6.2	5.6	4.8	4.4	4.4	9.5	59	270	43	13	7.0
17	9.5	5.2	5.7	4.8	4.4	4.4	11	75	293	42	12	6.4
18	9.4	5.5	5.8	4.8	4.4	4.6	11	90	316	39	12	6.2
19	9.3	6.0	6.0	4.6	4.4	4.8	11	93	300	39	12	5.8
20	9.0	6.6	5.6	5.2	4.4	4.2	9.5	74	316	38	11	5.4
21	8.9	6.3	5.8	4.4	4.6	7.4	15	55	316	36	11	5.8
22	8.8	6.0	6.0	4.6	5.6	4.2	21	44	300	32	11	5.8
23	8.7	6.0	6.2	4.4	4.4	7.4	27	36	316	28	11	5.7
24	8.6	5.9	6.4	4.0	4.5	6.2	27	37	286	36	11	5.6
25	7.0	5.8	6.6	4.4	4.7	5.8	25	41	255	30	10	5.4
26	7.2	5.9	6.8	4.2	4.8	5.4	24	45	270	26	10	5.2
27	7.4	6.0	6.6	4.4	4.4	7.0	20	40	255	26	10	5.2
28	7.6	6.0	6.7	4.4	4.8	5.8	18	36	240	25	11	5.2
29	7.8	7.0	6.8	4.4	.....	7.6	16	31	225	24	10	5.2
30	8.0	6.7	7.0	4.2	.....	8.0	14	34	225	23	10	5.2
31	7.6	.....	6.7	4.8	.....	6.2	.....	37	.....	19	10	.....

NOTE.—Discharge Oct. 4–Nov. 20, and Sept. 1–30, computed by indirect method for shifting control. Stage-discharge relation affected by ice Nov. 10, 13, 14, and Dec. 9; discharge interpolated.

Monthly discharge of Turkey Creek at Redcliff, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	11	7.0	8.82	542
November	7.0	4.5	5.63	335
December	7.2	5.4	6.13	377
January	6.4	4.0	4.77	293
February	5.6	4.2	4.57	254
March	8.0	4.2	5.22	321
April	27	4.8	12.6	750
May	93	12	34.7	2,130
June	316	35	206	12,300
July	204	19	68.5	4,210
August	18	10	13.1	806
September	8.9	5.2	6.75	402
The year	316	4.0	31.3	22,700

HOMESTAKE CREEK NEAR REDCLIFF, COLO.

LOCATION.—In sec. 30, T. 6 S., R. 80 W., half a mile above mouth of creek, at Forest Service bridge, 1 mile from Redcliff, Eagle County, below all tributaries.

DRAINAGE AREA.—64 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 17, 1914, to September 30, 1917. From January 8, 1911, to August 16, 1914, station was located quarter of a mile downstream.

GAGE.—Vertical staff on left abutment of bridge facing current; read by forest ranger. Gage used prior to August 17, 1914, was vertical staff attached to large boulder on right bank quarter of a mile downstream and just above the cascades.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of well-compacted gravel. Control is located 50 feet downstream at small rapids; apparently permanent. There are several small overflow channels around left bank which carry water above stage of 2.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet at 7 a. m. June 16 (discharge, 940 second-feet); minimum discharge probably occurred during winter when stage-discharge relation was ice affected.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—There are court decrees for diversion of 1.2 second-feet from a tributary of Homestake Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 10 and 700 second-feet. Gage read to hundredths once weekly. Daily discharge ascertained by applying the one weekly gage reading to rating table, and for days of missing gage heights the discharge was determined from a comparative hydrograph of Eagle River at Redcliff. Records fair.

Discharge measurements of Homestake Creek near Redcliff, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 9	P. V. Hodges	0.74	26.6
Dec. 19	J. H. Keep	*a* .82	15.8
June 23	H. W. Fear	3.00	633

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Homestake Creek near Redcliff, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.
1	27	.....	23	.....	19	64	130	500	90	25
2	27	.....	.....	.....	19	80	128	480	74	23
3	26	.....	.....	.....	19	62	130	460	68	21
4	26	.....	.....	.....	19	63	200	450	65	19
5	26	.....	.....	.....	19	64	440	430	63	20
6	25	.....	.....	.....	19	62	310	420	63	21
7	25	.....	.....	.....	19	61	270	368	62	23
8	26	.....	.....	.....	19	60	310	350	61	24
9	27	.....	.....	.....	19	58	368	330	60	24
10	28	.....	.....	.....	19	56	585	310	60	24
11	28	.....	.....	.....	22	54	600	288	60	24
12	29	.....	.....	22	35	80	500	260	59	24
13	30	.....	.....	.....	50	130	520	250	59	25
14	32	23	.....	.....	100	190	390	220	58	28
15	34	.....	.....	.....	50	250	304	200	56	33
16	36	.....	.....	.....	45	304	368	180	54	25
17	36	.....	.....	.....	45	319	700	172	52	22
18	38	.....	.....	.....	48	330	730	174	49	20
19	38	.....	16	.....	45	335	750	178	46	19
20	40	.....	.....	22	40	300	750	180	43	18
21	38	23	.....	.....	60	250	740	178	40	18
22	36	.....	.....	.....	90	220	730	175	37	17
23	34	.....	.....	.....	116	194	730	174	34	17
24	32	.....	.....	.....	100	208	670	172	30	16
25	29	.....	.....	.....	96	202	620	185	26	16
26	28	.....	.....	.....	100	190	608	206	28	15
27	27	.....	.....	.....	120	150	590	183	30	15
28	26	.....	.....	.....	90	102	570	160	32	14
29	24	.....	.....	.....	70	111	540	140	30	14
30	23	.....	.....	.....	60	130	520	125	29	14
31	22	.....	.....	.....	.....	150	.....	111	27	.....

NOTE.—Discharge Oct. 7, 9, 12, 20, 25, 31, Nov. 14 and 21 computed by indirect method for shifting control. Discharge Dec. 19 from discharge measurement.

Monthly discharge of Homestake Creek near Redcliff, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	40	22	29.8	1,830
April	120	19	52.4	3,120
May	335	54	156	9,590
June	750	128	493	29,300
July	500	111	258	15,900
August	90	26	49.8	3,060
September	33	14	20.6	1,230

ROARING FORK AT ASPEN, COLO.

LOCATION.—At bridge near old power plant at Aspen, Pitkin County. Castle, Maroon, and Hunter creeks all enter below.

DRAINAGE AREA.—109 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 25, 1915, to September 30, 1917. From January 1, 1911, to February 24, 1915, station was maintained just below Cooper Avenue Bridge, three-quarters of a mile upstream.

GAGE.—Vertical staff at downstream end of right bridge abutment; read by Chas. Gerstle, jr., and H. W. Wood. Gage used at original section was vertical staff fastened to old crib abutment on right bank, 25 feet below Cooper Avenue Bridge; no determined relation between two gages.

DISCHARGE MEASUREMENTS.—Made from single span bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of small boulders and is fairly smooth; control not well defined; practically permanent. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.1 feet during night of June 18 as determined from high-water marks (discharge, 3,170 second-feet); minimum stage recorded, 0.92 foot at 8. 25 a. m. March 1 (discharge, 17 second-feet).

ICE.—Stage-discharge relation practically unaffected by ice during the winter.

DIVERSIONS.—Salvation ditch, which has a decree for 58 second-feet, diverts water above station from last of June to end of September (see record below).

REGULATION.—None.

ACCURACY.—Stage-discharge relation nearly permanent; practically unaffected by ice. Rating curve well defined between 20 and 1,300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except during spring, when mean daily gage heights may be somewhat in error, making records for that period only good.

Discharge measurements of Roaring Fork at Aspen, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	P. V. Hodges	1.67	105	Jan. 12	T. J. Watkins	1.22	44.5
Dec. 12	T. J. Watkins	1.26	51	June 21	H. W. Fear	4.28	1,270

Discharge measurements of Salvation ditch at Aspen, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
July 25	Robert Follansbee.....	1.52	14.4	Aug. 16	H. W. Fear.....	1.77	19.7

Daily discharge, in second-feet, of Roaring Fork at Aspen, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	76	77	83	44	41	19	42	62	148	1,440	290	76
2	90	79	55	51	38	28	47	67	137	1,370	240	70
3	95	80	62	43	39	25	45	59	188	1,180	225	65
4	90	77	61	49	47	28	34	61	322	1,180	200	61
5	80	68	57	44	40	43	29	60	440	1,120	200	59
6	125	80	53	41	47	28	43	60	272	1,060	188	61
7	139	97	44	66	36	32	27	62	342	885	175	74
8	127	56	43	57	38	39	40	61	462	885	148	63
9	133	66	41	59	42	34	41	76	775	1,000	146	63
10	120	55	54	61	41	34	36	72	1,180	940	146	61
11	112	48	55	61	34	38	44	60	1,180	885	164	62
12	114	70	54	44	44	38	50	67	1,060	940	142	70
13	120	60	50	36	45	40	55	89	1,240	725	164	65
14	123	56	49	45	40	34	53	123	1,440	675	146	82
15	137	45	47	51	39	36	42	175	1,630	625	152	71
16	105	50	48	56	51	44	57	255	1,700	552	131	70
17	105	60	50	57	34	32	45	380	1,910	485	125	66
18	127	67	48	47	39	55	41	380	2,050	462	116	61
19	112	74	53	56	35	45	42	552	1,980	485	109	59
20	98	65	56	62	38	50	49	380	1,840	530	110	59
21	95	51	50	42	47	59	43	272	1,700	462	98	60
22	123	49	50	40	43	25	92	240	1,700	420	94	59
23	120	48	53	44	50	21	95	200	1,770	380	88	59
24	105	51	49	43	43	23	105	200	1,700	440	102	56
25	109	43	43	39	45	47	112	200	1,770	400	98	55
26	92	70	41	43	40	32	97	212	1,840	775	98	63
27	83	66	40	39	23	40	88	137	1,700	530	98	62
28	86	77	39	42	32	44	80	129	1,630	400	105	61
29	90	50	39	47	.....	49	54	139	1,560	325	88	57
30	83	57	39	51	.....	54	59	131	1,630	360	79	54
31	82	.....	39	41	.....	55	.....	146	.....	342	74	.....

• NOTE.—Stage-discharge relation affected by ice Dec. 29-31; discharge estimated.

Monthly discharge of Roaring Fork at Aspen, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	139	76	106	6,520
November	97	43	63.1	3,750
December	83	39	49.8	3,060
January	66	36	48.4	2,980
February	51	23	40.4	2,240
March	59	19	37.8	2,320
April	112	27	56.2	3,340
May	552	59	165	10,100
June	2,050	137	1,240	73,800
July	1,440	325	718	44,100
August	290	74	140	8,610
September	82	54	63.5	3,780
The year	2,050	19	228	165,000

ROARING FORK BELOW ASPEN, COLO.

LOCATION.—In sec. 1, T. 10 S., R. 85 W., at first highway bridge 2 miles below Aspen, Pitkin County. Nearest tributary above is Castle Creek; nearest below, Maroon Creek.

DRAINAGE AREA.—223 square miles (measured on topographic map).

RECORDS AVAILABLE.—October 18, 1913, to September 30, 1917.

GAGE.—Vertical staff on right abutment of bridge, facing channel; read at irregular intervals by forest ranger.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Channel composed of gravel and small boulders; practically permanent; no well-defined control. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum discharge, approximately 2,960 second-feet June 26, as determined from comparative hydrographs of Roaring Fork at Aspen and Castle Creek near Aspen; minimum stage recorded, 0.10 foot March 26 and April 2 (discharge, 104 second-feet).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Between this station and the one at Aspen there are a number of small diversions, some of which return the water to the river above the station. The Roaring Fork Light & Power Co. diverts water from Maroon Creek into Castle Creek and thence into Roaring Fork above the station.

REGULATION.—None so far as known.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice during winter. Rating curve well defined between 100 and 2,000 second-feet. Poorly defined above 2,000 second-feet. Gage read to hundredths twice weekly. Daily discharge ascertained by applying the one gage reading taken twice weekly to rating table, and for days of missing record the discharge is determined from comparative hydrographs of Roaring Fork at Aspen and Castle Creek near Aspen. Records fair.

Discharge measurements of Roaring Fork below Aspen, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	P. V. Hodges	0.53	260	Jan. 12	T. J. Watkins	0.20	129
Dec. 14	T. J. Watkins	.26	147	June 21	H. W. Fear	2.95	2,520

Daily discharge, in second-feet, of Roaring Fork below Aspen, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	240	234	225	148	127	104	106	182	370	2,690	660	278
2	250	238	161	154	125	106	104	180	387	2,080	610	255
3	260	242	157	160	123	109	108	178	430	1,920	540	232
4	255	235	154	154	125	111	112	181	490	1,760	495	220
5	250	225	148	160	128	115	114	184	755	1,640	495	222
6	278	225	140	169	126	110	118	176	640	1,480	495	225
7	290	250	137	185	123	106	109	169	760	1,350	495	230
8	280	235	135	183	120	110	109	169	900	1,400	480	223
9	288	225	145	180	116	112	109	169	1,070	1,460	470	217
10	278	220	152	170	114	111	109	169	1,250	1,570	450	217
11	275	208	154	135	112	114	120	190	1,250	1,400	440	217
12	282	220	154	128	118	118	135	208	1,120	1,280	428	235
13	283	206	154	115	109	123	128	240	1,600	1,130	414	238
14	284	185	148	123	115	128	135	297	2,220	1,040	414	242
15	256	180	152	128	120	132	128	360	2,300	1,000	415	236
16	260	177	154	128	128	134	140	480	2,370	945	420	232
17	265	195	156	127	123	135	135	620	2,540	890	425	225
18	287	225	158	123	123	140	132	760	2,780	860	414	223
19	270	230	161	126	123	118	135	755	2,880	830	400	220
20	252	215	159	128	123	140	142	755	2,880	830	387	218
21	242	220	158	128	124	110	118	755	2,860	800	350	215
22	275	186	156	128	124	108	185	468	2,860	820	320	214
23	265	177	154	128	122	108	200	430	2,860	830	287	213
24	255	190	148	128	118	114	245	400	2,880	830	298	214
25	258	200	141	128	116	120	275	380	2,920	840	305	217
26	250	212	137	128	114	104	269	362	2,960	1,200	315	222
27	242	218	132	128	107	109	234	350	2,690	960	325	224
28	234	205	128	128	105	114	251	340	2,640	720	313	224
29	230	177	132	128	.....	114	180	350	2,620	720	307	225
30	225	200	135	132	.....	114	184	355	2,690	720	290	225
31	230	.....	140	130	.....	114	.....	362	.....	720	280	.....

Monthly discharge of Roaring Fork below Aspen, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	290	225	261	16,000
November	250	177	211	12,600
December	225	128	150	9,220
January	185	115	140	8,610
February	128	105	120	6,660
March	140	104	116	7,130
April	275	104	152	9,040
May	760	169	354	21,800
June	2,960	370	1,900	113,000
July	2,690	720	1,180	72,600
August	660	280	411	25,300
September	278	213	226	13,400
The year	2,960	104	436	315,000

ROARING FORK AT GLENWOOD SPRINGS, COLO.

LOCATION.—About 1,500 feet above mouth of river, at Glenwood Springs, Garfield County.

DRAINAGE AREA.—1,450 square miles (measured on Nell's map of Colorado, 1903).

RECORDS AVAILABLE.—April 6, 1906, to September 30, 1909; September 31, 1910, to September 30, 1917.

GAGE.—Inclined staff on left bank 800 feet above highway bridge, used since November 20, 1915. Chain gage on downstream side of highway bridge previously used. Read by United States Forest Service.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Channel composed of boulders and coarse gravel; practically permanent during 1917; no well-defined control. Banks are high and will not be overflowed. Gage was moved to eliminate backwater effect during extremely high stages on Grand River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.4 feet afternoon of June 20 and 21, 26 and 27 (discharge, 11,100 second-feet): minimum stage recorded, 0.75 foot on March 1 and 2 (discharge, 390 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice, as river seldom freezes over, and only occasionally does slush or anchor ice form.

DIVERSIONS.—There are court decrees for diversion of 164 second-feet from Roaring Fork between Glenwood Springs and lower Aspen station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice during winter. Rating curve well defined between 400 and 10,000 second-feet. Gage read to half-tenths once daily, but there are many days with no record. Daily discharge ascertained by applying the one daily gage height to rating table and by interpolation for days on which gage was not read. Records good.

Discharge measurements of Roaring Fork at Glenwood Springs, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	P. V. Hodges	1.82	1,180	Feb. 14	T. J. Watkins	0.87	475
Jan. 20	J. H. Keep	1.08	565	June 14	H. W. Fear	6.45	11,600

Daily discharge, in second-feet, of Roaring Fork at Glenwood Springs, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,050	815	575	532	475	390	690	1,450	3,030	9,640	2,860	1,010
2	1,260	815	610	540	475	445	610	1,320	2,700	9,080	2,540	1,010
3	1,010	815	592	575	475	390	508	1,260	3,440	8,250	2,240	1,010
4	960	770	575	540	508	465	540	1,260	4,180	7,980	2,240	1,010
5	910	770	575	445	540	540	508	1,260	4,800	7,720	1,920	910
6	960	770	575	508	527	508	508	1,210	3,980	7,460	1,590	1,010
7	1,260	770	540	491	488	475	508	1,160	4,800	7,200	1,650	1,370
8	1,240	685	508	475	488	475	639	1,210	5,620	7,200	1,710	1,160
9	1,210	685	508	508	475	475	770	1,160	6,440	7,200	1,840	1,180
10	1,160	685	508	457	508	488	860	1,160	7,480	6,690	1,710	1,010
11	1,320	685	508	508	491	488	770	1,380	8,520	6,440	2,100	1,010
12	1,260	615	508	575	475	488	815	1,590	7,720	6,190	1,970	1,480
13	1,160	545	575	495	457	475	960	1,990	8,520	5,700	1,840	1,590
14	1,160	475	508	502	445	463	960	2,390	9,080	5,400	1,840	1,420
15	1,160	533	508	508	445	508	865	4,380	10,500	5,100	1,710	1,210
16	1,160	591	508	508	415	488	770	5,010	10,700	4,800	1,590	1,210
17	1,210	648	542	540	475	463	575	5,160	10,900	4,590	1,590	1,210
18	1,160	648	575	508	445	469	475	5,310	11,000	4,380	1,590	1,110
19	1,160	629	575	554	445	475	580	5,460	11,100	4,180	1,540	1,110
20	1,060	610	575	540	445	488	685	4,720	11,100	3,980	1,480	1,110
21	1,010	598	575	540	445	475	728	3,980	11,100	4,180	1,370	1,010
22	1,040	586	575	540	445	463	994	3,590	9,920	3,980	1,320	1,010
23	1,060	575	575	575	445	475	1,260	3,400	10,200	3,780	1,210	1,010
24	1,010	575	553	575	445	475	1,480	3,590	10,500	4,590	1,280	1,010
25	960	540	531	540	462	445	1,710	3,400	10,800	3,780	1,350	910
26	960	540	508	540	508	445	2,540	3,030	11,100	3,980	1,410	910
27	960	540	508	495	475	475	1,970	2,860	11,100	3,980	1,480	910
28	960	540	445	518	415	960	1,840	2,700	10,500	3,780	1,370	910
29	910	540	508	540	.....	728	1,710	2,860	10,500	3,680	1,210	910
30	860	558	516	475	.....	1,060	1,580	3,040	10,200	3,590	1,210	910
31	860	.....	524	475	.....	770	.....	3,210	.....	3,400	1,010	.....

Monthly discharge of Roaring Fork at Glenwood Springs, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,320	860	1,080	66,400
November	815	475	638	38,000
December	610	445	541	33,300
January	575	445	520	32,000
February	540	415	469	26,000
March	1,060	390	523	32,200
April	2,540	475	980	58,300
May	5,460	1,160	2,760	170,000
June	11,100	2,700	8,380	499,000
July	9,640	3,400	5,550	341,000
August	2,860	1,010	1,670	103,000
September	1,590	910	1,090	64,900
The year	11,100	390	2,020	1,460,000

CASTLE CREEK NEAR ASPEN, COLO.

LOCATION.—In sec. 35, T. 10 S., R. 85 W., 75 feet below highway bridge in Sopris National Forest, 4½ miles above Aspen, Pitkin County. No inflow below, except spring run-off from small gulches; nearest tributary above is Conundrum Creek, which enters about 1 mile upstream.

DRAINAGE AREA.—62 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 16, 1911, to September 30, 1917.

GAGE.—Gurley water-stage recorder on left bank, 75 feet below bridge. Staff on opposite bank at datum 1.0 foot higher than present gage, used February 16, 1911, to February 28, 1912. Vertical staff on right abutment of bridge at present datum used February 29, 1912, to April 11, 1915, but owing to slope of stream gage readings were somewhat higher.

DISCHARGE MEASUREMENTS.—Made from cable 22 feet below gage or by wading near by.

CHANNEL AND CONTROL.—Channel composed of coarse gravel; shifts during high water. Control is small rapids just below cable; shifting at intervals. Left bank is high and will not be overflowed; right bank will be overflowed a distance of 75 feet at gage height 4.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.85 feet at midnight June 27 (discharge, 890 second-feet); minimum discharge, 24 second-feet March 2 and 3.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—No water diverted above station except possibly for a small amount of meadow irrigation; there are court decrees for diversion of 160 second-feet below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts very seriously during high water; affected by ice during winter. Rating curve well defined between 25 and 500 second-feet until high water, after which it is poorly defined. The operation of the water-stage recorder was satisfactory throughout the year except for short periods indicated by breaks in the record as shown in the footnote to daily discharge table. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph, except for periods during which stage-discharge relation was affected by shifting control or by ice. Records excellent except those for period of ice effect, which are fair, and those for June 1 to September 30, which are poor.

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Discharge measurements of Castle Creek near Aspen, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	P. V. Hodges	1.16	71	June 20	H. W. Fear	2.35	504
Dec. 13	T. J. Watkins	.92	43.6	July 25	Robert Follansbee	2.34	288
Jan. 13	do	[a]1.30	27.1	Aug. 16	H. W. Fear	1.66	155
Feb. 16	do	.62	25.1				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Castle Creek near Aspen, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	69	59	46	34	26	26	31	43	117	680	236	97
2	73	58	46	34	27	24	33	45	121	656	221	93
3	69	55	45	34	28	24	31	45	144	620	203	91
4	66	53	45	34	29	25	31	44	183	590	199	90
5	63	52	45	34	29	26	31	43	203	558	194	91
6	90	52	45	34	29	26	32	41	194	575	199	95
7	88	53	40	34	29	28	30	43	214	532	188	105
8	81	52	33	34	28	29	31	42	252	540	179	101
9	73	52	40	34	28	29	33	44	335	508	175	98
10	70	52	42	34	27	29	33	46	408	500	179	95
11	73	51	44	32	26	28	33	53	402	495	181	111
12	71	51	45	30	26	28	34	60	425	428	175	126
13	69	41	47	27	26	29	37	77	470	408	186	107
14	76	41	45	29	26	29	37	105	502	450	177	111
15	77	48	44	29	26	28	35	157	550	458	175	101
16	74	52	41	29	25	28	34	190	570	415	172	90
17	73	55	42	29	25	37	34	194	578	382	199	82
18	74	53	41	29	26	35	33	201	562	375	183	79
19	71	52	41	29	27	28	33	188	546	382	168	76
20	69	51	41	29	28	28	33	168	530	352	153	74
21	66	51	40	29	29	27	36	146	492	320	144	73
22	66	47	37	29	29	28	45	132	498	300	134	70
23	69	49	37	29	29	29	48	132	555	332	130	66
24	67	48	34	29	29	30	52	132	600	372	126	60
25	66	44	31	29	29	28	55	130	618	340	121	58
26	66	47	31	29	29	29	56	128	653	465	117	58
27	64	48	29	29	28	30	50	121	752	355	130	63
28	63	47	28	29	26	30	47	123	746	292	126	69
29	62	46	35	29	.....	33	46	126	677	282	113	67
30	61	47	34	29	.....	34	43	126	612	282	109	64
31	61	.....	34	29	.....	33	.....	121	.....	285	109	.....

NOTE.—Stage-discharge relation affected by ice Dec. 30 to Mar. 9. Discharge based on temperature and gage-height record and discharge measurements. No gage-height record Dec. 11–12, June 18–19, and Sept. 9; discharge interpolated.

Monthly discharge of Castle Creek near Aspen, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	90	61	70.3	4,320
November	59	41	50.2	2,990
December	47	28	39.6	2,430
January	34	27	30.7	1,890
February	29	25	27.5	1,530
March	37	24	28.9	1,780
April	56	30	37.9	2,260
May	201	41	105	6,460
June	752	117	450	26,800
July	680	282	436	26,800
August	236	109	165	10,100
September	126	58	85.4	5,080
The year	752	24	128	92,400

MAROON CREEK NEAR ASPEN, COLO.

LOCATION.—In sec. 22, T. 10 S., R. 85 W., just above Roaring Fork Light & Power Co.'s head gate and 5 miles above Aspen, Pitkin County, in Sopris National Forest. Nearest tributary, Willow Creek, enters just below.

DRAINAGE AREA.—42 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 1, 1911, to June 2, 1917.

GAGE.—Vertical staff on right bank 100 feet above canal head gate; read by Harry Burnett.

DISCHARGE MEASUREMENTS.—Made by wading at points near gage.

CHANNEL AND CONTROL.—Channel composed of compacted gravel; shifted badly during 1916; practically permanent during 1917. Banks will not be overflowed to any great extent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 1.2 feet May 18–21 (discharge, 86 second-feet); minimum stage recorded, 0.51 foot March 21, 22, and 27 (discharge, 27 second-feet).

ICE.—Stage-discharge relation not affected by ice except for occasional short periods.

DIVERSIONS.—One or two small diversions above station; the Roaring Fork Light & Power Co. diverts water just below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice except for occasional short periods. Rating curve well defined between 25 and 150 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Maroon Creek near Aspen, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct 16	P. V. Hodges	1.13	73	Jan. 13	T. J. Watkins	[a] 0.88	30.9
Dec. 13	T. J. Watkins	.82	40.8	Feb. 16	do	.55	28.0

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Maroon Creek near Aspen, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	63	55	42	38	30	29	28	34	75
2	67	55	43	36	30	29	28	34	71
3	65	54	43	25	31	29	28	34	.....
4	63	53	42	34	30	39	28	33	.....
5	62	51	42	34	30	29	28	32	.....
6	67	51	42	34	30	29	28	32	.....
7	69	53	42	34	30	29	28	32	.....
8	67	51	45	33	30	28	28	32	.....
9	66	51	45	33	29	28	28	32	.....
10	66	50	43	33	29	28	29	33	.....
11	73	50	42	33	29	28	29	35	.....
12	71	50	40	33	29	28	29	38	.....
13	69	46	40	33	29	28	29	42	.....
14	69	46	39	33	29	28	29	46	.....
15	75	46	39	33	29	28	29	51	.....
16	73	47	38	33	29	28	29	65	.....
17	71	46	38	32	29	28	29	82	.....
18	71	46	38	32	29	28	29	86	.....
19	71	46	38	32	29	28	29	86	.....
20	67	46	38	32	29	28	29	86	.....
21	65	46	38	32	29	27	29	86	.....
22	65	45	37	32	29	27	31	67	.....
23	65	45	37	32	28	27	32	67	.....
24	65	43	37	32	28	28	33	69	.....
25	62	43	37	32	29	27	35	73	.....
26	61	43	37	32	29	27	36	75	.....
27	61	43	42	30	29	27	36	75	.....
28	60	43	45	30	29	28	36	78	.....
29	59	43	40	30	.....	28	34	80	.....
30	56	42	45	30	.....	28	34	80	.....
31	55	.....	45	30	.....	28	.....	78	.....

NOTE.—Stage-discharge relation affected by ice Jan. 13–15, 22–25, Feb. 1–2, 26, Mar. 4, 18, 23, and 26; discharge interpolated.

Monthly discharge of Maroon Creek near Aspen, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	75	55	65.7	4,040
November	55	42	47.6	2,830
December	45	37	40.6	2,500
January	38	30	32.6	2,000
February	31	28	29.2	1,620
March	29	27	28.0	1,720
April	36	28	30.2	1,800
May	86	32	57.2	3,520
June 1–2	75	71	73.0	290
The period	.....	.....	.....	20,300

FRYINGPAN CREEK AT NORRIE, COLO.

LOCATION.—In sec. 28, T. 8 S., R. 83 W., at highway bridge in Norrie, Pitkin County in Sopris National Forest. North Fork enters 1 mile below.

DRAINAGE AREA.—92 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 18, 1911, to March 31, 1917.

GAGE.—Vertical staff on downstream side of center pier; read by forest ranger. From February 18, 1911, to July 13, 1915, gage was located at side of pier and although referred to same datum gave a considerable higher reading during high-water stages as the water piled up against it. On August 20, 1915, gage datum was raised 1 foot.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of boulders and is uneven, but current is not greatly disturbed as at ordinary stages a pool is formed by the control located 100 feet downstream at well-defined rapids; practically permanent. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage for period, 1.95 feet at 7 a. m. October 2 (discharge, 93 second-feet); minimum stage for period, 1.40 feet several times during March (discharge, 18 second-feet).

ICE.—Stage-discharge relation affected by ice; daily discharge determined from observer's notes, discharge measurements, and temperature records.

DIVERSIONS.—None above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice for short periods during winter. Rating curve well defined between 20 and 400 second-feet. Gage read to half-tenths once daily, but there are many days with no record. Daily discharge ascertained by applying daily gage height to the rating table, and by interpolation for days when gage was not read. Records good.

Discharge measurements of Fryingpan Creek at Norrie, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 13	P. V. Hodges	1.80	65
Dec. 15	T. J. Watkins	1.60	35.5
Jan. 14	....do	1.55	29.7

Daily discharge, in second-feet, of Fryingpan Creek at Norrie, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	68	65	37	26	26	24	16	58	37	32	32	22	18
2	87	65	37	29	26	22	17	83	37	32	32	22	18
3	83	32	37	32	26	22	18	83	37	32	32	23	19
4	67	37	37	32	26	20	19	83	37	37	28	24	20
5	65	44	37	32	26	18	20	83	37	37	28	24	22
6	65	50	37	37	26	18	21	83	37	40	27	23	22
7	65	50	40	34	26	18	22	83	37	37	26	22	21
8	65	50	44	34	25	20	23	83	37	32	28	22	20
9	69	44	42	35	24	20	24	74	37	32	29	22	18
10	69	37	40	32	26	22	25	74	37	32	28	23	22
11	74	37	37	32	25	21	26	74	37	32	27	24	26
12	78	37	37	32	24	20	27	71	37	32	26	25	29
13	67	37	37	32	24	19	28	68	37	32	26	26	32
14	65	37	36	32	24	18	29	65	37	32	26	.....	37
15	62	37	34	32	22	18	30	65	37	26	26	.....	44
							31	65	.....	26	26	.....	44

NOTE.—Stage-discharge relation affected by ice Nov. 12–Dec. 4, 26; discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Monthly discharge of Fryingpan Creek at Norrie, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	87	58	72.4	4,450
November	65	32	40.5	2,410
December	44	26	35.2	2,160
January	37	26	30.0	1,840
February	26	22	24.2	1,340
March	44	18	23.0	1,410
The period				13,600

FRYINGPAN CREEK AT THOMASVILLE, COLO.

LOCATION.—In sec. 7, T. 8 S., R. 83 W., at private bridge 1,000 feet southwest of railroad station at Thomasville, Pitkin County. Nearest tributary, Deadman Gulch, enters a quarter of a mile below.

DRAINAGE AREA.—175 miles (measured on forest atlas and topographic map).

RECORDS AVAILABLE.—February 26, 1915, to September 30, 1917. From January 2, 1911, to February 25, 1915, station was maintained 1 mile downstream where drainage area was 190 square miles.

GAGE.—Vertical staff on upstream side of right bridge abutment; read by J. H. Swineford. Gage at original section was vertical staff attached to side of center bridge pier. No determined relation between two gages.

DISCHARGE MEASUREMENTS.—Made from single span bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of large boulders and is rough; no well-defined control; practically permanent during 1917. Banks will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage during year from high-water marks, 7 feet at 9 a. m. June 18 (discharge, 2,780 second-feet); minimum stage recorded, 1.20 feet March 15 (discharge, 34 second-feet).

ICE.—Stage-discharge relation affected by ice; flow estimated from discharge measurements, observer's notes, and records of temperature.

DIVERSIONS.—No court decrees for diversion of water above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice. Rating curve well defined between 40 and 1,800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records only fair as mean of two daily readings probably does not give true mean for day at all times.

Discharge measurements of Fryingpan Creek at Thomasville, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	P. V. Hodges	1.75	115	Jan. 14	T. J. Watkins	1.33	49.7
Dec. 15	T. J. Watkins	1.59	75	June 19	H. W. Fear	5.60	1,910

Daily discharge, in second-feet, of Fryingpan Creek at Thomasville, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	120	84	57	56	38	42	40	165	1,160	2,600	252	87
2	110	72	59	56	38	41	39	187	1,220	2,000	259	84
3	110	76	59	56	36	41	39	198	1,440	1,940	236	84
4	105	69	61	56	39	40	40	206	1,660	1,940	268	84
5	98	69	62	56	39	39	42	206	1,710	1,660	285	84
6	98	62	62	54	39	36	40	221	1,600	1,710	272	76
7	101	62	66	50	40	36	40	215	1,800	1,600	236	69
8	101	62	66	46	42	36	39	227	1,950	1,520	252	69
9	105	62	62	46	39	38	40	227	2,000	1,440	198	69
10	110	59	62	44	40	36	42	215	2,100	1,320	206	69
11	110	56	69	44	42	36	43	278	2,150	1,320	195	62
12	110	56	66	44	42	38	42	236	2,200	1,160	165	69
13	110	54	62	46	39	36	42	236	2,300	1,050	141	69
14	116	54	62	50	44	36	46	259	2,350	735	116	76
15	120	56	62	46	44	34	44	236	2,400	675	110	69
16	110	56	66	44	44	36	50	246	2,450	575	120	69
17	110	56	62	44	42	37	49	227	2,500	427	120	69
18	116	56	62	44	42	38	46	246	2,500	480	120	69
19	120	56	62	44	42	36	46	259	2,450	480	141	69
20	110	56	62	44	42	37	43	338	2,200	395	141	69
21	110	56	61	44	42	36	46	375	1,940	395	141	69
22	120	56	59	46	41	36	50	395	2,030	395	130	69
23	120	56	59	44	41	37	54	480	1,970	395	120	69
24	137	56	62	42	41	38	56	525	1,940	395	120	62
25	130	56	59	44	41	39	50	575	2,000	355	101	69
26	110	56	56	40	41	41	44	650	2,030	355	105	69
27	110	57	56	40	40	49	50	802	2,060	320	105	69
28	101	56	56	44	42	50	61	885	2,060	320	101	69
29	87	59	56	44	.....	46	56	819	2,000	288	92	69
30	84	56	56	42	.....	42	44	968	2,000	268	92	69
31	84	.....	56	42	.....	45	.....	1,160	.....	252	84	.....

NOTE.—Stage-discharge relation affected by ice Nov. 11–16, Dec. 3–5, 14, 18–22, 26–31, Jan. 2–3, 5–9, and 11–15; discharge based on temperature and gage-height records, discharge measurements, and observer's notes. No gage-height record Feb. 18–24 and June 7–20. Discharge interpolated Feb. 18–24, and based on comparative hydrograph of Roaring Fork at Glenwood Springs June 7–20.

Monthly discharge of Fryingpan Creek at Thomasville, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	137	84	109	6,700
November	84	54	58.9	3,500
December	69	56	60.9	3,740
January	56	40	46.5	2,860
February	44	36	40.8	2,270
March	50	34	39.0	2,400
April	61	39	45.4	2,700
May	1,160	165	396	24,300
June	2,500	1,160	2,010	120,000
July	2,000	252	909	55,900
August	285	84	162	9,960
September	87	62	71.6	4,260
The year	2,500	34	329	239,000

NORTH FORK OF FRYINGPAN CREEK NEAR NORRIE, COLO.

LOCATION.—In sec. 21, T. 8 S., R. 83 W., at highway bridge about 1 mile from Norrie, Pitkin County, in Sopris National Forest. No tributaries below.

DRAINAGE AREA.—42 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 18, 1911, to March 31, 1917.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by United States Forest Service.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of small boulders and is rough. No well-defined control; shifts between narrow limits. Banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.90 foot at 7.30 a. m. October 18 and at 10 a. m. October 22 (discharge, 52 second-feet); minimum stage recorded, 0.15 foot October 10–21 (discharge, 6 second-feet).

ICE.—Stage-discharge relation affected by ice; discharge determined from observer's notes and temperature records.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts between narrow limits; affected by ice for short period during winter. Rating curve fairly well defined between 5 and 60 second-feet. Gage read to hundredths once daily, but there are many days with no record. Daily discharge ascertained by applying daily gage height to rating table and by interpolation for days when gage was not read. Records fair.

The following discharge measurement was made by P. V. Hodges:
October 13, 1916—gage height, 0.60 foot; discharge, 22.5 second-feet.

Daily discharge, in second-feet, of North Fork of Fryingpan Creek near Norrie, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	28	19	13	8	7	7	16	26	15	9	7	7	6
2	24	16	12	8	7	7	17	46	15	9	7	7	6
3	25	12	12	8	7	7	18	50	15	9	7	7	6
4	25	12	12	8	7	7	19	48	16	10	7	7	6
5	24	13	12	8	7	7	20	48	16	10	7	7	6
6	24	14	12	8	7	7	21	46	16	10	7	7	6
7	25	14	12	8	7	7	22	52	16	10	7	7	6
8	25	14	12	8	7	7	23	46	16	10	7	7	7
9	22	14	10	8	7	6	24	41	14	10	7	7	7
10	24	14	11	8	7	6	25	36	12	10	7	7	7
11	25	15	10	8	7	6	26	32	13	10	7	7	7
12	25	15	10	8	7	6	27	30	13	9	7	7	7
13	25	15	10	7	7	6	28	28	14	9	7	7	7
14	25	15	10	7	7	6	29	22	14	9	7	.....	7
15	26	15	9	7	7	6	30	16	14	9	7	.....	8
							31	22	.....	9	7	.....	8

NOTE.—Stage-discharge relation affected by ice Nov. 9–19; discharge based on temperature record and observer's notes.

Monthly discharge of North Fork of Fryingpan Creek near Norrie, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	52	16	31.0	1,910
November	19	12	14.5	863
December	13	9	10.3	633
January	8	7	7.4	455
February	7	7	7.0	389
March	8	6	6.6	406
The period	.....	.....	.....	4,660

CRYSTAL RIVER AT MARBLE, COLO.

LOCATION.—In sec. 26, T. 11 S., R. 88 W., at electric railway bridge of Colorado-Yule Marble Co., at Marble, Gunnison County. Nearest tributary, Carbonate Creek, enters at Marble.

DRAINAGE AREA.—77 square miles (measured on forest atlas).

RECORDS AVAILABLE.—November 1, 1910, to August 18, 1917.

GAGE.—Vertical hook gage graduated to hundredths of a foot, on downstream side of left abutment; read by F. V. Mueller.

DISCHARGE MEASUREMENTS.—Made from railroad bridge 400 feet upstream or by wading.

CHANNEL AND CONTROL.—Channel is slightly rocky, but at section is smooth, having been cleared out to form regular section; shifts between narrow limits. Banks are overflowed slightly, but all water passes under bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.15 feet at 6 p. m. June 29 (discharge, 2,180 second-feet); minimum stage, 1.70 feet March 2 (discharge, 18 second-feet).

ICE.—Stage-discharge relation little, if at all, affected by ice, but occasionally affected by snow slides.

DIVERSIONS.—Court decrees for diversions of 114 second-feet below station; none for diversions above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation assumed to be permanent, although no discharge measurements were made after high water. Rating curve not well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean of two daily readings to rating table. Records fair.

Discharge measurements of Crystal River at Marble, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 19	P. V. Hodges	2.76	118
Jan. 11	T. J. Watkins	2.00	29.9
June 16	H. W. Fear	5.45	1,250

Daily discharge, in second-feet, of Crystal River at Marble, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	180	75	56	39	42	32	33	54	140	1,960	369
2	152	75	51	40	26	18	30	56	129	1,700	257
3	111	75	47	40	28	29	29	58	188	1,630	257
4	104	73	49	33	30	40	25	56	269	1,550	252
5	108	70	47	33	28	25	29	49	284	1,720	252
6	157	67	47	33	25	24	28	51	272	1,590	252
7	218	68	43	32	33	36	25	52	307	1,450	249
8	198	68	32	36	32	36	32	55	433	1,470	252
9	161	69	42	30	29	24	38	50	805	1,510	246
10	148	64	43	30	28	26	40	55	945	1,420	252
11	174	66	44	31	29	24	46	60	923	1,320	249
12	168	59	42	30	29	24	53	61	967	1,220	246
13	160	46	40	29	29	24	61	80	1,180	1,160	252
14	152	44	40	29	29	24	64	170	1,340	1,150	246
15	144	53	40	29	29	23	49	269	1,560	1,040	246
16	136	55	38	29	29	22	52	316	1,670	945	240
17	128	55	37	29	28	22	61	355	1,650	820	240
18	120	61	39	29	28	22	66	400	1,720	785	240
19	125	59	39	29	22	22	68	416	1,750	785	.....
20	120	57	39	22	25	23	66	362	1,500	695	.....
21	115	54	39	24	26	23	68	246	1,600	675	.....
22	110	52	40	32	26	23	72	213	1,730	645	.....
23	104	54	42	32	27	24	83	200	1,780	785	.....
24	105	54	40	28	27	24	116	188	1,810	775	.....
25	113	49	40	29	24	24	122	193	1,910	795	.....
26	88	50	36	28	26	25	111	176	1,940	775	.....
27	85	51	38	55	27	25	78	154	1,960	725	.....
28	84	52	32	30	38	26	67	148	1,950	562	.....
29	85	53	38	28	.....	29	68	161	1,960	540	.....
30	80	54	35	27	.....	32	61	170	2,110	518	.....
31	74	.....	36	24	.....	29	.....	154	.....	540	.....

NOTE.—Gage not read Oct. 12–17, 20–22, Nov. 26–30, Mar. 17–27, July 10, 29, Aug. 5; discharge interpolated.

Monthly discharge of Crystal River at Marble, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	218	74	129	7,930
November	75	44	59.4	3,530
December	56	32	41.0	2,520
January	55	22	31.3	1,920
February	42	22	28.5	1,580
March	40	18	25.9	1,590
April	122	25	58.0	3,450
May	416	49	162	9,960
June	2,110	129	1,230	73,200
July	1,960	517	1,070	65,800
August 1–18	369	240	255	9,100
The period	.....	.....	.....	181,000

TAYLOR RIVER AT ALMONT, COLO.

LOCATION.—In sec. 22, T. 51 N., R. 1 E. New Mexico principal meridian, at highway bridge at Almont, Gunnison County, 300 feet above junction of Taylor and East rivers.

DRAINAGE AREA.—413 square miles (measured on forest atlas).

RECORDS AVAILABLE.—July 27, 1910, to September 30, 1917.

GAGE.—Vertical staff on downstream side of center pier.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Channel composed of small boulders and coarse gravel. Banks not subject to overflow. Control practically permanent.

EXTREMES OF DISCHARGE.—No data, as only mean daily gage heights are furnished.

ICE.—Stage-discharge relation affected by ice during winter. Discharge based on temperature and gage-height record, discharge measurements, and observer's notes.

DIVERSIONS.—No court decrees for diversions from Taylor River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 100 and 2,000 second-feet; poorly defined above 2,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. As the reliability of the gage-height record is questionable, the results are considered only fair.

COOPERATION.—Gage-height record furnished by United States Reclamation Service except during winter when they were furnished by United States Forest Service.

Discharge measurements of Taylor River at Almont, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	P. V. Hodges	2.15	280	Feb. 22	T. J. Watkins	*a* 2.30	144
Dec. 18	T. J. Watkins	*a* 2.38	199	June 7	H. W. Fear	2.95	828
Jan. 19	....do	*a* 2.50	112				

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Taylor River at Almont, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	232	210	132	132	77	151	132	210	610	2,100	610	291
2	232	210	132	132	102	132	151	210	610	1,860	500	291
3	232	210	132	132	151	117	170	210	690	1,780	465	291
4	232	210	132	132	151	132	132	210	830	1,700	465	291
5	232	210	132	132	132	132	132	190	990	1,540	465	291
6	232	210	132	132	132	132	132	151	935	1,540	465	291
7	232	210	132	132	132	132	132	190	935	1,460	435	291
8	465	210	132	132	132	132	151	170	1,110	1,310	405	291
9	378	210	132	132	132	132	132	170	1,700	1,460	378	291
10	378	210	132	117	132	132	151	232	2,020	1,240	405	291
11	378	210	132	102	132	132	170	325	2,100	1,110	465	281
12	378	170	132	117	132	132	170	465	2,020	1,110	405	281
13	378	170	132	151	151	132	170	780	2,260	1,110	535	281
14	378	151	151	151	132	132	170	880	2,500	1,050	465	281
15	378	151	151	151	132	132	190	935	2,660	1,050	435	281
16	378	151	170	132	117	132	132	1,380	2,980	880	405	281
17	378	151	170	117	132	132	132	1,310	3,220	780	465	281
18	378	151	190	117	170	132	151	990	3,300	735	435	258
19	325	132	190	117	151	132	170	990	3,140	780	378	236
20	325	151	170	102	151	170	132	935	2,820	880	350	236
21	325	151	170	77	151	170	151	690	2,660	690	350	227
22	378	170	151	77	151	170	253	690	2,500	735	350	206
23	378	170	151	102	132	132	405	690	2,500	690	350	186
24	378	170	132	117	132	151	690	690	2,500	935	350	186
25	325	151	132	132	132	170	650	690	2,500	1,240	350	186
26	325	132	132	132	151	170	690	650	2,340	1,460	350	186
27	253	132	102	132	151	132	535	610	2,260	1,050	350	186
28	210	132	102	132	151	132	465	610	2,180	780	350	186
29	253	132	132	132	.....	132	378	610	2,180	690	350	186
30	253	132	132	132	.....	132	210	610	2,180	690	325	186
31	210	.....	132	132	.....	132	.....	610	.....	690	300	.....

NOTE.—Stage-discharge relation affected by ice Dec. 12-Mar. 17; discharge based on temperature and gage-height record, discharge measurements, and observer's notes.

Monthly discharge of Taylor River at Almont, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	465	210	316	19,400
November	210	132	172	10,200
December	190	102	141	8,670
January	151	77	124	7,620
February	170	77	137	7,610
March	170	117	139	8,550
April	690	132	248	14,800
May	1,380	151	583	35,800
June	3,300	610	2,040	121,000
July	2,100	690	1,130	69,500
August	610	300	410	25,200
September	291	186	251	14,900
The year	3,300	77	475	343,000

GUNNISON RIVER NEAR GUNNISON, COLO.

LOCATION.—In sec. 3, T. 49 N., R. 1 W. New Mexico principal meridian, at highway bridge 2 miles southwest of Gunnison, Gunnison County. Nearest tributary, Tomichi Creek, enters 1 mile below.

DRAINAGE AREA.—1,010 square miles (measured on Hayden's atlas).

RECORDS AVAILABLE.—November 27, 1910, to November 30, 1914; April 27, 1916, to September 30, 1917.

GAGE.—Bristol water-stage recorder on downstream side of right abutment, referred to chain gage in center of bridge. April 27 to September 30, 1916, gage referred to vertical staff at right abutment having datum 0.15 foot higher. Read by C. W. Chinery.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and small boulders and will shift during high water; control at well-defined rapids below bridge; will shift occasionally. Banks not subject to overflow except during extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 4.2 feet on June 22 (discharge, 6,250 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—There are court decrees for the diversion of 274 second-feet of water from Gunnison River between this station and the forks at Almont.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve well defined between 200 and 5,000 second-feet. Operation of the water-stage recorder fairly satisfactory throughout the period. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph. Records good.

Discharge measurements of Gunnison River near Gunnison, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	P. V. Hodges	0.30	562	Apr. 8	Robert Follansbee	[a]0.09	248
Dec. 17	T. J. Watkins		311	June 6	H. W. Fear	[a]1.63	1,890
Jan. 18	do		309	Aug. 18	do	[a].91	873
Feb. 21	do		192				

[a] Original datum.

Daily discharge, in second-feet, of Gunnison River near Gunnison, Colo., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1....	.....	626	1,410	4,590	1,690	470	16....	390	2,930	5,130	2,060	879	494
2....	.....	626	1,410	4,250	1,620	404	17....	323	3,170	5,130	1,920	940	448
3....	.....	645	1,540	4,000	1,540	448	18....	440	3,330	5,680	1,760	903	440
4....	.....	626	2,060	3,910	1,330	384	19....	345	3,330	5,680	1,990	789	410
5....	.....	664	2,370	3,820	1,260	425	20....	365	2,690	5,490	1,760	746	397
6....	.....	485	1,920	3,820	1,160	404	21....	455	2,140	5,680	1,690	664	364
7....	.....	485	2,140	3,570	1,060	397	22....	746	1,920	5,490	1,760	626	390
8....	239	528	2,610	3,410	1,000	364	23....	1,010	1,690	5,870	1,760	579	390
9....	268	448	3,410	3,330	940	432	24....	1,270	1,690	5,490	1,920	544	390
10....	301	528	4,080	3,250	879	410	25....	1,390	1,690	5,310	2,140	502	364
11....	340	757	4,250	3,090	1,130	410	26....	1,540	1,620	5,310	2,610	579	390
12....	404	1,050	4,080	2,770	1,060	418	27....	1,260	1,470	5,310	2,370	432	371
13....	478	1,300	4,340	2,930	1,130	455	28....	1,060	1,500	5,130	2,060	519	378
14....	404	2,060	4,590	2,370	1,060	485	29....	857	1,530	4,950	1,920	510	371
15....	404	2,530	4,950	2,370	879	485	30....	626	1,480	4,950	1,990	502	358
							31....	.....	1,480	.....	1,840	494	.....

NOTE.—Discharge Aug. 26–Sept. 30; computed by indirect method for shifting control.

Monthly discharge of Gunnison River near Gunnison, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April 8–30	1,540	239	648	29,600
May	3,330	448	1,520	93,500
June	5,870	1,410	4,190	249,000
July	4,590	1,690	2,680	165,000
August	1,690	432	901	55,400
September	494	358	412	24,500
The period	.....	.....	.....	617,000

GUNNISON RIVER NEAR GRAND JUNCTION, COLO.

LOCATION.—In NW. ¼ sec. 35, T. 1 S., R. 1 W., a quarter of a mile below Redlands Irrigation & Power Co.'s canal and 1½ miles above mouth of Gunnison River, Grand Junction, Mesa County, below all tributaries.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 1 to September 30, 1917. From October 19, 1894, to December 21, 1895, and May 2, 1897, to September 30, 1899, station maintained nearer mouth.

GAGE.—Vertical staff at left bank one-quarter mile below canal intake; read by employee of Redlands Irrigation & Power Co. Original gage vertical staff attached to wall of D. & R. G. pump house some distance below present site. Moved July 5, 1895, to highway bridge one mile below present gage. Relation between different gages not determined.

DISCHARGE MEASUREMENTS.—Made from cable at gage section.

CHANNEL AND CONTROL.—Channel composed of gravel well compacted, permanent; control at rapids 500 feet downstream; apparently permanent. Banks high and not subject to overflow.

EXTREMES OF STAGE.—Maximum stage recorded 12.0 feet at 5 p. m. June 18, and 7 p. m. June 19 (discharge, 25,000 second-feet); minimum stage, 1.7 feet on September 5, 8, and 9 (discharge, 350 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Below all diversions from Gunnison River. Most of water diverted through Redlands canal is for pumping and is returned to Grand River below the Gunnison.

COMBINED FLOW.—The combined flow of Gunnison River and Redlands power canal represents the flow of Gunnison River, which enters the Grand River less about 25 second-feet which is used during the irrigation season.

ACCURACY.—River: Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 300 and 22,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to the rating table. Records excellent.

Power canal: The Redlands Irrigation & Power Co. maintain a station on the canal and the daily discharge is furnished complete.

COOPERATION.—Daily gage-height record for station on river furnished by Redlands Irrigation & Power Co.

Discharge measurements of Gunnison River near Grand Junction, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
June 14	Fear and Oliver	11.11	21,400	Sept. 9	H. R. Oliver	1.75	365
July 23	Follansbee and Oliver	4.19	2,850				

Daily discharge, in second-feet, of Gunnison River near Grand Junction, Colo., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,490	4,470	9,570	14,500	3,280	448
2	1,380	3,040	8,660	12,800	2,720	412
3	1,180	5,360	9,050	11,300	2,930	430
4	1,100	5,360	11,400	10,400	1,890	430
5	1,060	5,050	13,400	9,700	1,660	350
6	990	5,160	13,700	8,920	1,730	628
7	1,130	4,560	12,400	8,400	2,110	610
8	1,180	4,760	12,800	8,400	1,620	390
9	1,230	4,280	12,100	7,900	1,100	350
10	1,890	4,020	20,200	7,540	950	375
11	2,140	4,320	23,400	7,660	926	390
12	2,020	5,470	22,600	7,160	1,160	568
13	2,580	6,210	21,200	6,100	2,050	508
14	3,600	8,150	21,400	5,680	2,700	742
15	3,520	12,400	22,600	4,850	2,470	640
16	3,040	17,600	24,200	4,660	1,690	610
17	2,420	19,400	24,200	4,190	1,440	628
18	1,950	21,000	24,800	3,570	1,540	568
19	2,420	21,000	24,600	3,440	1,690	550
20	2,020	17,600	23,800	3,410	1,200	520
21	1,710	15,200	21,400	3,520	910	520
22	1,830	13,300	20,200	3,250	830	520
23	3,600	12,400	19,900	2,930	628	520
24	5,680	12,900	20,000	3,410	580	490
25	7,320	12,000	18,700	5,110	580	460
26	7,780	10,800	18,600	4,100	490	490
27	7,900	10,100	18,100	4,380	460	830
28	7,430	10,100	16,700	4,100	448	760
29	7,200	10,200	15,300	3,200	448	730
30	7,320	10,500	14,400	3,250	472	580
31	.....	11,600	.....	3,570	490	.....

Daily discharge, in second-feet, of Redlands power canal near Grand Junction, Colo., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1....	0	385	405	450	410	230	16...	330	320	0	435	400	370
2....	120	385	415	445	385	230	17...	320	385	0	440	400	370
3....	140	390	420	450	375	240	18...	300	400	0	430	425	375
4....	215	385	420	445	380	240	19...	325	405	0	445	410	360
5....	200	400	430	450	390	190	20...	325	415	0	445	400	345
6....	200	385	425	450	420	305	21...	315	410	0	460	390	335
7....	200	390	425	450	440	310	22...	330	400	425	370	390	335
8....	0	390	430	450	400	170	23...	370	400	435	370	340	340
9....	215	385	430	450	390	155	24...	365	410	435	410	360	320
10....	240	390	430	450	390	205	25...	330	410	450	435	320	340
11....	255	390	425	460	430	230	26...	355	405	450	430	295	320
12....	290	390	440	460	425	340	27...	380	0	450	425	260	390
13....	330	380	450	450	430	275	28...	385	0	445	420	255	360
14....	360	390	450	450	440	410	29...	385	0	445	390	250	350
15....	320	400	0	435	430	365	30...	385	0	450	410	260	295
							31...	.....	390	.....	430	250	.....

NOTE.—Daily discharge taken from hydrograph furnished by the Redlands Irrigation & Power Co.

Monthly discharge of Gunnison River near Grand Junction, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April	7,900	990	3,200	190,000
May	21,000	3,040	9,950	612,000
June	24,800	8,660	18,000	1,070,000
July	14,500	2,930	6,170	379,000
August	3,280	448	1,390	85,500
September	830	350	535	31,800
The period				2,370,000

Monthly discharge of Redlands power canal near Grand Junction, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April	385	0	276	16,400
May	415	0	341	21,000
June	450	0	333	19,800
July	460	370	435	26,700
August	440	250	372	22,900
September	410	155	303	18,000
The period				125,000

Combined monthly discharge of Gunnison River and Redlands power canal near Grand Junction, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April	8,280	1,180	3,480	207,000
May	21,400	3,420	10,300	633,000
June	24,800	9,080	18,300	1,090,000
July	15,000	3,300	6,610	406,000
August	3,690	698	1,770	109,000
September	1,220	505	838	49,900
The period				2,490,000

EAST RIVER AT ALMONT, COLO.

LOCATION.—In sec. 22, T. 51 N., R. 1 E., at highway bridge at Almont, in Gunnison County, 100 feet above junction of East and Taylor rivers.

DRAINAGE AREA.—295 square miles (measured on forest atlas).

RECORDS AVAILABLE.—July 27, 1910, to September 30, 1917. From April 15 to October 8, 1905, a station was maintained at this point, gage being referred to different datum.

GAGE.—Vertical staff on downstream side of right abutment; read by Henry T. Miller.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Channel composed of small boulders and coarse gravel; station may be within the influence of backwater from Taylor River during extreme high water; control slightly shifting at ordinary stages.

EXTREME OF DISCHARGE.—No data.

ICE.—Stage-discharge relation affected by ice during winter.

DIVERSIONS.—There are court decrees for diversion of 78 second-feet from East River.

ACCURACY.—Stage-discharge relation slightly shifting, affected by ice during winter. Rating curve well defined between 80 and 1,800 second-feet, somewhat uncertain above that point. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except during high water, when they are fair owing to difficulty in reading gage accurately.

COOPERATION.—Gage heights furnished by United States Reclamation Service.

Discharge measurements of East River at Almont, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	P. V. Hodges	1.30	194	Feb. 22	T. J. Watkins	*a* 1.10	68
Dec. 18	T. J. Watkins	*a* 2.60	108	June 7	H. W. Fear	2.25	936
Jan. 19	.....do	*a* 1.00	48.7				

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of East River at Almont, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	192	192	120	75	85	315	745	2,060	605	175
2	192	175	120	75	85	315	745	1,710	565	175
3	192	175	120	75	85	255	905	1,600	488	175
4	192	175	120	75	85	255	1,020	1,600	488	175
5	192	175	120	75	85	255	1,140	1,480	450	175
6	192	175	120	75	85	285	962	1,480	450	175
7	192	175	120	75	85	315	1,080	1,250	450	175
8	380	175	75	75	85	315	1,190	1,250	415	175
9	232	175	80	75	85	315	1,650	1,310	380	175
10	232	175	92	75	85	415	2,170	1,360	380	175
11	232	160	100	75	100	525	2,230	1,250	450	175
12	232	120	100	75	132	650	2,110	1,080	450	175
13	232	85	110	75	160	745	2,520	1,080	450	175
14	232	100	110	75	160	1,020	2,580	1,080	415	175
15	232	120	110	75	160	1,310	2,880	1,020	380	175
16	232	120	110	80	145	1,420	3,240	905	348	175
17	232	120	110	75	145	1,480	3,480	1,020	315	175
18	232	120	110	75	145	1,600	3,540	905	315	175
19	232	120	110	75	120	1,480	3,420	745	315	175
20	232	120	100	75	110	1,420	3,060	745	285	175
21	232	120	100	75	132	1,250	2,940	745	255	175
22	232	120	100	75	232	1,190	2,880	745	232	145
23	232	120	100	80	285	962	2,940	695	210	120
24	232	120	100	75	415	795	2,940	745	210	120
25	232	120	100	85	488	795	3,000	850	210	120
26	210	120	80	85	525	745	3,000	905	210	120
27	192	120	47	85	450	695	2,520	795	210	120
28	192	120	47	85	450	745	2,340	650	210	120
29	192	120	56	85	315	795	2,280	605	210	120
30	192	120	60	85	315	795	2,280	650	175	120
31	192	120	60	85	.....	795	.....	650	175	.....

NOTE.—Stage-discharge relation affected by ice Nov. 13–14, Dec. 8–31, Mar. 1–21; discharge based on temperature and gage-height records, discharge measurements, and observer's notes.

Monthly discharge of East River at Almont, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	380	192	221	13,600
November	192	85	142	8,450
December	120	47	97.0	5,960
January	.....	.....	52.9	3,250
February	.....	.....	66.8	3,710
March	85	75	77.6	4,770
April	525	85	194	11,500
May	1,600	255	782	48,100
June	3,540	745	2,260	134,000
July	2,060	605	1,060	65,200
August	605	175	345	21,200
September	175	120	159	9,460
The year	3,540	.....	456	329,000

NOTE.—Stage-discharge relation affected by ice January and February. Discharge based on temperature and gage-height record, discharge measurements, and observer's notes.

TOMICHI CREEK AT SARGENTS, COLO.

LOCATION.—In NW. ¼ sec. 28, T. 48 N., R. 5 E., at railroad bridge three-quarters of a mile west of Sargents, Saguache County. Nearest tributary, Marshall Creek, enters one-quarter mile above.

DRAINAGE AREA.—145 square miles (measured on forest atlas).

RECORDS AVAILABLE.—May 12 to September 30, 1917.

GAGE.—Vertical staff attached to downstream piling of railroad bridge. Read by W. S. Cole.

DISCHARGE MEASUREMENTS.—Made from pile bent railroad bridge. Medium and low water measurements made by wading.

CHANNEL AND CONTROL.—Composed of gravel, shifting; control 30 feet downstream at small rapids of compact gravel; apparently permanent during 1917.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 4.05 feet at 6 a. m. June 16 (discharge, 622 second-feet); minimum stage, 1.7 feet at 7 a. m. September 25 (discharge, 30 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—A few small ditches divert water for irrigation above Sargents.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve is well defined between 20 and 500 second-feet. Gage is read to quarter-tenths once daily except during high water when it is read twice daily. Daily discharge ascertained by applying the one daily gage reading or the mean of two daily gage readings to the rating table. Records excellent.

Discharge measurements of Tomichi Creek at Sargents, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 12	Robert Follansbee	2.08	68	June 7	H. W. Fear	2.90	267
19	....do	2.80	189	July 19	Robert Follansbee	2.38	107

Daily discharge, in second-feet, of Tomichi Creek at Sargents, Colo., for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1		134	170	82	44	16	142	495	93	59	37
2		126	160	82	39	17	170	467	89	61	34
3		146	130	89	39	18	200	427	95	59	34
4		190	130	76	37	19	200	415	109	57	30
5		235	112	70	34	20	192	387	93	54	30
6		192	104	64	32	21	170	387	82	49	30
7		220	104	64	37	22	154	348	82	49	34
8		257	121	59	37	23	140	348	89	49	34
9		375	140	59	37	24	146	313	96	47	34
10		475	170	64	34	25	166	250	121	47	30
11		483	140	64	34	26	146	257	130	44	37
12	68	523	112	64	49	27	134	244	112	44	37
13	64	515	104	68	34	28	130	244	89	44	34
14	77	604	96	70	39	29	132	215	89	49	34
15	123	575	96	59	44	30	138	190	89	44	34
						31	128		96	44	

Monthly discharge of Tomichi Creek at Sargents, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May 12-31	200	64	141	5,590
June	604	126	335	19,900
July	170	82	111	6,820
August	89	44	59.2	3,640
September	49	30	35.8	2,130
The period				38,100

CRYSTAL CREEK NEAR MAHER, COLO.

LOCATION.—In sec. 35, T. 50 N., R. 6 W., at old Kruemling ranch, 300 feet above head gate of Fruitland Irrigation Co.'s ditch, 8 miles southeast of Maher, Montrose County. Nearest important tributary, North Fork, enters 1 mile above.

DRAINAGE AREA.—26 square miles (measured on forest atlas).

RECORDS AVAILABLE.—April 6 to September 30, 1917.

GAGE.—Vertical staff attached to downstream left abutment of highway bridge; read by V. S. Meek.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—Channel of compact gravel; permanent. Control at small rapids of compact gravel 40 feet downstream; permanent during 1917. Banks will be overflowed at stage of 4 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded 3.2 feet at 8.30 p. m. June 13 (discharge, 419 second-feet); minimum stage recorded 0.02 foot September 1 and 3 (discharge, 0.1 second foot).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Above station, Cedar Canyon and Iron Springs ditch has adjudicated decree for 50 second-feet. Below station, the Fruitland Irrigation Co.'s ditch diverts water into the Onion Valley reservoir.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined below 350 second-feet. Gage read to quarter-tenths twice daily, except during August and September when it was read about three times weekly. Daily discharge ascertained by applying to the rating table the mean of two daily readings, and the gage reading taken three times weekly. For days of missing record the discharge is interpolated. Records good.

Discharge measurements of Crystal Creek near Maher, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 6	Robert Follansbee	0.33	5.4	June 11	H. W. Fear	2.68	328
May 14	do	1.24	91	July 20	Robert Follansbee	.09	.5
14	do	1.62	166				

Daily discharge, in second-feet, of Crystal Creek near Maher, Colo., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	53	136	107	0.5	0.1	16	14	249	307	5	.3	5
2	.....	56	171	84	.5	.1	17	14	297	307	5	.3	8
3	.....	52	206	56	.4	.1	18	14	332	302	3	.2	8
4	.....	51	197	47	.4	.2	19	14	327	293	2	.2	9
5	.....	53	267	24	.4	.2	20	13	161	292	.6	.2	9
6	6	53	280	19	.4	.2	21	16	155	297	.5	.2	9
7	6	53	241	15	.4	.2	22	42	149	292	.5	.2	9
8	6	62	269	12	.4	.2	23	63	141	281	.5	.2	9
9	7	62	399	13	.4	.4	24	99	126	267	.8	.2	9
10	7	71	405	10	.4	.5	25	187	131	259	.5	.2	9
11	9	82	387	10	.4	1	26	155	125	245	.4	.2	9
12	16	125	371	12	.4	2	27	94	123	225	.5	.2	12
13	26	149	395	9	.4	2	28	71	125	216	.8	.2	15
14	31	149	399	9	.4	2	29	70	131	205	.8	.2	15
15	22	171	365	7	.4	2	30	62	129	173	.6	.2	15
							31	.....	139	.....	.6	.1	.....

Monthly discharge of Crystal Creek near Maher, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April 6-30	187	6	42.6	2,110
May	332	51	132	8,120
June	405	136	282	16,800
July	107	.4	14.7	904
August	.5	.1	.31	19.1
September	15	.1	5.37	320
The period				28,300

LEROUX CREEK NEAR LAZEAR, COLO.

LOCATION.—In sec. 33, T. 13 S., R. 93 W., at highway bridge about 8 miles north of Lazear, Delta County. No important tributary within several miles.

DRAINAGE AREA.—52 square miles (measured on forest atlas).

RECORDS AVAILABLE.—May 15 to July 20, 1917.

GAGE.—Vertical staff fastened to downstream side of left bridge abutment; July 20, 1917, gage moved to face of abutment and datum lowered 0.40 foot; read by J. E. Hansen.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of gravel and boulders, very rough; control 50 feet downstream, apparently permanent during 1917.

EXTREMES OF DISCHARGE.—Maximum stage recorded 3.95 feet at 7.30 p. m., June 17 (discharge, 1,420 second-feet).

ICE.—No data.

DIVERSIONS.—Adjudicated decrees for diversion of 55 second-feet from Leroux Creek above station. Of this 33 second-feet are for diversion out of the drainage basin. Below, adjudicated decrees for 290 second-feet.

ACCURACY.—Stage-discharge relation apparently permanent. Rating curve well defined below 800 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to the rating table. Records good.

COOPERATION.—Daily gage heights furnished through courtesy of Mr. J. E. Hansen.

Discharge measurements of Leroux Creek near Lazear, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 15	Follansbee and Getty	2.13	244
June 10	H. W. Fear	3.15	808
July 20	Baily and Getty	1.31	59

Daily discharge, in second-feet, of Leroux Creek near Lazear, Colo., for the year ending Sept. 30, 1917.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1		90	11		1,060	21	263	1,060
2		90	12		1,100	22	266	1,100
3		175	13		948	23	270	1,020
4		380	14		875	24	270	948
5		332	15	246	1,020	25	235	875
6		310	16	260	1,020	26	126	750
7		405	17	275	1,300	27	126	705
8		520	18	290	1,220	28	101	298
9		840	19	310	1,160	29	77	282
10		805	20	286	1,080	30	88	282
						31	83	

NOTE.—No gage-height record May 16–17, 20, 22, and June 24; discharge interpolated.

Monthly discharge of Leroux Creek near Lazear, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May 15–31	310	77	210	7,080
June	1,300	90	735	43,700

SURFACE CREEK AT CEDAREDGE, COLO.

LOCATION.—About sec. 29, T. 13 S., R. 94 W., at Cedaredge, Delta County. Nearest tributary, Mill Creek, enters 4 miles above.

DRAINAGE AREA.—43 square miles (measured on forest atlas).

RECORDS AVAILABLE.—May 16 to September 30, 1917.

GAGE.—Lallie water-stage recorder referred to vertical staff fastened to right concrete abutment of footbridge 400 feet upstream from highway bridge in Cedaredge.

DISCHARGE MEASUREMENT.—Made from footbridge at gage section.

CHANNEL AND CONTROL.—Channel of small boulders; control is old concrete weir located 12 feet downstream. Channel behind control is filled with boulders and gravel. Above stage 0.7 foot water flows through an overflow channel which may shift somewhat.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 1.75 feet on June 24 (discharge, 550 second-feet); minimum discharge, 0.10 foot September 29 and 30 (discharge, 2 second-feet).

ICE.—No data. Flow was very small as most of it is stored during winter.

DIVERSIONS.—Adjudicated decrees for diversions of 142 second-feet from Surface Creek above station of which 67 second-feet are for diversion out of the drainage basin. Below, adjudicated decrees for 272 second-feet.

REGULATION.—Alternate melting and freezing of snow in mountains caused diurnal fluctuation during spring. Adjudicated decrees for storage of 8,140 acre-feet on headwaters of Surface Creek. The release of this flow during irrigation season changes the natural flow.

ACCURACY.—Stage-discharge relation apparently permanent. Rating curve well defined below 500 second-feet. Gage read to hundredths twice daily May 16 to June 29. The water-stage recorder gave fairly satisfactory results June 30 to September 30, except for occasional short periods as explained in the footnote. Daily discharge ascertained by applying to the rating table the mean daily gage heights, obtained from two daily readings and from inspecting the gage-height graph. Records good.

Discharge measurements of Surface Creek at Cedaredge, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 26	H. C. Getty	0.78	68	July 19	Baily and Getty	0.84	73
May 16	Follansbee and Getty	1.32	220		H. C. Getty	.38	15.5
June 8	H. W. Fear	1.68	486				

Daily discharge, in second-feet, of Surface Creek at Cedaredge, Colo., for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	106	226	35	40	16	304	362	104	14	9
2	.....	125	188	33	32	17	330	378	106	13	8.3
3	.....	210	159	31	18	18	338	410	86	12	7.5
4	.....	243	138	32	22	19	254	410	75	12	6.7
5	.....	265	130	28	16	20	201	362	82	11	5.9
6	.....	278	115	29	16	21	174	317	84	17	5.1
7	.....	324	110	22	15	22	232	362	75	26	4.3
8	.....	346	108	24	13	23	165	410	82	52	3.5
9	.....	410	128	21	9	24	170	550	77	54	3.5
10	.....	394	138	21	8	25	147	455	68	52	3.5
11	.....	394	159	22	14	26	135	378	64	52	3.2
12	.....	370	150	15	14	27	135	346	48	52	2.9
13	.....	378	141	15	12	28	138	346	39	48	2.3
14	.....	362	108	15	12	29	135	278	34	56	2.0
15	.....	394	110	15	11	30	122	254	35	45	2.0
						31	118	.....	39	42	.....

NOTE.—No gage-height record Aug. 16–19, 26, Sept. 17–22 because water-stage recorder was out of order; discharge interpolated.

Monthly discharge of Surface Creek at Cedaredge Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May 16-31	338	118	194	6,160
June	550	106	341	20,300
July	226	34	103	6,330
August	56	11	29.5	1,810
September	40	2.0	10.7	637
The period				35,200

UNCOMPAHGRE RIVER AT OURAY, COLO.

LOCATION.—River: In sec. 31, T. 44 N., R. 7 W., in box canyon a short distance upstream from highway bridge half a mile south of Ouray, Ouray County. Nearest tributary, Canyon Creek, enters 150 feet below; nearest tributary above is Bear Creek.

Power-house flume: In tailrace of power-house flume in Ouray, about 100 feet upstream from entrance to river. Water diverted from Uncompahgre River above river station.

DRAINAGE AREA.—44 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 25, 1911, to September 30, 1916, for river station and February 25 to September 30, 1917, for power-house flume. Beginning October 1, 1916, combined daily flow for river and flume are given as the intermittent operation of the latter causes low-water flow in river to fluctuate to such an extent that the one daily gage height does not represent the mean daily stage. From January 7 to March 17, 1908, records were kept at dam of Ouray Electric Light & Power Co., 1 mile south of present station, and were furnished through courtesy of Wheeler and Whinnerah.

GAGE.—River: Vertical staff attached to rock cliff at left side of stream 150 feet above mouth of Canyon Creek.

Power-house flume: Vertical staff fastened to side of wooden flume just below power house. Both gages read by T. J. Watkins, forest ranger.

DISCHARGE MEASUREMENTS.—River: Made from footbridge at gage or by wading.

Flume: Made from footbridge just below gage.

CHANNEL AND CONTROL.—River: Channel composed of small boulders and is rough and shifting. Control short distance downstream, will shift somewhat after high water; station is in box canyon with high vertical walls.

Flume: Control is plank nailed across bottom of flume at lower end. Elevation of crest 0.9 foot; stage-discharge relation permanent.

EXTREMES OF DISCHARGE.—River: Maximum stage recorded during year 4.3 feet from high-water mark on gage during nights of June 19 and 30 (discharge, 1,130 second-feet); data insufficient for determining minimum discharge.

ICE.—Stage-discharge relation not affected by ice as warm springs keep the stream open.

DIVERSIONS.—No diversion above station other than pipe line the flow of which is included in these records.

REGULATION.—None.

ACCURACY.—River: Stage-discharge relation slightly shifting; not affected by ice. Rating curve well defined between 4 and 600 second-feet. Gage read to hundredths once daily, and during certain periods of high water it is read twice daily. The maximum stage which occurs during night is also determined from water marks.

Flume: Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 20 second-feet. Gage read to hundredths once a day.

Daily discharge ascertained by adding the daily discharge of the river and flume together, and this gives the total discharge of the river. Records good.

Discharge measurements of Uncompahgre River at Ouray, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	P. V. Hodges	1.26	42.6	June 4	T. J. Watkins	2.00	189
Nov. 11	T. J. Watkins	1.10	28.4	12	do	2.70	385
Jan. 8	do	.92	19.0	July 30	do	1.80	140
Feb. 10	do	1.00	25.5	Sept. 19	do	.94	15.7

Discharge measurements of power-house flume at Ouray, Colo., during the year ending Sept. 30, 1917.

[Made by T. J. Watkins.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
Jan. 8	0.80	2.13	Apr. 6	1.15	9.10	Apr. 6	1.25	11.2
Feb. 10	.45	.92	Do	1.20	10.3	Sept. 19	1.40	14.2

Daily discharge, in second-feet, of Uncompahgre River and power-house flume at Ouray, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	37	19	22	15	13	10	45	97	650	144	29
2	53	38	19	19	15	13	15	47	106	605	114	29
3	48	37	23	19	15	12	15	47	137	560	86	33
4	48	38	23	19	15	11	15	49	309	500	86	29
5	29	37	23	21	15	11	14	52	200	480	86	28
6	256	38	23	21	25	11	16	47	175	440	86	27
7	178	37	14	22	25	11	16	44	281	500	78	25
8	138	38	10	21	25	12	24	38	417	385	70	24
9	131	29	10	21	25	13	26	38	560	332	67	26
10	191	30	10	8	25	13	29	36	440	332	64	23
11	255	29	25	8	25	13	30	46	515	338	70	30
12	194	29	27	20	13	13	38	50	560	338	78	29
13	105	22	27	17	13	13	38	59	605	289	85	29
14	101	23	26	9	13	15	49	163	845	275	102	41
15	88	27	27	9	13	15	47	226	795	275	76	32
16	94	34	21	24	13	15	42	281	795	247	65	32
17	93	26	22	19	13	17	38	293	895	247	63	30
18	91	30	26	9	20	17	35	279	895	194	63	29
19	97	29	27	21	18	17	23	198	745	194	55	28
20	94	30	20	20	19	17	18	131	795	194	48	27
21	93	29	13	14	12	17	29	112	795	181	44	26
22	61	17	20	14	13	16	33	100	895	160	43	25
23	61	22	21	17	15	15	40	107	780	169	41	24
24	60	22	21	16	17	16	49	94	780	146	41	23
25	31	23	21	16	19	16	57	94	845	146	39	23
26	76	22	21	16	18	17	63	85	845	146	37	26
27	57	20	21	16	13	17	63	107	895	194	36	25
28	44	23	21	16	13	19	52	106	845	157	36	25
29	45	22	21	16	.....	24	49	106	945	135	35	23
30	41	23	22	16	.....	31	49	106	845	135	29	22
31	41	.....	22	16	.....	19	.....	106	.....	146	29	.....

Daily discharge, in second-feet, of power-house flume at Ouray, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.4	0.4	12.4	4.7	12.4	9.9	3.0	1.1	0.0	15	9.0	9.0
2	.4	.4	12.4	11.6	12.4	9.9	3.0	1.1	.0	15	9.0	8.8
3	.4	.4	12.4	11.6	12.4	9.9	3.0	1.1	.0	15	9.0	8.8
4	.4	.4	12.4	11.6	12.4	9.9	3.0	.8	15.0	0	9.0	8.8
5	.4	.4	12.4	3.0	12.4	9.9	2.1	.8	15.0	0	9.0	9.0
6	.4	.4	12.4	3.0	.9	9.9	2.1	.8	15.0	0	9.0	9.0
7	.4	.4	6.4	3.0	.9	9.9	2.1	.5	15.0	0	9.0	9.0
8	.4	.4	4.7	3.0	.9	9.9	2.1	.5	15.0	0	9.0	9.0
9	.4	.4	4.7	3.0	.9	9.9	1.1	.5	15.0	9	9.0	9.0
10	.4	.4	4.7	2.1	.9	9.9	1.1	1.1	.0	9	9.0	9.0
11	.4	.4	4.7	2.1	.9	9.9	1.1	.0	15.0	15	9.0	9.0
12	.4	.4	4.7	2.1	9.9	9.9	1.1	15.0	15.0	15	8.6	9.0
13	.4	4.7	4.7	3.0	9.9	9.9	1.1	15.0	15.0	9	8.6	9.0
14	.4	4.7	4.7	3.0	9.9	3.0	1.1	15.0	15.0	9	8.6	.0
15	17.6	4.7	4.7	3.0	9.9	3.0	1.1	15.0	15.0	9	8.6	9.0
16	.4	4.7	4.7	.4	9.9	3.0	1.1	15.0	15.0	9	8.6	9.0
17	.4	16.7	12.4	4.7	9.9	3.0	1.1	13.3	15.0	9	8.6	9.0
18	14.2	.4	4.7	3.0	9.9	3.0	1.1	13.3	15.0	9	8.6	9.0
19	.4	.4	4.7	11.6	9.9	3.0	1.1	13.3	15.0	9	8.6	13.3
20	.4	.4	4.7	1.1	9.9	3.0	1.1	15.0	15.0	9	8.8	13.3
21	.4	.4	4.7	1.1	9.9	3.0	1.1	15.0	15.0	9	8.8	13.3
22	16.7	.6	4.7	1.1	9.9	3.0	1.1	11.6	15.0	0	8.8	13.3
23	16.7	.4	4.7	13.3	9.9	3.0	1.1	9.9	.0	9	8.8	13.3
24	14.2	.4	4.7	13.3	9.9	3.0	1.1	15.0	.0	9	8.8	14.2
25	2.6	.4	4.7	13.3	9.9	3.0	1.1	15.0	15.0	9	9.0	14.2
26	.4	.4	4.7	13.3	9.9	3.0	1.1	15.0	15.0	9	9.0	14.2
27	.4	12.4	4.7	13.3	9.9	3.0	1.1	9.9	15.0	9	9.0	14.2
28	.4	.4	4.7	13.3	9.9	3.0	1.1	.0	15.0	9	9.0	14.2
29	.4	.4	4.7	13.3	.....	3.0	1.1	.0	15.0	9	9.0	13.3
30	.4	.4	4.7	13.3	.....	3.0	1.1	.0	15.0	9	9.0	13.3
31	.4	.....	4.7	13.3	.....	3.0	.....	.0	.....	9	9.0	.....

Combined monthly discharge of Uncompahgre River and power-house flume at Ouray, Colo., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	256	29	95.0	5,840
November	38	17	28.7	1,710
December	27	10	20.8	1,280
January	24	8	16.8	1,030
February	25	12	17.1	950
March	31	11	15.5	953
April	63	10	34.1	2,030
May	293	36	106	6,520
June	945	97	621	37,000
July	650	135	293	18,000
August	144	29	64.4	3,960
September	41	22	27.4	1,630
The year	945	8	112	80,900

Monthly discharge of power-house flume at Ouray, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	17.6	0.4	2.97	183
November	16.7	.4	1.92	114
December	12.4	4.7	6.49	399
January	13.3	.4	6.85	421
February	12.4	.9	8.42	468
March	9.9	3.0	5.89	362
April	3.0	1.1	1.49	89
May	15	.0	7.41	456
June	15	.0	12.0	714
July	15	.0	8.23	506
August	9	8.6	8.86	545
September	14.2	.0	10.6	631
The year	17.6	.0	6.75	4,890

UNCOMPAHGRE RIVER BELOW OURAY, COLO.

LOCATION.—In sec. 30, T. 44 N., R. 7 W. New Mexico principal meridian, near lowest bridge in Ouray, Ouray County, a third of a mile below railroad station, below all tributaries in Ouray.

DRAINAGE AREA.—76 square miles (measured on topographic maps)

RECORDS AVAILABLE.—May 12, 1913, to September 30, 1917.

GAGE.—Gurley water-stage recorder installed March 28, 1917, referred to vertical staff attached to rock cliff 500 feet above bridge. This gage has been used since March 22, 1916, and is read by T. J. Watkins, a forest ranger. Original gage, vertical staff attached to downstream side of right bridge abutment, was used prior to March 22, 1916.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and small boulders; fairly permanent during 1917; no well-defined control. Banks will not be overflowed except at extreme high-water stage of 6.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.3 feet at 2.30 p. m. June 18 (discharge, 2,330 second-feet); minimum stage, 1.10 feet December 8–10 (discharge, 24 second-feet).

ICE.—Stage-discharge relation not affected by ice. Warm springs keep the river from freezing.

DIVERSIONS.—All diversions returned to river above station except one of 5.2 second-feet from Oak Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation shifts slightly; not affected by ice. Rating curve used October 1 to March 27 well defined between 20 and 200 second-feet, and curve used March 28 to September 30 well defined between 30 and 700 second feet; above 700 second-feet the rating curves are poorly defined. Gage read to hundredths once daily October 1 to March 27. From March 28 to September 30 the operation of the water-stage recorder was satisfactory. Daily discharge ascertained by applying to the rating table the one daily gage height, or the mean daily gage height determined by inspecting gage-height graph. For the period when gage was read once daily the records are only fair because of the rapid fluctuations of stage; records excellent for remainder of year.

Discharge measurements of Uncompahgre River below Ouray, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	P. V. Hodges	1.98	107	June 4	T. J. Watkins	2.74	266
22	do	2.08	100	12	do	3.46	665
Nov. 11	T. J. Watkins	1.70	64	July 31	do	2.64	237
Jan. 8	do	1.28	30.9	Sept. 19	do	1.58	62
Feb. 10	do	1.24	32.2				

Daily discharge, in second-feet, of Uncompahgre River below Ouray, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	59	63	40	34	28	28	41	100	169	1,400	228	79
2	61	63	40	33	28	26	38	103	178	1,140	202	75
3	61	63	40	33	28	24	35	104	254	1,150	185	74
4	63	63	40	32	28	24	39	105	331	1,090	180	73
5	54	63	40	32	28	24	51	96	340	875	180	72
6	274	63	40	32	28	26	49	91	288	835	180	72
7	202	63	28	32	29	26	46	92	362	1,000	180	73
8	222	59	24	30	29	26	73	90	545	958	162	73
9	193	58	24	30	29	26	83	84	795	875	154	71
10	160	54	24	34	29	26	71	88	795	875	173	69
11	193	54	35	39	29	26	69	98	755	1,000	198	86
12	176	54	35	32	30	26	86	108	915	835	239	91
13	156	35	38	32	30	26	104	145	1,040	755	270	88
14	142	38	38	26	29	26	98	248	1,180	680	225	84
15	135	39	38	28	28	26	83	331	1,320	610	198	75
16	135	40	37	32	28	26	70	362	1,450	610	173	72
17	122	42	38	32	27	27	67	405	1,450	545	169	66
18	110	42	39	33	28	27	63	410	1,680	515	147	62
19	84	40	39	31	28	27	56	319	1,400	578	134	62
20	96	40	34	32	29	28	66	236	1,360	485	120	60
21	110	40	31	27	28	29	86	202	1,450	430	114	59
22	107	40	32	32	26	27	116	192	1,400	430	108	58
23	84	39	32	27	31	26	133	198	1,450	430	102	58
24	84	39	33	30	31	26	143	190	1,540	405	98	55
25	122	39	33	29	37	27	158	178	1,500	371	94	54
26	110	39	34	29	38	27	139	162	1,500	380	92	70
27	94	39	34	29	35	28	116	150	1,540	405	106	58
28	94	39	34	29	31	52	102	169	1,580	295	102	54
29	73	39	34	32	.....	69	94	188	1,580	267	92	53
30	73	39	35	29	.....	60	96	185	1,500	278	86	54
31	63	.....	35	29	.....	47	.....	178	.....	260	83	.....

Monthly discharge of Uncompahgre River below Ouray, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	274	54	120	7,380
November	63	35	47.6	2,830
December	40	24	34.8	2,140
January	39	26	31.0	1,910
February	38	26	29.5	1,640
March	69	24	30.3	1,860
April	158	35	82.4	4,900
May	410	84	181	11,100
June	1,680	169	1,050	62,500
July	1,400	260	669	41,100
August	270	83	154	9,470
September	91	53	68.3	4,060
The year	1,680	24	209	151,000

UNCOMPAHGRE RIVER AT COLONA, COLO.

LOCATION.—In sec. 17, T. 47 N., R. 8 W., half a mile east of Colona, Ouray County. No important tributary within several miles.

DRAINAGE AREA.—475 square miles, approximately (measured by United States Reclamation Service).

RECORDS AVAILABLE.—April 6 to September 30, 1917.

GAGE.—Vertical staff read by Mrs. Rosa Osborn.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge near gage.

CHANNEL AND CONTROL.—Somewhat shifting.

EXTREMES OF DISCHARGE.—No data.

ICE.—No data as station is discontinued during winter.

DIVERSIONS.—Only a few small diversions above station.

COOPERATION.—Daily-discharge record furnished by United States Reclamation Service.

Discharge measurements of Uncompahgre River at Colona, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 11	Hilland Chase	1.4	196	July 20	Chester Hill	2.12	785
25	Chester Hill	2.0	565	25	do	1.90	580
May 17	do	2.62	742	Aug. 2	Hilland Getty	1.70	460
25	Hilland Getty	2.20	496	7	Chester Hill	1.50	343
June 11	Chester Hill	2.82	1,070	22	do	1.30	271
16	do	3.32	1,880	28	do	1.13	204
25	do	3.22	1,950	Sept. 5	do	.90	107
July 16	do	2.26	930	10	Hilland Getty	.95	120

Daily discharge, in second-feet, of Uncompahgre River at Colona, Colo., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	246	538	1,610	430	127	16	182	755	2,270	860	460	110
2	.....	364	498	1,440	430	110	17	175	800	2,270	750	460	110
3	.....	349	563	1,220	400	110	18	175	762	2,320	750	400	110
4	.....	364	673	1,180	375	110	19	156	725	2,070	805	350	110
5	.....	338	704	1,000	375	110	20	145	584	1,700	750	305	110
6	110	323	642	910	375	110	21	235	548	1,800	580	285	110
7	93	349	642	1,040	350	110	22	298	553	1,700	580	265	110
8	175	313	739	1,040	350	110	23	338	553	1,800	545	222	110
9	227	283	1,230	990	285	110	24	385	548	1,900	559	222	110
10	192	283	1,450	941	305	110	25	495	521	1,900	545	222	110
11	182	283	1,230	1,120	327	127	26	385	495	2,270	580	183	110
12	164	283	1,230	1,450	375	127	27	385	428	1,800	723	183	110
13	253	338	1,450	1,150	705	127	28	349	415	1,800	620	183	110
14	283	459	1,720	1,070	485	145	29	298	428	1,700	510	183	110
15	235	642	1,830	925	460	127	30	338	402	1,290	620	145	110
							31	.....	415	.....	485	145	.....

NOTE.—Figures have been changed slightly to conform with rules of computation followed by the U. S. Geological Survey.

Monthly discharge of Uncompahgre River at Colona, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
Apr. 6-30	495	93	250	12,400
May	800	246	456	28,000
June	2,320	498	1,460	86,900
July	1,610	485	882	54,200
August	705	145	330	20,300
September	145	110	114	6,780
The period	.....	.....	.....	209,000

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

LOCATION.—In sec. 31, T. 49 N., R. 9 W. New Mexico principal meridian, at highway bridge one-fourth mile west of Montrose, Montrose County. Nearest important tributary, Happy Canyon Creek, enters about 2 miles below.

DRAINAGE AREA.—565 square miles.

RECORDS AVAILABLE.—April 22, 1903, to September 30, 1917.

GAGE.—Vertical staff attached to bridge; read by L. R. Allen.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Channel composed of sand and gravel; shifts occasionally.

EXTREMES OF DISCHARGE.—No data.

ICE.—Although ice forms along the banks during winter, river is not frozen over. Observations, however, are discontinued.

DIVERSIONS.—Uncompahgre River is so overappropriated that the United States Reclamation Service has constructed a tunnel and canal to divert 1,300 second-feet from Gunnison River into the Uncompahgre above Uncompahgre.

COOPERATION.—Daily-discharge record furnished by the United States Reclamation Service.

Discharge measurements of Uncompahgre River at Montrose, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	B. T. Chase	3.50	271	July 18	Chester Hill	4.35	562
Apr. 12	Hill and Chase	2.70	70	Aug. 3	do	3.65	302
May 2	Chester Hill	3.35	223	7	do	2.80	84
June 4	do	4.38	616	Sept. 24	do	3.60	264
14	do	5.13	991				

Daily discharge, in second-feet, of Uncompahgre River at Montrose, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	71	185	415	1,320	367	650
2	94	63	185	384	1,060	315	452
3	114	63	237	415	822	283	360
4	124	32	237	705	840	283	442
5	124	27	223	586	782	237	112
6	202	56	117	243	625	185	80
7	281	49	300	321	600	112	535
8	355	63	237	415	705	266	535
9	258	148	215	960	730	251	479
10	258	165	185	1,280	1,200	266	377
11	396	101	160	755	1,160	49	360
12	305	124	148	755	960	330	415
13	202	165	266	870	705	822	395
14	202	197	535	1,100	650	577	360
15	248	160	870	1,680	990	197	367
16	208	125	755	1,280	870	650	377
17	264	137	900	1,630	650	330	367
18	238	177	793	1,850	577	137	360
19	238	43	650	1,550	577	80	377
20	129	27	377	1,100	650	237	336
21	85	49	315	1,240	543	330	300
22	94	165	237	1,200	543	315	266
23	89	197	452	1,280	470	330	283
24	94	266	336	1,370	315	345	266
25	94	345	321	1,360	730	300	251
26	94	283	177	1,450	555	283	160
27	89	266	148	1,160	600	283	90
28	94	185	197	1,200	452	300	56
29	78	172	215	1,280	435	330	266
30	64	172	251	1,550	452	315	300
31	64	.....	384	.....	492	300	.....

NOTE.—Figures have been changed slightly to comply with rules of computation followed by the U. S. Geological Survey.

Monthly discharge of Uncompahgre River at Montrose, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	396	52	169	10,400
April	345	27	136	8,090
May	900	117	342	21,000
June	1,850	243	1,050	62,500
July	1,320	315	712	43,800
August	822	49	303	18,600
September	650	56	332	19,800

UNCOMPAHGRE RIVER NEAR DELTA, COLO.

LOCATION.—In T. 15 S., on line between Rs. 95 and 96 W., at highway bridge 2 miles south of Delta, Delta County. No tributaries below station and none for several miles above.

DRAINAGE AREA.—1,130 square miles.

RECORDS AVAILABLE.—April 29, 1903, to September 30, 1917.

GAGE.—Vertical staff; read by Mrs. W. J. Lance. Original gage was located at a highway bridge one-fourth mile above Denver & Rio Grande Railroad bridge; moved to latter bridge November 17, 1903; replaced by an inclined gage installed near bridge April 21, 1904, which was used until November, 1906, when a staff gage was placed at present site. April 16, 1910, a new gage was installed at slightly different datum. No determined relation between gages at the various sites.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Channel composed of silt and gravel. Banks are not subject to overflow. Control shifts at intervals.

EXTREMES OF DISCHARGE.—No data.

ICE.—Although ice forms along banks and slush ice frequently occurs, the stage-discharge relation is probably not materially affected thereby; observations, however, are discontinued during winter.

DIVERSIONS.—Ditches above station divert the normal flow during irrigation season; records represent largely return seepage water.

REGULATION.—None.

COOPERATION.—Daily-discharge record furnished by United States Reclamation Service, which maintains the station.

Discharge measurements of Uncompahgre River near Delta, Colo., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 14	Hill and Chase	2.32	393	July 31	Chester Hill	2.07	272
May 8	Chester Hill	2.65	533	Aug. 27	do	1.58	112
June 5	do	3.20	749	Sept. 21	do	2.17	266
July 12	do	2.62	475				

Daily discharge, in second-feet, of Uncompahgre River near Delta, Colo., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	102	180	432	337	769	112	103
2	141	190	373	337	648	167	103
3	166	182	489	356	445	124	103
4	174	166	426	337	420	124	96
5	166	141	642	420	318	126	90
6	174	141	458	460	215	112	89
7	359	152	545	511	215	84	86
8	532	143	475	267	283	59	112
9	346	200	397	248	248	74	97
10	388	260	367	333	345	96	86
11	700	215	318	520	337	169	77
12	548	182	302	326	248	356	109
13	402	230	403	497	209	648	71
14	375	323	465	470	337	397	48
15	532	305	775	681	200	197	267
16	433	252	865	800	164	474	195
17	467	210	916	675	102	280	218
18	481	257	841	675	105	105	319
19	506	150	755	865	87	87	356
20	420	130	624	479	91	95	248
21	367	126	420	384	103	136	224
22	359	160	307	737	103	96	209
23	326	285	333	675	77	95	248
24	420	332	356	768	77	103	224
25	367	358	333	762	84	109	270
26	334	462	245	675	90	112	314
27	326	503	189	675	102	112	158
28	295	349	156	622	95	103	129
29	.....	419	277	577	86	103	153
30	.....	452	277	648	245	103	287
31	.....	.....	215	.....	290	103	.....

Monthly discharge of Uncompahgre River near Delta, Colo., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October 1–28	700	102	364	20,200
April	503	126	248	14,800
May	916	156	451	27,700
June	865	248	537	32,000
July	769	77	230	14,100
August	648	59	163	10,000
September	356	48	170	10,100

MILL CREEK NEAR MOAB, UTAH.

LOCATION.—In sec. 8, T. 26 S., R. 22 E., about a quarter of a mile above dam, three-quarters of a mile above power plant of Moab Light & Power Co., half a mile below mouth of Dry Fork, 1½ miles above confluence with Pack (Deep) Creek, and 2 miles southeast of Moab, Grand County.

DRAINAGE AREA.—76 square miles.

RECORDS AVAILABLE.—October 24, 1914, to June 28, 1917.

GAGE.—Vertical staff on left bank; read by Bruce Cox and Peter Shumway, operators at the plant.

DISCHARGE MEASUREMENTS.—Made by wading in the vicinity of the gage.

CHANNEL AND CONTROL.—Stream bed rocky and banks high. Control is a rock ledge a few feet below the gage and should be fairly permanent. Stage of zero flow about −0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 3.5 feet at 11 p. m. October 7 (discharge not computed); minimum stage recorded, 0.44 foot, March 17 (discharge, 4 second-feet).

1915–1917: Maximum and minimum stages recorded occurred in 1917.

ICE.—Stage-discharge relation affected at times by ice.

DIVERSIONS.—No definite information.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 7 and 50 second-feet. Gage read to hundredths two or three times a week. Daily discharge determined by applying gage height to rating table. No estimates made for days on which gage was not read, and data considered insufficient for computing monthly means. Records fair.

Discharge measurements of Mill Creek near Moab, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 9	J. J. Sanford	[a] 0.76	8.6
Mar. 7	....do	.76	21.4
July 25	R. P. Flagel	.74	22.8

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Mill Creek near Moab, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	63	12			12	11		20	
2	17		13						
3	20	15			12	9	6	21	
4	32	13	13					17	63
5	42					9	10		68
6	142	12		17	13		9		61
7			16			15		20	65
8		11			16				
9	32		9					17	
10						11	13	18	
11	29	12						17	82
12						11	15		68
13		7			12		17		
14	24					11		42	75
15		16							80
16	20								
17					13	4	15	75	
18	18	15						70	87
19						10	15		82
20					12		12		75
21	17	13							
22			12		10	11		54	75
23	17	13		12				46	
24					11	10	27	52	
25	17	13						42	
26							32		63
27	16	13		12	13	9	30		61
28	16							46	56
29						11		52	
30	15	13						50	
31						12		59	

NOTE.—Mean discharge estimated on account of ice as follows: Dec. 10–21, 10 second-feet: 23–31, 14 second-feet; Jan. 1–5, 16 second-feet; 24–26, 12 second-feet; and Jan. 28 to Feb. 2, 12 second-feet. Gage not read on days for which no discharge is given. Short flood on Oct. 7 reached a stage of 3.5 feet but discharge was not computed due to uncertainty of rating curve at stages above 1.5 feet.

SAN JUAN RIVER BASIN.

SAN JUAN RIVER NEAR BLUFF, UTAH.

LOCATION.—In sec. 7, T. 42 S., R. 19 E., at suspension bridge about a quarter of a mile from Spencer's trading post at Goodridge, a quarter of a mile below Gypsum Creek, 6 miles below Lime Creek, and 25 miles southwest of Bluff, San Juan County.

DRAINAGE AREA.—24,000 square miles.

RECORDS AVAILABLE.—October 30, 1914, to September 30, 1917, when station was discontinued.

GAGE.—Chain gage on right bank about 150 feet above the suspension bridge; read by A. H. Spencer. Gage was moved upstream about 50 feet and datum changed March 4, 1916.

DISCHARGE MEASUREMENTS.—Made from a cable 200 feet below the bridge.

CHANNEL AND CONTROL.—Bed composed of shifting sand. Stream confined between rock walls; one channel only. Stage of zero flow is about minus 2 feet. Control probably a rock ledge three-eighths mile below gage.

EXTREMES OF DISCHARGE.—1915–1917: Maximum stage recorded, 18.1 feet at 2 p. m. October 15, 1916 (discharge, 31,400 second-feet); minimum discharge, 199 second-feet at 9 a. m. December 10, 1916.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—No diversions between Bluff and the gaging station. Considerable water is diverted farther up the stream.

REGULATION.—Regulation of the stream probably does not affect the diurnal flow at the gage.

ACCURACY.—Stage-discharge relation not permanent; not seriously affected by ice. Rating curve well defined for range in gage heights. Gage read to hundredths once daily. Daily discharge determined by applying gage heights to rating table and by indirect method for shifting control. Records good.

Discharge measurements of San Juan River near Bluff, Utah, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 13	J. J. Sanford	3.25	201	Apr. 11	R P. Flagel	7.85	6,350
Mar. 11	Sanford and Flagel	4.34	929	18	do	8.90	5,860
11	do	4.36	976	25	do	10.45	9,680
18	R. P. Flagel	4.42	891	June 18	do	14.00	18,900
21	do	5.02	1,330	24	do	12.3	16,200
28	do	5.50	2,140	July 2	do	12.0	14,900
Apr. 4	do	5.72	2,660	8	do	9.7	9,010

Daily discharge, in second-feet, of San Juan River near Bluff, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,830	2,010	956	596	725	1,420	5,000	8,780	7,490	14,700	5,310	1,580
2	1,830	1,920	1,060	628	596	1,270	4,130	7,850	8,210	14,200	4,700	1,540
3	1,740	1,830	990	725	660	1,060	2,910	6,960	6,620	14,000	4,130	1,500
4	1,920	1,830	1,060	823	502	990	2,590	6,960	6,790	12,700	3,610	1,580
5	2,190	1,830	1,130	790	410	823	2,490	6,450	7,670	11,800	3,370	1,620
6	2,490	1,740	1,060	790	533	758	2,100	6,790	9,550	11,000	3,250	1,420
7	14,000	1,660	923	725	596	790	2,590	6,790	10,800	9,950	3,130	1,420
8	13,300	1,660	890	596	790	923	3,740	5,630	10,200	9,160	2,910	1,420
9	12,200	1,660	692	692	856	856	4,000	6,280	11,200	10,400	2,690	1,420
10	14,700	1,660	199	823	1,130	856	4,550	6,620	12,900	10,200	2,690	1,340
11	25,300	1,500	350	923	1,130	923	6,450	8,400	15,900	9,750	2,490	1,340
12	17,900	1,500	204	923	1,270	923	5,310	8,590	17,400	9,160	2,490	1,740
13	19,200	1,340	204	990	1,340	890	5,150	8,590	16,600	8,970	4,000	2,190
14	16,600	1,270	350	725	1,420	856	6,620	7,850	16,600	8,590	3,370	1,920
15	28,300	1,270	502	533	1,340	923	5,470	7,670	17,100	8,030	3,740	2,490
16	14,700	1,060	660	350	1,420	923	5,790	12,000	17,900	7,670	3,610	2,190
17	8,030	1,060	725	471	1,500	990	5,470	13,600	18,700	6,960	3,370	2,490
18	6,280	1,130	628	596	1,340	923	6,110	14,700	18,700	6,620	2,910	2,290
19	5,470	1,130	923	660	1,270	856	4,850	14,700	18,100	5,470	2,800	2,140
20	4,700	1,200	596	856	1,200	890	6,450	14,700	18,400	5,790	2,590	2,010
21	4,130	1,200	692	990	1,340	1,270	4,550	13,600	17,100	5,950	2,490	2,290
22	3,490	1,200	725	956	1,200	1,920	3,870	13,300	15,900	6,280	2,490	2,010
23	2,910	1,200	790	890	1,920	2,100	4,550	9,750	15,200	6,280	2,290	1,920
24	3,020	1,130	790	725	2,010	1,920	8,400	9,350	15,200	5,630	2,100	1,920
25	2,690	1,060	758	502	2,290	1,660	9,550	9,950	14,900	6,280	1,920	1,920
26	2,690	1,130	725	502	2,800	1,580	10,800	8,970	15,400	6,450	1,920	1,920
27	2,590	1,130	440	471	1,830	1,830	12,400	8,780	15,200	8,030	1,920	2,100
28	2,390	990	471	410	1,660	2,190	11,400	7,850	14,900	5,630	1,830	2,190
29	2,290	990	410	503	.....	2,100	10,800	6,960	14,500	6,280	1,740	2,190
30	2,190	990	291	628	.....	3,490	9,350	6,620	14,200	5,790	1,700	2,100
31	2,190	.....	533	725	.....	3,610	.....	7,310	.....	5,000	1,660	.....

Monthly discharge of San Juan River near Bluff, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	28,300	1,740	7,850	483,000
November	2,010	990	1,040	61,900
December	1,130	199	669	41,100
January	990	350	694	42,700
February	2,800	410	1,250	69,400
March	3,610	758	1,370	84,200
April	12,400	2,100	5,910	352,000
May	14,700	5,630	9,110	560,000
June	18,700	6,620	14,000	833,000
July	14,700	5,000	8,470	521,000
August	5,310	1,660	2,880	177,000
September	2,490	1,340	1,870	111,000
The year	28,300	199	4,630	3,340,000

DAVENPORT & CAMPBELL CANAL NEAR MONTICELLO, UTAH.

LOCATION.—In sec. 7, T. 33 S., R. 23 E., at Trujillo's ranch, half a mile below head of canal and 8 miles northwest of Monticello.

RECORDS AVAILABLE.—May 26 to June 24, 1914; April 20 to July 16, 1915; and April 1 to June 30, 1916.

GAGE.—Vertical staff just above the Trujillo ranch house. Datum raised 0.8 foot on May 27, 1915. Read by Gusman Trujillo.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel of earth and gravel. Control is a riffle formed by rocks placed in a trench. Stage of zero flow about 0.5 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 1.75 feet April 23, 24, 26, and 29 (discharge, 23 second-feet); canal dry May 22–27 and June 24–30.

1914–1916: Maximum discharge occurred in 1916.

DIVERSIONS.—Water is diverted above the gage at times.

REGULATION.—Regulated at the head gate.

ACCURACY.—Stage-discharge relation remained permanent. Gage read to hundredths once daily. Daily discharge determined by applying gage heights to a rating table well defined between 0 and 8 second-feet. Records fair.

This canal diverts from Spring Creek in SW. ¼ sec. 7, T. 33 S., R. 23 E.; water is used for irrigation in Dry Valley and not returned to the creek. A small amount of water is taken out of the ditch above the gage.

Discharge measurements of Davenport and Campbell canal near Monticello, Utah, during the period Oct. 1, 1915, to Dec. 15, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21[a]	L. W. Jordan	0.64	0.10
June 16	W. E. Dickinson	1.02	3.45
Dec. 15	J. J. Sanford	.....	.42

[a] No water in canal at head; flow comes from small spring and wastes back to creek 1000 feet below gage.

Daily discharge, in second-feet, of Davenport & Campbell canal near Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	.0	9.8	7.4	11	20	12	7.4	21	11	7.4	3.7
2	.0	11.	8.6	12	18	19	6.3	22	20	0	3.0
3	14	7.4	12	13	15	9.8	6.3	23	23	0	3.0
4	16	12	12	14	16	7.4	5.2	24	23	0	0
5	18	17	7.4	15	15	7.4	4.1	25	21	0	0
6	20	12	6.3	16	16	8.6	3.0	26	23	0	0
7	19	7.4	6.3	17	17	6.3	5.4	27	19	0	0
8	19	8.6	8.6	18	20	7.4	3.7	28	16	6.3	0
9	16	16	7.4	19	18	12	4.4	29	23	9.8	0
10	16	19	6.3	20	15	12	5.4	30	12	6.3	0
								31	.....	8.6	.....

Monthly discharge of Davenport & Campbell canal near Monticello, Utah, for the period Apr. 1 to June 30, 1916.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April	23	0	16.6	988
May	19	0	8.40	516
June	12	0	4.78	284
The period	.....	.....	.....	1,790

NOTE.—Canal practically dry remainder of year.

LITTLE COLORADO RIVER BASIN.

LITTLE COLORADO RIVER NEAR WOODRUFF, ARIZ.

LOCATION.—In T. 16 N., R. 22 E., at highway bridge about 1½ miles below Woodruff, Navajo County, and 4 miles below Silver Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 16, 1905, to December 31, 1908; December 5, 1915, to September 30, 1917.

GAGE.—Stevens water-gage recorder on right bank just below highway bridge.

DISCHARGE MEASUREMENTS.—From bridge or by wading near bridge.

CHANNEL AND CONTROL.—Channel consists of bedrock covered with thin deposit of sand and silt. Control is not well defined. It is liable to shift considerably because of the large quantities of silt that are constantly being deposited at low stages and scoured out at each rise. Banks are clean of vegetation, high, are not overflowed, and fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 5.0 feet at 2 p. m. April 18 (discharge not determined); minimum stage from water-stage recorder, 0.44 foot June 29 (discharge, 2 second-feet).

1915–1917: Maximum stage, 12.7 feet January 19, 1916 (discharge not determined). Stream dry for about 2 weeks during June and July, 1916.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Much of low-water flow is diverted for irrigation in the vicinity of St. Johns and Snowflake; amount unknown.

REGULATION.—There are several small reservoirs in the headwaters and on Silver Creek that no doubt regulate flow to some extent.

ACCURACY.—Stage-discharge relation changed considerably during floods and slightly at low stages; probably affected somewhat by ice during December, January, and part of February. Standard rating curve fairly well defined below 400 second-feet and poorly defined above. Operation of the water-stage recorder was unsatisfactory because of excessive silt deposits in float well and trouble with gage clock. Daily discharge determined by indirect method for shifting control except as indicated in footnote to monthly discharge table. Daily discharge not sufficiently accurate to warrant publication. Records poor.

Discharge measurements of Little Colorado River near Woodruff, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 10	M. D. Anderson	1.28	32.3	Aug. 2	J. B. Spiegel	1.10	25.2
Apr. 6	C. E. Ellsworth	.79	12.6	Sept. 26	C. E. Ellsworth	.41	11.6
6	do	.79	12.4	26	do	.41	11.2
Aug. 2	J. B. Spiegel	1.10	26.8				

Monthly discharge of Little Colorado River near Woodruff, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	.....	.....	23.8	14,600
November 1–8	57	10	17.9	284
December 6–31	65	34	48.5	2,500
January	92	21	45.2	2,780
February	475	25	67.6	3,750
March	143	17	59.2	3,640
April	634	6	79.8	4,750
May	12	5	7.2	443
June	8	2	4.9	292
July	101	2	29.4	1,810
August	.....	.....	80.5	4,950

NOTE.—Because of missing gage heights, discharge estimated from study of weather data and records at other stations Oct. 6–14, and 25–29; Apr. 22–30; Aug. 7–10, 15, 16, 18–23, and 25–30. Discharge interpolated Dec. 10–13 and 22–29; Dec. 31 to Jan. 7; Jan. 25–28; Feb. 1–6; Apr. 4 and 5; July 19 and 27–31. Discharge Sept. 1, 805 second-feet; Sept. 2, 95 second-feet; Sept. 26–30, 11 second-feet. During missing periods, Nov. 9 to Dec. 5 and Sept. 3–25, there were probably no floods of consequence and a study of records at other stations indicates that these periods could be interpolated without introducing large errors. The above results are approximate and should be used with care.

ZUNI RIVER AT BLACK ROCK, N. MEX.

LOCATION.—At reservoir of Zuni Indian Reservation at Black Rock, McKinley County. Rio de Los Nutrias, nearest large tributary, enters from north about 4 miles above.

DRAINAGE AREA.—About 660 square miles.

RECORDS AVAILABLE.—Yearly flow July 1, 1903, to June 30, 1905; July 1, 1908, to June 30, 1910. Monthly flow October 1, 1910, to September 30, 1917. Record since July 1, 1908, shows inflow into reservoir.

METHOD OF COLLECTING DATA.—From July 1, 1903, to June 30, 1905, the records were obtained by the ordinary stream-gaging methods. Reservoir completed in 1908. Record beginning July 1, 1908, obtained by means of a gage in the reservoir and a capacity curve for the reservoir, the quantity of water released from the reservoir during the periods of inflow being taken into consideration.

FLOODS.—Channel dry the greater part of the year below the point where it leaves the mountains, but stream is subject to sudden floods of considerable volume and usually of short duration. An account of the flood of September 6, 1909, which damaged the reservoir, is given in Water-Supply Paper 269, pages 206–210.

DIVERSIONS.—A reservoir at Ramah, about 18 miles above the station (the capacity of which is given as 4,240 acre-feet), is used to irrigate about 1,150 acres in T. 11 N., R. 16 W. There are other small ponds or reservoirs in the drainage area.

COOPERATION.—Record furnished by the Office of Indian Affairs, Irrigation Service, through H. F. Robinson, supervising engineer, Albuquerque, N. Mex.

Monthly run-off of Zuni River at Black Rock, N. Mex., for the year ending Sept. 30, 1917.

Month.	Run-off in acre-feet.	Month.	Run-off in acre-feet.
October	22,100	May	134
November	38	June	98
December	0	July	0
January	40	August	600
February	712	September	505
March	1,230		
April	354	The year	25,800

CHEVELON FORK NEAR WINSLOW, ARIZ.

LOCATION.—In T. 18 N., R. 17 E., 300 yards below highway bridge, 1 mile above concrete diversion dam, 1½ miles above junction with Little Colorado River, and 14 miles southeast of Winslow, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 18, 1905, to December 12, 1908; December 18, 1915, to September 30, 1917.

GAGE.—Stevens water-stage recorder attached to ledge on right bank 300 yards below highway bridge.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Gage is in box canyon which opens just above cable section, where the banks are formed by bedrock, partly covered by a thin deposit of sand and gravel. Both banks rise gradually to well above high water. Channel at cable consists of fairly permanent sand and gravel. Control at high stages is probably box canyon. Low-stage control not definitely determined; changes considerably during floods, but is fairly permanent during low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 5.30 feet at 3 p. m., April 24 (approximate discharge 1,300 second-feet, determined from extension of rating curve); minimum stage, 0.57 foot at 4 p. m., November 5 (discharge, less than 1 second-foot).

1916–1917: Maximum stage, 13.2 feet at 9 a. m., January 19, 1916 (discharge not determined); minimum discharge same as for 1917 (see above).

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—No record.

ACCURACY.—Stage-discharge relation practically permanent except at low stages, when the control may be slightly changed by the operation of canal headworks, and possibly for short periods during December and January, by ice in float well. Rating curve fairly well defined below 500 second-feet except for extremely low stages, when discharge measurements are liable to considerable error because of poor measuring channel. Operation of the water-stage recorder was satisfactory except for breaks in record as shown in daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage heights determined by inspecting gage-height graph. Records fair except for extremely low and high stages, for which curve is poorly defined.

Discharge measurements of Chevelon Fork near Winslow, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 5	C. E. Ellsworth	2.52	283
July 30	J. B. Spiegel	1.15	[a]15
Sept. 26	C E. Ellsworth	.96	2.4

[a] Estimated.

Daily discharge, in second-feet, of Chevelon Fork near Winslow, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3	4	4	4	4	58	640	447	5	4	8	7
2	2	4	3	4	4	63	481	532	5	3	6	9
3	1	4	3	4	4	63	392	447	3	3	8	9
4	1	4	4	4	4	49	351	366	2	3	130	8
5	3	1	4	4	4	35	321	300	2	3	10	7
6	3	2	3	4	4	28	382	239	2	4	17	6
7	5	3	4	4	4	.....	676	165	3	3	9	6
8	4	4	4	4	8	.....	752	126	3	4	8	5
9	3	4	4	4	9	.....	790	118	2	4	8	5
10	3	4	4	4	9	.....	640	120	1	4	8	5
11	2	2	4	4	10	.....	430	272	1	4	7	5
12	3	1	4	4	10	.....	306	264	2	3	7	6
13	78	2	4	4	10	.....	430	154	2	3	7	6
14	28	3	4	4	10	.....	532	114	3	3	6	6
15	46	.....	4	4	11	.....	481	80	3	3	6	6
16	124	.....	4	4	13	.....	414	61	3	5	6	6
17	120	.....	4	3	10	28	222	48	3	10	6	6
18	68	.....	4	3	10	28	222	39	3	4	8	6
19	40	.....	4	3	8	30	924	28	3	4	14	6
20	27	.....	3	3	9	26	714	18	3	5	12	6
21	[b]19	.....	4	3	9	52	733	14	3	4	31	6
22	11	.....	4	4	8	112	984	13	2	4	23	5
23	8	.....	2	4	8	184	1,040	68	3	5	11	5
24	8	.....	3	4	8	165	1,060	65	3	5	10	5
25	7	.....	2	4	4	140	1,060	33	3	11	10	5
26	6	4	3	4	7	189	944	21	3	20	9	5
27	5	4	4	4	11	333	790	15	3	13	8	5
28	4	3	4	4	35	379	568	10	3	58	7	5
29	5	3	4	4	.....	618	464	7	3	27	7	5
30	5	4	4	3	.....	885	568	5	3	30	6	6
31	5	.....	4	3	.....	836	.....	4	.....	9	6	.....

NOTE.—Observer reports ice at gage on several days during December, January, and February, which, however, probably did not seriously affect the stage-discharge relation. Discharge estimated because of unsatisfactory operation of recorder, from partial graph record Nov. 15–25, 4 second-feet: Mar. 7–16, 15 second-feet. No gage-height record Dec. 15–16, Aug. 9–14 and 24–29, and Sept. 9–13 and 18–25: discharge interpolated. Apr. 4–5, Aug. 8, and Aug. 30 to Sept. 8, gage heights partly estimated because of recorder not working properly.

Monthly discharge of Chevelon Fork near Winslow, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	124	1	20.9	1,290
November	4	1	3.5	208
December	4	2	3.7	228
January	4	3	3.8	234
February	35	4	8.8	489
March	885	.....	144	8,850
April	1,060	222	610	36,300
May	532	4	135	8,300
June	5	1	2.8	167
July	58	3	8.5	523
August	130	6	13.5	830
September	9	5	5.9	351
The year	1,060	1	79.8	57,800

VIRGIN RIVER BASIN.

VIRGIN RIVER AT VIRGIN, UTAH.

LOCATION.—In NW. ¼ sec. 27 or NE. ¼ sec. 28, T. 41 S., R. 12 W., a few hundred feet above point where river enters a steep, narrow gorge and three-quarters of a mile west of Virgin, Washington County. Station replaces the one maintained prior to February, 1915, half a mile above Virgin, and gives practically the same record of flow.

DRAINAGE AREA.—1,010 square miles.

RECORDS AVAILABLE.—April 18, 1909, to September 30, 1917.

GAGE.—Chain gage on the right bank near the lower end of sandstone bluff. Installed February 1, 1915; read by Niles Earl. Gage used April 18 to August 31, 1909, was an inclined staff on right bank half a mile above Virgin and a few hundred feet below North Creek; washed out August 31, 1909, and replaced October 14 by an inclined staff on left bank at a new datum. This gage was damaged by flood January 1, 1910, and on January 25 a new inclined staff was installed also on left bank, about 65 feet upstream and at datum 0.8 foot higher than the gage installed October 14, 1909. This gage was used until chain gage was installed below Virgin, February 1, 1915.

DISCHARGE MEASUREMENTS.—Made by wading below the gage except during high water, when the old cable above Virgin must be used.

CHANNEL AND CONTROL.—Bed consists of sand and gravel. Right bank high; left bank low and is overflowed. One channel at all stages. Control is a gravel bar a short distance below the gage; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5 feet at 5.30 p. m. October 6 (discharge, 2,610 second-feet); minimum stage recorded, 1.72 feet at 6 p. m. September 3 (discharge, 39 second-feet).

1909–1917: Maximum stage recorded, 11.6 feet at upper station October 27, 1912 (discharge estimated, 12,000 second-feet). The flood of August 31, 1909, probably equaled or exceeded this flow. Minimum discharge, 24 second-feet, July 1, 2, 4, and 5, 1909.

ICE.—Stage-discharge relation not affected by ice to any extent.

DIVERSIONS.—Above all important diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation usually changed by floods, but was fairly constant for periods of ordinary flow. Rating curve used as standard, fairly well defined for range in stage, except for peaks of floods of short duration. Gage read to hundredths once a day about five or six times a week. Daily discharge determined by applying daily gage height to rating table, except for periods when stage-discharge relation was affected by shifting control and during floods. Records fair.

Discharge measurements of Virgin River at Virgin, Utah, during the year ending Sept. 30, 1917.

[Made by C. W. Bennett.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 4	2.25	155
Mar. 10	2.12	166
July 10	2.01	126

Daily discharge, in second-feet, of Virgin River at Virgin, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	256	153	132	134	176	192	190	600	517	139	.....	43
2	324	160	125	139	184	192	176	712	544	132	.....	41
3	1,880	158	146	146	192	160	161	675	486	139	.....	39
4	168	156	139	146	188	160	146	544	428	146	.....	45
5	200	168	132	136	184	160	192	544	428	132	.....	45
6	2,610	176	126	125	184	160	254	544	440	134	.....	45
7	250	176	119	132	184	160	244	544	368	136	.....	150
8	213	176	113	139	184	160	334	835	350	139	88	64
9	174	164	168	142	200	160	357	465	333	132	88	64
10	136	153	113	146	209	160	380	532	315	125	88	68
11	141	153	107	153	218	160	282	600	297	126	68	62
12	146	150	109	160	200	153	303	660	280	127	122	56
13	139	146	112	168	209	146	324	675	262	128	116	50
14	156	119	114	132	209	146	334	1,140	244	130	109	45
15	152	119	117	132	200	146	345	985	244	131	102	48
16	148	119	119	132	200	169	303	830	244	132	95	68
17	145	122	119	132	235	192	357	675	226	128	88	88
18	142	125	119	132	250	176	235	712	209	125	72	80
19	146	122	119	153	184	160	282	615	193	116	72	72
20	150	119	119	188	200	168	320	622	176	107	78	72
21	150	139	126	178	200	153	357	630	160	150	73	78
22	148	132	132	168	192	154	544	580	160	192	68	141
23	146	125	132	176	209	156	518	530	160	125	61	204
24	150	125	132	200	217	157	491	517	184	119	55	154
25	153	125	150	209	226	159	835	530	192	95	48	104
26	153	142	132	200	235	160	732	465	184	.....	56	110
27	154	160	132	192	192	139	630	465	176	.....	64	116
28	156	155	136	196	192	218	558	491	168	.....	56	110
29	153	150	139	200	.....	235	965	517	153	.....	52	104
30	156	146	125	209	.....	220	782	544	146	.....	49	104
31	154	.....	130	184	.....	205	.....	544	.....	.....	45	.....

NOTE.—Discharge for days when gage was not read, interpolated or roughly estimated from precipitation records. Observer absent July 26 to Aug. 7, during which period there were several short floods.

Monthly discharge of Virgin River at Virgin, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2,610	136	302	18,600
November	176	119	144	8,570
December	168	107	127	7,810
January	209	125	161	9,900
February	250	176	202	11,200
March	235	139	169	10,400
April	965	146	398	23,700
May	1,140	465	623	38,300
June	544	146	276	16,400
July 1–25	192	95	131	6,500
August 8–31	122	45	75.5	3,590
September	204	39	82.3	4,900

NOTE.—See footnote to table of daily discharge.

LEEDS (QUAIL) CREEK NEAR LEEDS, UTAH.

LOCATION.—In N. ½ sec. 36, T. 40 S., R. 14 W., just above head of R. C. Savage's canal, a quarter of a mile above head of Leeds canal, three-quarters of a mile north of abandoned mining camp of Silver Reef, and 2½ miles north of Leeds, Washington County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 31, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank 60 feet above the head of the Savage ditch. Read by R. C. Savage.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Stream bed consists of gravel and boulders; shifts occasionally, but apparently permanent during 1917.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet, July 28 (discharge not determined); minimum stage recorded, 2.20 feet in December and January (discharge, 5.9 second-feet).

1915–1917: Maximum stage recorded, 5.0 feet, August 3, 1916 (discharge not estimated); minimum stage, 1.98 feet, January 31, 1915 (discharge, 3.9 second-feet).

ICE.—Stage-discharge relation probably not seriously affected by ice for any length of time.

DIVERSIONS.—Above all diversions. R. C. Savage diverts water about 60 feet below the station for irrigation and domestic uses. Measurements of this ditch have shown from 1 to 3 second-feet. Measurements of Leeds canal, which diverts about a quarter of a mile below, have shown discharge up to 18.5 second-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined between 3 and 30 second-feet. Gage-height record fragmentary. Records fair.

Discharge measurements of Leeds (Quail) Creek near Leeds, Utah, during the year ending Sept. 30, 1917.

[Made by C. W. Bennett.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 5	2.28	8.2
Mar. 9	2.26	7.4
July 9	2.58	19.4

Daily discharge, in second-feet, of Leeds (Quail) Creek near Leeds, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1										26		6.7
2								12	15			6.7
3					6.4		8.6		16	24	13	
4							9.2	13		22	13	
5		8.1					9.6	12	16		12	6.7
6			5.9							21		
7								13	16	20		
8											11	6.7
9						7.5		14	16	19		6.7
10					6.4		9.6		17			
11		8.1	5.9				9.9	14		18	11	
12							9.6	14	18		11	6.4
13	6.4	7.2					9.9		18	17		
14	6.4						9.6	14		17		
15							9.9		19	16	10	6.2
16		7.2	5.9				9.9	14	19			5.9
17					6.4							
18									20	15	9.6	5.9
19								15		16	8.9	
20						8.3			21			
21		7.2	5.9			8.3	32	15	22	14		8.9
22									22	14		5.9
23			5.9	5.9		8.9			23		8.3	
24					7	8.9	12	15	23	16	8.6	
25		7.2					13	15			8.3	
26						8.9	12	14	24	16		5.9
27		7.2		5.9		9.9	12		24			
28						11		15			6.7	
29						11	13	15	25	32		
30						12		15	25			
31						12		15		14		

NOTE.—Daily discharge is given for days on which gage was read except Apr. 19, 28, July 23 and 28, when discharge was above limits of rating table.

SANTA CLARA CREEK NEAR CENTRAL, UTAH.

LOCATION.—In sec. 11, T. 39 S., R. 16 W., just above ford at R. H. Hunt's ranch, about a mile southeast of Central, Washington County, on road to Pine Valley. Hunt's spring, which has fairly constant discharge of about 3 second-feet, enters 10 feet below.

DRAINAGE AREA.—84 square miles.

RECORDS AVAILABLE.—April 21, 1909, to September 30, 1917.

GAGE.—Vertical staff nailed to cottonwood tree on left bank about 20 feet above the ford; read by R. H. Hunt. Datum of gage was raised 0.45 foot on January 20, 1910, and 2 feet on February 22, 1916.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—Stream bed consists of gravel and boulders. Both banks fairly high but may be overflowed at extreme stages; one channel at all stages. Control is at a riffle formed by small boulders just below ford; shifts at times.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.00 feet at 11 a. m. October 6 (approximate discharge, 1,450 second-feet, estimated from extension of rating curve); minimum stage 0.24 foot, September 3–4 (discharge, 9.6 second-feet).

1909–1917: Maximum stage recorded in 1917 (see preceding paragraph); minimum discharge, 5 second-feet, February 6–8 and September 10–17, 1914.

ICE.—Stage-discharge relation not usually affected by ice.

DIVERSIONS.—The New Castle Reclamation Co. has constructed a reservoir on Grass Valley Creek with a capacity of 23,000 acre-feet. Water is taken from Santa Clara Creek above the town of Pine Valley, stored in the reservoir, and diverted by means of a tunnel through the rim of the Great Basin to irrigate lands outside the Colorado River basin. The Central canal diverts water about 2 miles above station for irrigation of lands near Central. This canal has been measured when it was carrying 16 second-feet.

REGULATION.—Flow affected by the diversions and storage noted above.

ACCURACY.—Control fairly permanent. Rating curve is well defined from 10 to 90 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table except October 1–6, when indirect method for shifting control was used. Records fair.

Discharge measurements of Santa Clara Creek near Central, Utah, during the year ending Sept. 30, 1917.

[Made by C. W. Bennett.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 8	0.55	29.0
Mar. 5	.40	21.0
July 6	.42	18.1

Daily discharge, in second-feet, of Santa Clara Creek near Central, Utah, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	124	30	20	20	14	23	32	41	79	20	23	12
2	22	30	19	20	17	22	26	30	82	20	21	11
3	56	30	18	18	17	21	27	28	88	19	22	10
4	25	28	18	21	17	14	24	26	95	18	23	10
5	50	28	18	18	17	18	26	24	109	20	23	10
6	1,100	28	20	18	17	18	28	24	112	20	23	10
7	329	31	20	20	18	21	29	24	102	22	23	10
8	124	31	20	21	20	19	30	28	107	30	23	10
9	82	31	20	20	18	17	30	33	116	25	23	10
10	68	30	19	18	21	24	30	35	116	20	21	10
11	58	28	18	17	19	26	30	35	94	20	21	10
12	52	28	18	17	17	27	31	37	72	20	23	12
13	47	26	19	17	18	28	31	43	63	20	23	11
14	47	26	20	16	18	28	35	88	54	20	22	12
15	45	26	20	16	19	26	35	151	45	20	21	12
16	43	26	20	17	17	26	35	132	39	20	20	12
17	41	24	20	18	24	26	33	109	43	20	20	12
18	41	21	20	18	20	26	35	95	39	23	18	12
19	39	20	20	17	16	56	33	88	37	21	17	12
20	37	19	20	16	20	68	32	78	35	21	17	12
21	35	18	20	16	23	52	30	68	33	20	17	13
22	35	18	20	17	24	26	33	63	28	21	16	14
23	35	20	20	18	26	26	39	62	24	20	16	13
24	35	21	20	17	28	28	45	61	19	20	14	13
25	35	20	21	17	49	33	52	61	20	20	14	13
26	33	20	21	17	28	30	54	76	20	23	14	13
27	33	20	21	17	24	56	55	68	30	24	13	13
28	33	20	21	17	19	57	56	61	31	23	13	13
29	31	20	21	18	.....	92	54	68	26	30	14	13
30	31	20	21	17	.....	45	48	74	24	28	14	13
31	30	.....	21	16	.....	37	.....	76	.....	26	12	.....

NOTE.—Gage not read and discharge estimated Oct. 12, Nov. 5, 15, 20, 23, 26, 30, Dec. 2, 4, 8, 10, 13, 16, 18, 21, 23, 26, 29, Jan. 7, 9, 12, 14, 16, 19, 21, 25, 27, Feb. 3, 5, 11, 14, 18, 23, 27, Mar. 2, 8, 11, 16, Apr. 1, 9, 15, 20, 26, 30, May 8, 20, 27, June 3, 11, 20, July 3, 9, 12, 16, 24, Aug. 3, 6, 8, 14, 16, 26, 28, Sept. 5, 7, 10, 14, 16, and 26. Discharge estimated Oct. 5.

Monthly discharge of Santa Clara Creek near Central, Utah, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,100	22	90.2	5,550
November	31	18	24.6	1,460
December	21	18	19.8	1,220
January	21	16	17.7	1,090
February	49	14	20.9	1,160
March	92	14	32.8	2,020
April	56	24	35.9	2,140
May	151	24	60.9	3,740
June	116	19	59.4	3,530
July	30	18	21.7	1,330
August	23	12	18.8	1,160
September	14	10	11.7	696
The year	1,100	10	34.7	25,100

NOTE.—See footnote to table of daily discharge.

MUDDY RIVER NEAR MOAPA, NEV.

LOCATION.—In SE. ¼ sec. 15, T. 14 S., R. 65 E., at concrete weir three-quarters of a mile below Home ranch, 6 miles northwest of Moapa, Clark County, a short distance below springs that form source of stream.

DRAINAGE AREA.—1,080 square miles. A large drainage area above Arrow Canyon is tributary to Muddy River but produces no surface run-off except during cloudbursts or periods of heavy rainfall.

RECORDS AVAILABLE.—July 1, 1913, to September 30, 1915, and April 20, 1916, to September 30, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder in pool above weir.

DISCHARGE MEASUREMENTS.—Made from a foot plank below weir.

CONTROL.—A 10-foot Cippoletti weir. Stage of zero flow, zero on gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.5 feet at midnight July 23 (discharge, 62 second-feet); minimum stage, 1.02 feet at 5.30 p. m. July 21 (discharge, 36 second-feet).

1913–1917: Maximum stage recorded, 9.9 feet at 11 p. m. February 21, 1914 (discharge estimated, 765 second-feet); minimum discharge, 36 second-feet between July 2 and 14, 1916, and July 21, 1917.

ICE.—Stage-discharge relation not affected by ice, but stream is subject to sudden freshets in winter.

DIVERSIONS.—Several ranch ditches divert water for irrigation above the station.

REGULATION.—Flow affected somewhat by diversions above.

ACCURACY.—Stage-discharge relation varies due to sand collecting above the weir, thereby increasing the velocity of approach. Range of stage is small except for short peak floods, and curves are reasonably well defined from 40 to 50 second-feet. Operation of water-stage recorder satisfactory except for a few short interruptions. Daily discharge estimated for such periods from the station at the Indian reservation. Records good.

Discharge measurements of Muddy River near Moapa, Nev., during the year ending Sept. 30, 1917.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 12	1.25	49.7	Feb. 22	1.24	49.7	Aug. 7	1.17	45.7
Oct. 29	1.29	49.3	May 16	1.00	35.4			

Daily discharge, in second-feet, of Muddy River near Moapa, Nev., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	43	50	49	50	47	46	48	48	47	47	47	48
2	43	50	48	50	47	47	49	48	45	46	47	48
3	43	50	48	51	47	50	49	47	45	46	48	45
4	43	50	48	50	48	51	49	48	45	45	48	44
5	42	50	48	50	50	51	48	47	45	42	48	43
6	41	50	48	50	50	51	45	48	46	41	48	43
7	41	50	49	49	51	50	47	48	47	38	47	47
8	43	50	49	49	51	46	48	48	43	43	46	43
9	45	50	48	50	51	46	48	48	40	45	45	41
10	47	50	49	49	51	47	47	43	43	44	44	40
11	48	50	49	48	51	48	45	45	43	46	43	42
12	49	50	48	48	51	50	47	46	45	46	44	42
13	.....	49	48	48	51	50	47	46	43	47	44	41
14	.....	50	49	47	51	48	46	45	39	46	42	39
15	.....	49	50	47	50	48	48	43	40	46	43	41
16	.....	49	50	47	48	48	47	38	42	46	44	43
17	.....	50	50	47	50	48	46	38	48	45	45	42
18	.....	54	50	46	51	49	45	40	46	46	45	45
19	.....	50	50	46	50	49	43	38	43	46	45	46
20	.....	49	50	51	49	49	43	40	44	40	46	46
21	.....	49	49	48	48	49	43	.....	47	37	42	46
22	47	49	49	47	48	48	48	.....	47	40	40	46
23	48	49	49	47	49	48	45	.....	48	42	41	47
24	48	49	50	47	49	49	46	.....	48	44	41	46
25	50	49	50	47	49	48	47	.....	46	45	40	46
26	50	50	50	47	48	47	47	.....	45	43	41	46
27	49	48	49	48	46	47	47	.....	45	46	43	47
28	49	48	48	48	45	47	47	.....	47	45	48	47
29	49	49	49	48	.....	47	48	.....	47	44	48	47
30	49	50	50	48	.....	47	48	.....	47	50	48	48
31	49	.....	50	47	.....	47	.....	47	.....	47	47	.....

NOTE.—Discharge estimated July 30 to Aug. 4; interpolated July 3, 14–16, 22, 23, 28, and Aug. 8. Mean discharge estimated as follows: Oct. 13–21, 48 second-feet; May 21–30, 44 second-feet.

Monthly discharge of Muddy River near Moapa, Nev., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	50	41	46.7	2,870
November	54	48	49.7	2,960
December	50	48	49.1	3,020
January	51	46	48.2	2,960
February	51	45	49.2	2,730
March	51	46	48.3	2,970
April	49	43	46.7	2,780
May	48	38	44.5	2,740
June	48	39	44.9	2,670
July	50	37	44.3	2,720
August	48	40	44.8	2,750
September	48	39	44.5	2,650
The year	54	37	46.7	33,800

MUDDY RIVER ABOVE MOAPA RIVER INDIAN RESERVATION, NEAR MOAPA, NEV.

LOCATION.—In SW. ¼ sec. 26, T. 14 S., R. 65 E., about a quarter of a mile above upper end of Moapa River Indian Reservation, 2 miles below station at Home ranch, and 5 miles west of Moapa, Clark County.

DRAINAGE AREA.—1,100 square miles.

RECORDS AVAILABLE.—August 24, 1914, to September 30, 1917, when station was discontinued. Several current-meter measurements were made in 1914 before the gage-height record was started.

GAGE.—Stevens water-stage recorder installed August 24, 1914; moved 90 feet downstream December 14, 1915, and datum lowered 0.06 foot. Current-meter measurements prior to August 24, 1914, referred to a vertical staff at the upper site.

DISCHARGE MEASUREMENTS.—Made from a footbridge about 85 feet above gage.

CHANNEL AND CONTROL.—Bed consists of clay and limestone deposit, with some sand and vegetal growth. One channel at all stages but banks are overflowed during excessive floods. Control is a limestone reef about 20 feet below the present gage. Stage of zero flow approximately −2 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.24 feet at 5.30 a. m. July 30 (discharge, 63 second-feet); minimum discharge during year, 36 second-feet, September 14.

1914–1917: Maximum discharge, 86 second-feet at 4 a. m. February 11, 1915; minimum discharge, 36 second-feet, at 10 p. m. July 12, 1916, and September 14, 1917.

ICE.—Stage-discharge relation not affected by ice. Except for sudden freshets flow is very uniform as stream is fed by springs.

DIVERSIONS.—One small diversion and some seepage and return flow between this station and the one 2 miles above at the Home ranch.

REGULATION.—Affected somewhat by the diversions at the Home ranch.

ACCURACY.—Stage-discharge relation affected by moss. Rating curves fairly well defined from 40 to 50 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying indirectly to rating table, gage height obtained by inspection of recorder graph. Records good.

Discharge measurements of Muddy River above Moapa River Indian Reservation, near Moapa, Nev., during the year ending Sept. 30, 1917.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 29	2.21	48.9	May 16	1.95	38.9	July 23	2.41	40.9
Feb. 23	2.12	48.6	July 20	2.68	46.9	Aug. 7	2.56	45.7

Daily discharge, in second-feet, of Muddy River above Moapa River Indian Reservation, near Moapa, Nev., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	43	49	47	49	46	46	49	51	49	44	48	44
2	43	49	46	49	46	48	50	51	46	44	48	44
3	43	49	46	51	46	51	50	49	46	42	49	42
4	43	49	46	50	48	51	50	50	46	43	48	39
5	42	49	47	49	50	50	49	50	46	40	46	40
6	41	49	47	49	50	50	47	51	48	39	47	39
7	41	49	49	48	50	51	48	51	48	37	47	43
8	43	49	49	48	50	48	49	51	45	41	47	42
9	45	49	48	49	50	47	49	50	41	44	46	36
10	47	49	49	48	50	49	48	50	42	43	44	36
11	48	49	49	47	50	50	46	49	44	44	43	39
12	49	49	48	47	50	51	48	48	45	46	46	39
13	48	49	47	46	50	50	49	48	42	45	44	39
14	45	49	48	46	50	49	48	47	30	46	42	36
15	44	48	48	46	48	49	49	44	40	46	42	38
16	44	48	49	46	47	49	49	42	41	46	43	40
17	45	49	49	45	49	49	49	40	47	46	44	40
18	46	49	49	45	50	50	46	42	44	45	44	43
19	45	48	49	45	49	50	45	42	40	46	44	44
20	45	48	49	51	48	51	45	42	39	41	45	44
21	45	48	49	47	48	50	45	43	42	37	41	45
22	46	48	49	46	49	50	47	49	44	39	38	44
23	47	48	49	46	49	50	50	49	44	42	38	45
24	48	48	49	46	49	50	47	49	44	46	38	44
25	49	48	50	46	50	49	49	51	42	46	37	44
26	50	48	49	46	50	48	50	49	41	46	37	45
27	49	47	48	46	48	49	50	49	41	44	39	45
28	49	46	48	46	46	49	50	49	43	45	46	46
29	49	47	48	46	.....	49	51	49	44	49	45	46
30	49	48	49	46	.....	49	51	49	44	52	44	48
31	49	.....	49	46	.....	48	.....	49	.....	48	44	.....

NOTE.—Discharge estimated Oct. 5–11 from records at station above. Discharge interpolated May 10, 11, 19, and Sept. 3.

Monthly discharge of Muddy River above Moapa River Indian Reservation, near Moapa, Nev., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	50	41	45.8	2,820
November	49	46	48.4	2,880
December	50	46	48.3	2,970
January	51	45	47.1	2,900
February	50	46	48.8	2,710
March	51	46	49.4	3,040
April	51	45	48.4	2,880
May	51	40	47.8	2,940
June	49	39	43.6	2,590
July	52	37	43.9	2,700
August	49	37	43.7	2,690
September	48	36	42.0	2,500
The year	52	36	45.3	33,600

MUDDY RIVER AT RAILROAD PUMPING PLANT NEAR MOAPA, NEV.

LOCATION.—In sec. 5, T. 15 S., R. 66 E., at railroad bridge on main-line track of Salt Lake Route, about a mile below Indian reservation and 1¾ miles south of Moapa, Clark County, above confluence of Meadow Valley Wash.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 8, 1914, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on right bank attached to pile of railroad bridge; read by Wilma McDonald. Gage installed at apparently same location but at different datum, November 22, 1916.

DISCHARGE MEASUREMENTS.—Made from foot plank about 150 feet below gage.

CHANNEL AND CONTROL.—Bed composed of clay. Banks comparatively low; overflowed during freshets; one channel at all stages. There is a well-defined riffle 200 feet below gage, but stage-discharge relation is evidently affected by changes in channel between gage and riffle. Rocks in channel below gage blasted out June 13, 1917, changing stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.94 feet, new datum, at 9 a. m. August 5 (discharge estimated by prolonging rating curve, 57 second-feet); minimum stage recorded, 1.28 feet, new datum, April 20 and 21 (discharge, 35 second-feet).

1914–1917: Maximum stage recorded, 2.4 feet, old datum, at 3 p. m. February 11, 1915 (discharge about 145 second-feet); minimum discharge, 29 second-feet at 6.30 p. m. June 20, 1915.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Water to irrigate about 200 acres is diverted at the Indian reservation and also for a ranch between the reservation and the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Range of stage small; direction of rating curves not accurately determined. Gage read twice daily to hundredths. Discharge ascertained by applying mean daily gage height to three rating tables applicable as follows: October 1 to November 21; November 22 to June 12; June 14 to September 30. Records fair.

Discharge measurements of Muddy River at railroad pumping plant near Moapa, Nev., during the year ending Sept. 30, 1917.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Feb. 3	2.06	44.1
June 8	1.84	34.6
Aug. 3	1.67	44.7

Daily discharge, in second-feet, of Muddy River at railroad pumping plant near Moapa, Nev., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	45	46	46	45	42	44	43	43	46	46	41
2	40	45	43	46	44	41	44	45	45	44	46	40
3	41	46	43	48	46	42	43	40	44	41	45	41
4	41	47	43	47	46	42	45	42	43	40	46	41
5	41	46	44	47	49	42	45	43	44	40	55	38
6	41	46	42	46	49	42	42	44	44	38	46	40
7	42	45	44	47	49	44	41	44	44	35	46	40
8	43	45	44	46	47	43	42	45	38	38	45	40
9	43	45	46	46	47	44	43	45	37	40	44	39
10	45	45	45	46	47	46	46	42	37	38	44	38
11	46	46	44	46	47	46	46	37	41	38	44	41
12	46	45	46	43	48	47	45	43	38	38	44	39
13	46	45	45	45	47	47	43	44	37	37	46	39
14	43	44	46	44	47	47	39	43	37	38	43	38
15	42	46	46	44	46	47	40	39	37	38	41	38
16	42	45	45	46	45	45	42	38	37	39	41	38
17	43	44	47	45	46	46	41	37	40	37	41	38
18	44	44	46	44	45	46	42	37	41	38	40	38
19	44	45	47	44	44	46	41	38	41	39	42	39
20	44	46	46	50	45	45	35	37	40	40	42	39
21	43	46	46	47	45	45	35	37	45	37	40	41
22	45	46	46	46	46	45	42	42	46	40	37	42
23	45	46	47	45	46	45	45	42	46	42	37	45
24	46	46	46	46	46	46	43	42	45	43	39	46
25	46	46	46	46	44	45	44	44	42	41	39	42
26	46	46	46	45	43	46	44	45	41	40	36	46
27	46	46	46	46	42	46	43	44	39	40	37	46
28	43	46	48	46	42	46	44	45	40	39	40	46
29	44	46	45	43	.....	46	46	44	40	54	42	46
30	44	46	46	45	.....	45	44	46	42	52	41	47
31	44	.....	46	45	.....	44	.....	43	.....	44	41	.....

NOTE.—Discharge interpolated Oct. 4, 5, June 13, July 7, 8, and 11.

Monthly discharge of Muddy River at railroad pumping plant near Moapa, Nev., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	46	40	43.5	2,670
November	47	44	45.5	2,710
December	48	42	45.4	2,790
January	50	43	45.7	2,810
February	49	42	45.8	2,540
March	47	41	44.8	2,750
April	46	35	42.6	2,530
May	46	37	41.9	2,580
June	46	37	41.1	2,450
July	54	35	40.5	2,490
August	55	37	42.5	2,610
September	47	38	41.1	2,450
The year	55	35	43.4	31,400

MUDDY RIVER AT WEISER RANCH, NEAR MOAPA, NEV.

LOCATION.—In NE. ¼ sec. 2, T. 15 S., R. 66 E., 250 feet below intake of Weiser canal, a quarter of a mile above mouth of Meadow Valley Wash, 1 mile above Weiser ranch house, and 3 miles southeast of Moapa, Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 17, 1915, to September 30, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading about 150 feet above gage.

CHANNEL AND CONTROL.—Bed composed of clay; clean but subject to scouring and filling; one channel at all stages. Control at remains of an old dam; loose rock and firm clay but shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 1.32 feet at 2 a. m. July 31 (discharge, 58 second-feet); minimum discharge, 28 second-feet at 8 a. m. July 21.

1915–1917: Maximum stage recorded from water-stage recorder, 3.12 feet at 7 a. m. August 4, 1916 (discharge, 69 second-feet); minimum discharge, 21 second-feet at 1 p. m. July 13, 1916.

ICE.—Stage-discharge relation not affected by ice; winter flow very uniform except for sudden freshets, usually of short duration, due to storms.

DIVERSIONS.—The Weiser canal diverts about 250 feet above gage and there are numerous diversions farther upstream.

ACCURACY.—Stage-discharge relation not permanent. Rating curve, applicable November 7 to July 29, fairly well defined between 25 and 50 second-feet. Discharge ascertained by applying to rating table daily gage height determined by inspection of recorder graph and by indirect method for shifting control. Records fair.

Discharge measurements of Muddy River at Weiser ranch, near Moapa, Nev., during the year ending Sept. 30, 1917.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 9	1.21	38.3	Mar. 10	.1.02	44.4	July 8	0.68	32.6
Feb. 2	1.06	45.2	May 14	.83	38.1			

Daily discharge, in second-feet, of Muddy River at Weiser ranch, near Moapa, Nev., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	34	45	46	.....	45	43	41	38	37	35	43	38
2	34	47	47	49	45	44	41	38	38	36	41	39
3	35	47	49	51	45	43	40	37	38	37	42	38
4	35	48	49	52	45	44	40	38	38	35	42	36
5	35	48	46	51	47	44	41	39	38	34	42	36
6	35	48	46	50	47	43	40	39	38	33	41	34
7	37	47	47	50	47	42	39	40	39	32	41	33
8	38	47	47	48	47	42	41	40	38	32	40	36
9	38	46	.....	48	47	42	41	40	34	35	40	37
10	40	47	.....	47	47	42	40	38	33	35	39	35
11	40	47	.....	46	47	42	38	37	35	34	39	34
12	40	47	.....	46	47	43	39	38	32	36	41	34
13	41	47	.....	.....	47	43	38	37	33	34	41	34
14	41	46	.....	.....	47	43	38	37	31	32	39	33
15	39	47	.....	.....	46	43	40	37	32	32	39	33
16	39	47	48	47	45	43	40	35	32	34	38	36
17	40	47	48	48	45	43	41	35	34	34	38	37
18	41	49	.....	47	46	42	39	35	36	31	38	38
19	42	49	.....	47	46	42	38	35	36	31	38	36
20	42	49	.....	52	45	42	37	35	35	31	38	37
21	42	50	.....	53	45	41	38	36	35	29	39	39
22	43	50	.....	48	45	41	39	37	35	30	37	39
23	43	47	.....	49	46	41	39	37	37	31	36	40
24	44	46	.....	49	45	41	39	37	37	34	35	41
25	45	46	.....	49	45	41	38	38	35	35	34	41
26	46	46	.....	49	44	40	38	39	34	35	34	41
27	47	46	.....	47	44	40	38	38	34	34	38	40
28	45	46	.....	48	43	41	38	39	34	36	38	40
29	45	46	.....	46	.....	42	39	38	35	47	39	40
30	45	46	.....	45	.....	42	39	38	35	46	39	40
31	45	.....	.....	45	.....	40	.....	38	.....	50	38	.....

NOTE.—Mean discharge estimated on account of lack of gage-height record as follows: Dec. 9–15, 47 second-feet; Dec. 18 to Jan. 1, 48 second-feet; Jan. 13–15, 46 second-feet.

Monthly discharge of Muddy River at Weiser ranch, near Moapa, Nev., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	47	34	40.5	2,490
November	50	46	47.2	2,810
December	.....	.....	47.5	2,920
January	53	.....	48.2	2,960
February	47	43	45.7	2,540
March	44	40	42.1	2,590
April	41	37	39.2	2,330
May	40	35	37.5	2,310
June	39	31	35.3	2,100
July	50	29	34.8	2,140
August	43	34	38.9	2,390
September	41	33	37.2	2,210
The year	53	29	41.2	29,800

NOTE.—See footnote to table of daily discharge.

187042°—21—WSP 459——10

GILA RIVER BASIN.

GILA RIVER AT GUTHRIE, ARIZ.

LOCATION.—In sec. 3, T. 6 S., R. 30 E., about 1,500 feet above Arizona & New Mexico Railroad bridge at Guthrie, Greenlee County, and 8 miles above junction of Gila and San Francisco rivers.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 6, 1910, to September 30, 1917,

GAGE.—Stevens water-stage recorder on left bank, installed May 16, 1914, at datum different from that of inclined staff gage on right bank about 500 feet above railroad bridge, which was used prior to that date.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet below gage or by wading.

CHANNEL AND CONTROL.—Sand and gravel; shifts slightly at low stages and considerably at high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, 14.7 feet on morning of October 15, determined from flood marks on gage (discharge, not determined); minimum stage, from water-stage recorder, 1.20 feet July 19 (discharge, 26 second-feet.

1910–1917: Maximum stage occurred October 15, 1916 (see above); minimum discharge, 18 second-feet May 21, 1914.

DIVERSIONS.—Sufficient water to irrigate about 7,000 acres of land is diverted from stream above station.

ACCURACY.—Stage-discharge relation continually changing. Standard rating curve fairly well defined below 500 second-feet, poorly defined from 500 to 2,400 second-feet, and approximate above 2,400 second-feet. Twenty discharge measurements made during year by means of which changes in stage-discharge relation were determined with fair accuracy. Operation of the water-stage recorder was reasonably satisfactory except as indicated in footnote to daily-discharge table. Daily discharge determined by indirect method for shifting control. Records fair.

Discharge measurements of Gila River at Guthrie, Ariz., during the year ending Sept. 30, 1917.

[Made by J. B. Spiegel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 11	4.39	844	Jan. 4	1.98	165	July 10	1.24	33.9
11	6.00	[a] 2,380	30	3.10	542	10	1.24	33.2
24	3.05	514	30	3.10	588	Aug. 22	1.74	65
24	3.04	499	Mar. 22	2.74	348	22	1.74	66
Nov. 16	1.98	168	22	2.74	347	Sept. 20	1.38	30.3
16	1.98	174	May 18	2.09	134	20	1.38	30.8
Jan. 4	1.98	156	18	2.10	147			

[a] Surface velocity observed over greater part of section and coefficient of 0.85 used to reduce to mean velocity.

Daily discharge, in second-feet, of Gila River at Guthrie, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	128	288	152	150	492	775	532	255	118	30	77	30
2	118	282	152	152	464	725	544	243	118	29	112	29
3	116	267	144	152	448	636	488	216	116	29	128	29
4	114	258	150	160	416	564	428	195	110	28	86	29
5	114	237	148	158	396	512	393	175	100	28	104	28
6	116	216	146	162	382	460	372	165	90	29	124	29
7	118	210	142	162	376	428	362	162	83	31	116	33
8	134	208	138	160	379	412	362	156	76	31	112	35
9	128	202	144	158	379	393	358	152	70	32	87	42
10	488	198	142	158	379	393	362	150	64	32	84	36
11	1,240	192	142	156	362	400	393	150	57	31	83	36
12	680	188	142	156	354	436	400	148	48	31	80	34
13	1,370	180	140	156	340	428	386	152	47	35	74	31
14	.....	180	140	165	334	412	365	148	44	31	73	31
15	.....	175	136	178	330	382	351	146	42	29	94	31
16	.....	170	136	175	334	354	334	144	41	28	208	30
17	.....	170	134	168	324	337	334	138	38	30	175	31
18	.....	160	134	188	321	327	334	138	35	27	168	31
19	.....	158	134	1,060	318	312	327	136	33	26	142	31
20	.....	156	134	.....	312	312	309	152	33	37	117	31
21	.....	158	134	.....	309	318	303	182	32	35	92	32
22	580	168	136	3,610	294	334	303	198	33	74	66	36
23	516	170	140	2,060	294	340	294	192	32	58	62	37
24	488	165	142	1,390	300	358	279	188	32	40	60	38
25	448	162	150	1,070	337	365	270	182	31	34	58	41
26	408	165	146	870	412	358	261	170	32	37	61	42
27	382	158	148	740	584	351	249	154	31	49	62	47
28	354	158	152	650	825	365	231	162	31	36	57	44
29	330	154	152	604	.....	386	234	154	31	45	50	44
30	324	150	152	564	.....	408	249	140	31	31	38	43
31	309	.....	152	528	.....	464	.....	128	.....	98	31	.....

NOTE.—Because of incomplete data, discharge partly estimated from study of other Gila River stations, Oct. 14–21, 4,000 second-feet; Jan. 20 and 21, 8,600 second-feet. Discharge interpolated Aug. 19–21 because of silt in gage well. Oct. 22 and 23, Jan. 20–29 recorder not working, gage heights from daily readings on staff gage. Mean daily gage heights Oct. 14, 9.4 feet; Jan. 20, 11 feet; Jan. 21, 8.6 feet. Results may be slightly in error because of silt in gage well or recorder not working properly on Nov. 6–13; Apr. 15; June 7–19; Aug. 6–8 and 22–30; and Sept. 14–20.

Monthly discharge of Gila River at Guthrie, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	.....	114	1,320	81,200
November	288	150	190	11,300
December	152	134	143	8,790
January	.....	150	1,070	65,800
February	825	294	386	21,400
March	775	312	421	25,900
April	544	231	347	20,600
May	255	128	167	10,300
June	118	31	56.0	3,330
July	98	26	36.8	2,260
August	208	31	92.9	5,710
September	47	28	34.7	2,060
The year	.....	26	358	259,000

GILA RIVER NEAR SOLOMONVILLE, ARIZ.

LOCATION.—In NE. ¼ sec. 31, T. 6 S., R. 28 E., 1 mile below intake of Brown canal and 10 miles above Solomonville, Graham County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 21, 1914, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank, directly opposite J. W. Earven's ranch.

DISCHARGE MEASUREMENTS.—Made from cable just below gage or by wading.

CHANNEL AND CONTROL.—Gravel, sand, and silt; changes slightly at low stages and considerably at high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 10.7 feet at 6 a. m., October 14 (discharge, determined from extension of rating curve, about 67,900 second-feet); minimum stage, from water-stage recorder, −0.17 foot, September 6 and 7 (discharge, 89 second-feet).

1914–17: Maximum stage 14 feet, January 19, 1916, determined from flood marks on gage (discharge, about 100,000 second-feet, determined from extension of rating curve); minimum discharge, 64 second-feet, June 29, 1914.

DIVERSIONS.—Brown canal, which is used to irrigate a few hundred acres on the north side of the river, heads about 1 mile above the station; maximum capacity about 35 second-feet. About 17,000 acres are irrigated from this stream above the station at Guthrie.

ACCURACY.—Stage-discharge relation continually changing. Standard rating curve fairly well defined below 10,000 second-feet and poorly defined above. Thirty-two discharge measurements were made during year by means of which changes in stage-discharge relation were determined with fair accuracy, except for high stages. Operation of the water-stage recorder was satisfactory throughout year, except for short periods as indicated in footnote to the daily-discharge table. Daily discharge determined by indirect method for shifting control. Records fair for low and medium stages, with increasing errors for higher stages.

Discharge measurements of Gila River near Solomonville, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	J. B. Spiegel	0.18	197	Apr. 12	J. B. Spiegel	1.18	865
4	do	.18	189	June 9	do	.11	168
15	do	5.25	[a] 20,400	9	do	.11	163
16	do	2.84	8,440	July 6	do	.04	108
21	do	1.08	1,720	6	do	.03	108
21	do	1.07	1,640	18	do	.11	160
Nov. 9	do	.53	517	18	do	.12	167
9	do	.53	518	Aug. 15	do	.10	180
Dec. 29	Spiegel and Empie	.45	310	15	do	.10	186
29	do	.45	302	Sept. 6	H. D. Empie	−.17	90
Feb. 5	J. B. Spiegel	1.02	744	6	J. B. Spiegel	−.17	90
5	do	1.02	750	12	do	.92	107
Mar. 17	do	1.02	749	12	do	.92	110
17	do	1.02	760	26	do	1.08	145
Apr. 12	do	1.17	826	26	do	1.08	148

[a] Surface velocity observed by floats and coefficient of 0.90 used to reduce to mean velocity. Results liable to considerable error account of impossibility of making accurate soundings. Area determined from soundings made Oct. 16 when the channel may have filled in considerably.

Daily discharge, in second-feet, of Gila River near Solomonville, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	234	710	352	320	920	1,820	1,480	630	256	196	1,180	112
2	219	687	352	320	845	1,640	1,480	574	250	136	746	105
3	205	652	344	328	818	1,480	1,340	532	234	128	630	98
4	191	618	336	344	770	1,260	1,100	490	217	120	641	94
5	191	584	336	336	746	1,110	965	463	206	112	1,050	90
6	211	564	336	328	710	965	860	436	187	105	758	89
7	206	532	314	320	698	875	818	445	183	103	641	90
8	228	511	306	306	698	806	770	427	174	115	532	98
9	490	490	314	314	687	794	770	409	170	200	542	96
10	595	481	306	306	664	794	794	392	157	129	445	115
11	2,440	463	306	300	641	830	845	368	143	129	445	110
12	1,790	454	306	294	606	905	830	360	136	132	360	110
13	3,670	454	288	306	595	920	794	360	129	143	294	120
14	46,000	454	288	352	606	905	746	352	129	166	234	122
15	21,800	427	281	352	606	830	722	336	126	170	234	143
16	9,300	427	288	344	595	770	734	336	123	183	553	150
17	4 990	418	288	344	574	758	746	328	120	196	427	250
18	3,530	409	288	384	584	746	770	328	117	161	384	211
19	2,500	400	281	687	652	722	770	336	113	153	320	161
20	1,920	409	281	4,250	641	722	746	376	111	146	250	166
21	1,640	427	269	15,200	618	782	686	436	110	183	222	166
22	1,480	418	269	6,580	630	875	652	454	108	376	196	166
23	1,240	409	275	3,530	770	920	641	427	107	368	178	166
24	1,120	400	275	2,210	935	965	618	376	106	256	157	154
25	1,020	400	300	1,620	1,300	965	618	376	104	234	187	154
26	905	384	314	1,180	1,520	965	630	328	103	306	183	150
27	905	376	320	1,070	1,720	998	618	314	102	463	170	146
28	860	368	306	1,020	1,870	1,020	630	314	102	532	146	140
29	830	352	306	965	.....	1,090	618	307	100	618	120	132
30	794	352	306	965	.....	1,200	652	281	100	522	117	129
31	758	.....	320	950	.....	1,380	.....	275	.....	1,380	115	.....

NOTE.—Discharge interpolated Oct. 1-3 and July 3-5, because of missing gage heights. Oct. 14 and 15, June 16-30, July 17 and 18, Aug. 2-14, 28, and 29, Sept. 2-5 and 22-25, results partly estimated account of recorder not working properly.

Monthly discharge of Gila River near Solomonville, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	46,000	191	3,620	223,000
November	710	352	468	27,800
December	352	269	305	18,800
January	15,200	294	1,490	91,600
February	1,870	574	822	45,700
March	1,820	722	994	61,100
April	1,480	618	815	48,500
May	630	275	392	24,100
June	256	100	144	8,570
July	1,380	103	263	16,200
August	1,180	115	402	24,700
September	250	89	134	7,970
The year	46,000	89	825	598,000

GILA RIVER NEAR SAN CARLOS, ARIZ.

LOCATION.—One mile above dam site in box canyon on San Carlos Indian Reservation and about 6 miles below San Carlos Indian Agency, Gila County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 29, 1914, to September 30, 1917, at present site; 1899 to 1905 at a point half a mile south of the Indian Agency at San Carlos and below San Carlos Creek; August 17, 1910, to February 5, 1911 at a point just below the Arizona Eastern Railroad bridge and half a mile above San Carlos Creek.

GAGE.—Stevens water-stage recorder on left bank about one mile above dam site.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from cable about one mile above gage.

CHANNEL AND CONTROL.—Channel composed of sand, gravel, and boulders. A semipermanent control is formed by rapids over heavy boulders just below gage. Control shifts somewhat because of sand filling in and washing out from crevices between the boulders.

EXTREMES OF DISCHARGE.—Maximum stage during year 20.4 feet during night of October 14 determined from flood marks on gage (discharge, about 62,000 second-feet determined from rating curve extended largely on basis of slope formula); minimum stage from water-stage recorder 0.34 foot at 6 p. m. July 1 (discharge, 12 second-feet).

1914–1917: Maximum stage 25.5 feet January 20, 1916 (discharge, determined from extension of rating curve, about 92,000 second-feet); minimum stage 0.15 foot, July 1, 1914 (discharge, 1 second-foot).

DIVERSIONS.—Water for irrigating about 30,000 acres is diverted from river in valley just above station. At times this diversion reduces the low flow practically to zero at the station. About 7,000 acres are irrigated from this stream above the station at Guthrie.

ACCURACY.—Stage-discharge relation continually changing. Standard rating curve fairly well defined below 14,000 second-feet and poorly defined above. Twenty-six discharge measurements were made during year by means of which changes in stage-discharge relation were determined with fair accuracy. Operation of the water-stage recorder was reasonably satisfactory except as indicated in footnote to the daily-discharge table. Daily discharge determined by indirect method for shifting control. Records fair.

Discharge measurements of Gila River near San Carlos, Ariz., during the year ending Sept. 30, 1917.

[Made by J. B. Spiegel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 2	3.72	734	Jan. 25	5.88	2,870	July 3	.42	15.6
2	3.72	757	Feb. 9	3.58	789	3	.42	14.9
Dec. 19	2.10	[a] 342	9	3.57	765	17	.66	41.7
Jan. 21	10.62	13,900	Mar. 13	3.08	670	17	.66	39.1
23	8.00	5,730	13	3.03	598	Aug. 17	2.28	256
23	7.90	5,950	Apr. 17	2.60	446	17	2.28	252
24	6.83	4,420	17	2.60	460	Sept. 28	.60	23.0
24	6.80	4,320	May 25	1.30	114	28	.60	22.3
25	5.90	2,890	25	1.30	106			

[a] Doubtful because of strong upstream wind.

NOTE.—Mean gage height for most of the above measurements was obtained from one reading on staff gage just before measurement began and study of graph record.

Daily discharge, in second-feet, of Gila River near San Carlos, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	122	822	325	376	1,300	1,900	715	225	66	14	810	55
2	117	735	319	369	1,250	1,910	878	219	65	16	827	54
3	113	616	319	383	1,140	1,520	938	208	62	28	459	53
4	108	602	316	474	1,070	1,370	849	195	60	61	463	51
5	103	562	316	425	986	1,280	745	179	54	40	330	50
6	202	566	316	386	926	1,110	645	173	53	32	633	48
7	277	531	316	390	860	992	575	173	49	31	308	67
8	1,340	494	316	383	827	844	536	173	47	30	202	.....
9	670	482	316	376	761	766	527	173	46	30	256	.....
10	311	486	322	369	715	670	518	.....	43	30	142	.....
11	393	459	325	354	715	602	510	.....	39	31	86	.....
12	1,640	444	325	342	695	570	522	.....	39	32	221	.....
13	1,890	411	328	330	675	631	531	.....	37	33	115	.....
14	11,500	407	330	328	655	631	527	.....	34	34	162	.....
15	33,500	407	333	345	588	593	486	.....	32	34	70	.....
16	14,800	390	333	376	547	570	470	.....	29	84	94	.....
17	8,850	380	333	386	514	553	459	.....	29	40	292	.....
18	4,800	390	339	411	575	575	400	.....	27	24	229	.....
19	3,140	369	342	414	650	553	376	.....	26	36	169	.....
20	2,430	360	339	1,470	675	523	383	160	24	383	131	.....
21	2,020	351	336	9,440	730	490	360	193	23	156	112	.....
22	1,790	339	333	14,400	1,080	444	339	150	20	142	101	.....
23	1,530	330	330	6,390	1,440	418	120	120	20	1,050	90	.....
24	1,400	333	328	4,340	1,530	474	316	110	20	418	82	.....
25	1,290	336	432	3,020	1,490	557	298	107	19	158	76	.....
26	1,180	330	444	2,290	1,500	588	266	107	18	269	71	.....
27	1,110	333	444	2,130	1,540	575	232	100	17	191	67	.....
28	1,050	333	436	1,880	1,550	536	214	100	16	114	65	22
29	980	333	400	1,730	.....	548	190	87	16	890	61	22
30	914	333	393	1,550	.....	570	330	78	15	844	60	23
31	878	.....	383	1,460	.....	616	.....	72	.....	510	57	.....

NOTE.—Because of missing gage heights, discharge estimated by comparison with other Gila River stations as follows: May 10–19, 160 second-feet; May 22–24 as published; Sept. 8–27, 50 second-feet. Oct. 14–18, Jan. 27, and May 6–9 gage heights partly estimated, account of débris in gage well.

Monthly discharge of Gila River near San Carlos, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	33,500	103	3,240	199,000
November	822	330	442	26,300
December	444	316	347	21,300
January	14,400	328	1,850	114,000
February	1,550	514	964	53,500
March	1,910	418	774	47,600
April	938	190	482	28,700
May	.....	72	152	9,350
June	66	15	34.8	2,070
July	1,050	14	187	11,500
August	827	57	221	13,600
September	.....	.....	48.2	2,870
The year	33,500	14	732	530,000

GILA RIVER AT WINKELMAN, ARIZ.

LOCATION.—In NE. ¼ sec. 24, T. 5 S., R. 15 E., at highway bridge at Winkleman, Gila County, 1 mile above San Pedro River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 10–30, 1917.

GAGE.—Chain gage attached to upstream side of bridge; read by S. H. Snider.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading near bridge.

CHANNEL AND CONTROL.—Silt, sand, and gravel—likely to shift at all stages. Right bank high, rocky; left bank not subject to overflow except during extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 3.60 feet at 8 a. m. September 14 (discharge, 106 second-feet); minimum stage, 3.16 feet at 8 a. m. September 30 (discharge, 30 second-feet).

DIVERSIONS.—About 30,000 acres are irrigated from this stream between this station and station at Guthrie and about 7,000 acres above Guthrie.

ACCURACY.—Stage-discharge relation probably did not change during period covered by records, but is likely to change seriously during high stages. Rating curve fairly well defined above 60 second-feet by 7 discharge measurements from September 10, 1917, to February 28, 1918. Gage read to hundredths once daily. Daily discharge determined by applying daily gage height to rating table. Records fair.

Discharge measurements of Gila River at Winkelman, Ariz., during the year ending Sept. 30, 1917.

[Made by C. E. Ellsworth.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Sept. 10	3.48	76
10	3.48	78

Daily discharge, in second-feet, of Gila River at Winkelman, Ariz., for the year ending Sept. 30, 1917.

Day.	Sept.	Day.	Sept.
10	80	20	48
11	74	21	48
12	64	22	48
13	95	23	45
14	106	24	48
15	95	25	40
16	64	26	47
17	48	27	40
18	42	28	37
19	58	29	34
		30	30

GILA RIVER AT KELVIN, ARIZ.

LOCATION.—In sec. 12, T. 4 S., R. 13 E., about half a mile below the mouth of Mineral Creek, 1 mile below Kelvin,[1] Pinal County, and 25 miles above Florence, Ariz.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 26, 1911, to September 30, 1917.

GAGE.—Stevens water-stage recorder installed June 15, 1914, on left bank, half a mile above the original gage and referred to new datum. The original gage, an inclined staff fastened to basalt ledge on right bank opposite observer's house, was destroyed by the flood March 8, 1911, and replaced by painting the graduations on the ledge a few feet downstream. November 23, 1911, an inclined staff for low-water readings was fastened to the rock at the same location as first gage, and on September 20, 1912, an auxiliary vertical staff for low-water readings was installed on left bank opposite the inclined section. All gages previous to present gage were referred to same datum.

[1] Ray Junction on Arizona & Eastern Railroad.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge about 1½ miles above gage, or by wading near gage.

CHANNEL AND CONTROL.—Sand, gravel, and silt; changes slightly at low stages and considerably at high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 14.0 feet at 2 a.m., October 15 (discharge, about 46,800 second-feet, determined from extension of rating curve); minimum stage, from water-stage recorder, 1.61 feet at 8 p. m. July 1 (discharge, 21 second-feet).

1911-1917: Maximum stage 19.5 feet about noon January 20, 1916, determined from flood marks (discharge, determined from extension of rating curve, about 93,000 second-feet); no flow June 29 to July 11, 1913.

DIVERSIONS.—About 30,000 acres are irrigated from stream between this station and Guthrie, and about 7,000 acres above Guthrie.

ACCURACY.—Stage-discharge relation continually changing. Standard rating curve fairly well defined below 30,000 second-feet, poorly defined above. High-stage discharge measurements liable to considerable error account of impossibility of obtaining accurate soundings. Twenty-six discharge measurements were made during the year by means of which the changes in stage-discharge relation were determined with fair accuracy except for high stages. Operation of the water-stage recorder was satisfactory except as indicated in footnote to the daily discharge table. Daily discharge determined by indirect method for shifting control. Records fair for low and medium stages, with increasing errors for high stages.

Discharge measurements of Gila River near Kelvin, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	C. E. Ellsworth	2.01	154	Apr. 21	J. B. Spiegel	2.88	420
15	M. D. Anderson	11.2	[a]28,800	21	do	2.88	423
16	Ellsworth and Anderson	8.15	[b]17,000	May 23	C. E. Ellsworth	2.23	190
17	do	6.30	[c]9,720	June 30	do	1.65	26.5
Nov. 23	C. E. Ellsworth	2.77	389	30	do	1.65	28.4
23	do	2.77	381	July 27	J. B. Spiegel	3.56	2,620
25	do	2.86	395	27	do	3.46	2,210
Jan. 12	J. B. Spiegel	2.86	391	28	do	2.74	900
12	do	2.88	370	28	do	2.74	862
Feb. 19	Anderson and Adams	3.10	681	Aug. 20	C. E. Ellsworth	2.28	180
Mar. 11	C. E. Ellsworth	2.90	633	Sept. 8	do	2.82	560
11	do	2.90	650	17	L. N. Morscher	2.00	87
Apr. 2	do	3.16	766	27	do	1.95	51

[a] Surface velocity observed and coefficient of 0.90 used to reduce to mean velocity. Results liable to considerable error account of inaccurate determination of depths.

[b] Surface velocity determined with floats and coefficient of 0.90 used to reduce to mean velocity. Results liable to considerable error account of inaccurate determination of depths.

[c] Surface velocity determined with floats and coefficient of 0.90 used to reduce to mean velocity.

Daily discharge, in second-feet, of Gila River at Kelvin, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	162	1,020	258	300	.....	1,180	640	321	89	24	1,370	40
2	150	958	300	307	.....	1,270	710	321	76	282	1,090	40
3	126	898	258	356	.....	1,090	773	300	70	182	1,750	44
4	104	839	258	504	.....	958	680	307	64	142	2,220	40
5	89	795	294	426	.....	886	612	300	62	282	1,060	38
6	86	730	356	349	.....	862	594	294	60	150	1,100	38
7	98	690	300	356	.....	874	531	294	58	130	910	37
8	630	630	282	349	.....	817	522	307	54	1[illegible]	762	740
9	531	600	282	349	.....	784	558	307	48	118	886	970
10	200	540	321	363	.....	784	576	282	48	122	839	410
11	158	531	288	341	.....	690	558	276	46	107	680	450
12	477	468	270	394	.....	600	549	276	44	158	773	378
13	806	450	288	386	.....	630	531	270	42	138	862	328
14	4,930	426	282	442	.....	670	495	258	40	138	1,020	418
15	32,000	442	288	442	.....	670	486	246	40	158	540	205
16	17,600	418	276	468	.....	650	434	235	40	282	427	130
17	10,100	426	294	477	.....	640	418	230	42	240	540	92
18	6,130	442	294	540	.....	630	410	240	38	240	434	74
19	4,340	402	270	560	680	590	402	252	38	567	314	72
20	3,300	410	300	2,920	828	610	386	603	35	762	215	66
21	2,840	410	282	6,130	850	610	394	264	31	205	300	64
22	2,620	402	270	10,500	946	570	410	205	33	230	95	154
23	2,340	394	282	.....	1,230	513	402	182	30	1,020	95	142
24	2,150	349	264	.....	983	531	386	162	30	1,230	80	98
25	1,980	321	300	.....	934	610	378	138	52	710	40	72
26	1,780	321	356	.....	898	660	349	122	33	1,370	40	66
27	1,580	342	370	.....	1,070	610	321	122	29	2,700	60	58
28	1,430	300	307	.....	1,050	600	300	114	27	910	40	39
29	1,270	335	300	.....	.....	630	282	110	26	1,260	30	38
30	1,190	288	294	.....	.....	630	282	107	24	1,570	30	38
31	1,110	.....	294	.....	.....	580	.....	98	.....	1,290	44	.....

NOTE.—Because of missing gage heights, mean discharge estimated from study of climatic data and records of discharge at other Gila River stations, Jan. 23–31, 3,000 second-feet; Feb. 1–18, 850 second-feet. Sept. 6, discharge interpolated. July 6–11, 13, 15, and 18, Sept. 10–14, 19–21, and 25–30, results liable to slight error account of silt in gage well. Aug. 21 to Sept. 7, recorder not working properly; gage heights from daily readings on staff gage.

Monthly discharge of Gila River at Kelvin, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	32,000	86	3,300	203,000
November	1,020	288	519	30,900
December	370	258	293	18,000
January	10,500	300	1,750	108,000
February	.....	.....	885	49,200
March	1,270	513	724	44,500
April	773	282	479	28,500
May	603	98	243	14,900
June	89	24	45.0	2,680
July	2,700	24	543	33,400
August	2,220	30	601	37,000
September	970	37	179	10,700
The year	32,000	24	801	581,000

GILA RIVER NEAR SENTINEL, ARIZ.

LOCATION.—In sec. 10, T. 5 S., R. 9 W., 1 mile below old diversion dam of Southwestern Arizona Fruit & Irrigation Co., about 10 miles north of Sentinel, Maricopa County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 1, 1913, to March 2, 1917, when station was discontinued. Daily discharge, October 1, 1913, to December 20, 1914.

GAGE.—Vertical staff on left bank; read by J. T. Lee.

DISCHARGE MEASUREMENTS.—Measuring cable destroyed by flood January, 1916.

CHANNEL AND CONTROL.—Shifting sand.

EXTREMES OF STAGE.—Maximum stage during year 12.3 feet during night of October 15, determined from flood marks on gage; minimum stage recorded 5.9 feet October 4 and 5.

1913–1917: The river is dry a part of each year at this point. The maximum stage on record occurred at 5 p. m. January 20, 1916, gage height 24.75 feet.

ACCURACY.—Stage discharge not permanent. Control shifts considerably at all stages. Rating curve not developed. Gage read to half-tenths twice daily prior to January 22 and once daily since that date. Daily discharge not determined because of shifting control and lack of discharge measurements.

No discharge measurements were made at this station during the year.

Daily gage height, in feet, of Gila River near Sentinel, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1....	6.1	8.0	7.1	7.9	7.5	8.3	16....	11.75	7.3	6.8	7.95	7.0	.....
2....	6.0	7.9	7.1	7.9	7.55	8.1	17....	10.6	7.3	6.8	8.05	7.05	.....
3....	5.95	7.8	7.05	8.0	7.55	.....	18....	9.55	7.3	6.8	8.15	.....	.....
4....	5.9	7.7	7.0	8.1	.....	.....	19....	9.05	7.2	6.9	8.35	7.25	.....
5....	5.9	7.65	7.0	8.5	7.5	.....	20....	8.95	7.2	7.0	8.55	7.4	.....
6....	6.75	7.6	7.0	8.45	7.45	.....	21....	8.8	7.2	7.0	10.1	7.5	.....
7....	7.55	7.6	6.95	8.3	.....	.....	22....	8.8	7.2	7.25	9.5	.....	.....
8....	8.05	7.5	6.95	8.25	.....	.....	23....	8.7	7.15	7.3	9.4	.....	.....
9....	8.50	7.5	6.9	8.2	7.25	.....	24....	8.6	7.1	7.25	7.5	7.7	.....
10....	8.05	7.45	6.9	8.2	.....	.....	25....	8.55	7.1	8.0	8.5	.....	.....
11....	7.85	7.4	6.85	8.1	7.1	.....	26....	8.45	7.15	7.75	7.8	7.95	.....
12....	8.0	7.4	6.85	8.0	6.9	.....	27....	8.3	7.1	7.9	7.5	8.6	.....
13....	7.8	7.35	6.85	7.9	7.2	.....	28....	8.2	7.1	7.95	7.5	.....	.....
14....	7.6	7.3	6.85	7.9	7.15	.....	29....	8.15	7.15	8.0	7.3	.....	.....
15....	9.0	7.3	6.8	7.85	7.0	.....	30....	8.1	7.1	8.0	7.3	.....	.....
							31....	8.05	.....	7.9	7.6	.....	.....

SAN FRANCISCO RIVER AT CLIFTON, ARIZ.

LOCATION.—In sec. 30, T. 4 S., R. 30 E., between highway bridge and railroad bridge at Clifton, Greenlee County, 1½ miles below diversion dam of Arizona Copper Co., and 5 miles above junction with Gila River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 24, 1910, to January 14, 1911; January 24 to March 31, 1912; and August 5, 1912, to September 30, 1917.

GAGE.—Stevens water-stage recorder with inclined well on right bank about 1,000 feet below highway bridge, installed June 11, 1916, at different datum from previous gages. Original gage read from October 24, 1910, to September 30, 1912, was a vertical staff attached to highway bridge; replaced October 1, 1912, by a chain gage set at the same datum and read until August 5, 1913. From August 6, 1913, to May 14, 1914, a vertical staff on railroad bridge was used. On May 15, 1914, this was replaced by a Stevens water-stage recorder set at the same datum, which was used until January 19, 1916, when it was destroyed by flood. From January 20 to April 7, 1916, the staff gage on railroad bridge was read. From April 8 to June 10, 1916, the staff gage now used in connection with the present water-stage recorder was read. Gages on the railroad bridge were referred to a different datum from that of gages on the highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Both banks high and steep and not subject to overflow except at extreme floods. Channel composed of sand and gravel. Control at old station constantly shifting; at new station fairly permanent except during high water, when it shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage during year 19.7 feet on morning of October 14, determined from flood marks on gage (discharge not determined); minimum stage recorded 2.2 feet June 29 (discharge, about 2 second-feet).

1910–1917: Maximum and minimum stage same as for 1917 (see above).

DIVERSIONS.—Small amount of water is used for irrigation above station.

ACCURACY.—Stage-discharge relation changed during high water in October and February. Three rating curves used, as follows: October 1–11, well defined; October 12 to February 26, well defined below 1,400 second-feet and poorly defined above; February 27 to September 30, well defined between 40 and 400 second-feet and fairly well defined for stages above and below. Operation of the water-stage recorder was fairly satisfactory except for periods indicated in footnote to the daily-discharge table. Daily discharge ascertained by applying to the rating table mean daily gage heights determined by inspecting gage height graph, or, for days of considerable fluctuation, by averaging hourly gage heights. Records good except for estimated periods and for extremely high and low stages for which the rating curves are poorly defined.

Discharge measurements of San Francisco River at Clifton, Ariz., during the year ending Sept. 30, 1917.

[Made by J. B. Spiegel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 10	4.05	313	Jan. 3	3.05	132	May 18	3.39	157
10	4.20	396	3	3.05	122	July 11	2.98	74
12	5.10	1,320	31	3.72	269	11	2.98	71
12	5.07	1,310	31	3.72	275	Aug. 21	3.04	82
27	3.53	285	Mar. 23	3.94	397	21	3.04	81
Nov. 15	3.19	158	23	3.97	413	Sept. 19	3.11	94
15	3.19	154	May 18	3.39	160	19	3.11	94

Daily discharge, in second-feet, of San Francisco River at Clifton, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	132	235	155	135	354	680	526	273	151	32	245	95
2	127	235	155	140	354	580	508	266	145	48	145	95
3	120	235	149	128	354	496	484	259	140	75	145	95
4	113	218	146	138	350	455	410	252	132	95	145	105
5	108	200	155	140	342	410	388	245	120	128	145	108
6	132	204	149	140	342	388	378	238	122	128	145	110
7	132	204	143	138	330	370	365	231	125	128	145	112
8	269	200	143	135	330	360	342	224	120	132	145	112
9	406	185	143	135	330	360	352	217	.....	91	.....	115
10	542	185	138	135	322	356	365	210	.....	81	.....	115
11	873	185	128	130	318	374	365	210	.....	75	.....	120
12	1,270	180	122	130	310	388	365	206	.....	67	.....	125
13	3,900	175	120	130	310	383	365	200	.....	120	.....	160
14	.....	170	118	138	318	374	342	192	.....	125	.....	175
15	.....	170	115	140	322	365	329	186	.....	120	.....	175
16	.....	164	115	140	322	342	342	178	.....	120	.....	245
17	.....	158	102	143	318	320	334	172	.....	100	.....	122
18	.....	155	100	146	334	320	342	172	.....	95	.....	108
19	.....	155	100	500	364	320	342	186	.....	262	.....	95
20	.....	155	100	2,410	372	338	329	189	.....	108	89	95
21	.....	149	100	3,150	395	342	329	192	.....	186	81	100
22	.....	149	110	1,330	395	365	320	200	.....	262	79	108
23	372	149	115	940	405	410	312	192	.....	178	77	108
24	338	146	115	720	435	383	312	189	.....	160	65	108
25	330	149	128	590	450	360	300	189	.....	132	.....	98
26	302	149	132	518	512	356	300	189	.....	115	.....	91
27	282	149	122	489	680	365	300	186	.....	145	.....	84
28	270	152	128	472	814	392	296	182	.....	200	.....	77
29	310	155	128	420	.....	420	288	169	2	217	.....	70
30	350	155	128	372	.....	472	280	166	25	175	145	64
31	235	.....	132	354	.....	520	.....	160	.....	365	95	.....

NOTE.—No gage-height record Oct. 8, 9, 14–22, and 29; Nov. 12 and 13; Dec. 18–22; June 9–28; Aug. 9–19 and 25–29; Sept. 26, 27, 29, and 30. Gage heights partly estimated Jan. 20 and 21; Apr. 28 to May 11; July 8 and 9; Aug. 1–8; Sept. 2 and 16–18. Gage heights from daily readings on staff Oct. 23–28; Oct. 30 to Nov. 11; Nov. 14; June 29; Sept. 24, 25, and 28. Discharge interpolated Oct. 8, 9, and 29; Sept. 26, 27, 29, and 30. Discharge estimated from study of climatic records and records of discharge at stations on Gila River above and below San Francisco River, and from notes by observer, Oct. 14–22, mean 6,000 second-feet Dec. 18–22 as published; June 9–28, mean 60 second-feet; Aug. 9–19, mean 120 second-feet; and Aug. 25–29, mean 60 second-feet.

Monthly discharge of San Francisco River at Clifton, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	.....	108	2,090	129,000
November	235	146	176	10,500
December	155	100	127	7,810
January	3,150	128	475	29,200
February	814	310	385	21,400
March	680	320	399	24,500
April	526	280	354	21,100
May	273	160	204	12,500
June	15	2	76.1	4,530
July	365	32	138	8,480
August	245	.....	113	6,950
September	245	.....	113	6,720
The year	.....	2	390	283,000

SAN PEDRO RIVER NEAR FAIRBANK, ARIZ.

LOCATION.—Opposite Boquillas Land & Cattle Co.'s ranch house, 1½ miles southeast of Fairbank, Cochise County, 3 miles below old Charleston mill.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 28, 1912, to September 30, 1917. January 27, 1904, to August 31, 1906, and October 18, 1910, to November 15, 1911, for station at Charleston; November 15, 1911, to September 28, 1912, for station at diversion dam of the Boquillas Land & Cattle Co.

GAGE.—Vertical and inclined staff on right bank; read once daily to half-tenths by J. M. Barnes. Original gage—a vertical staff on right bank about 800 feet below the present gage—was installed September 28, 1912, destroyed by flood on August 17, 1914, and replaced at the same datum August 24, 1914; second gage was washed out on December 23, 1914, and was replaced by the present gage on January 21, 1915, at an independent datum.

DISCHARGE MEASUREMENTS.—Made from a cable 600 feet below gage or by wading near gage.

CHANNEL AND CONTROL.—Sand, gravel, and clay; liable to slight shift during low stages and considerable shift at high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year 6 feet on night of July 18, determined from flood marks on gage (discharge not determined); minimum discharge, 2 second-feet October 1–10 and January 28 to February 3.

1912–1917: Maximum stage recorded 16 feet at 5 p. m. December 22, 1915 (discharge not determined); minimum discharge about 2 second-feet for several days each year.

DIVERSIONS.—The Boquillas Land & Cattle Co. diverts water at various points above station for irrigation. Total acreage irrigated not known.

ACCURACY.—Stage-discharge relation not permanent. Standard rating curve fairly well defined below 1,800 second-feet. Gage read to half-tenths once daily except during flood periods, when it was read oftener. Daily discharge ascertained by indirect method for shifting control. Determination of discharge above 1,800 second-feet obtained from an extension of rating curve and may be considerably in error. Records poor.

Discharge measurements of San Pedro River near Fairbank, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	M. D. Anderson	0.20	1.7	July 24	J. B. Spiegel	2.02	681
Jan. 18	J. B. Spiegel	.28	26.2	25	do	1.22	217
18	do	.28	24.8	Aug. 29	do	.61	17.2
July 24	do	3.01	1,700	29	do	.61	18.1
24	do	2.58	1,050				

Daily discharge, in second-feet, of San Pedro River near Fairbank, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2	4	6	24	2	24	44	37	37	37	118	19
2	2	4	6	24	2	24	37	37	37	306	3,840	16
3	2	4	6	24	2	24	37	37	37	505	3,280	14
4	2	4	6	24	6	24	30	37	37	118	331	14
5	2	4	6	24	6	24	24	37	37	52	133	10
6	2	4	6	24	6	24	24	37	37	37	61	10
7	2	4	6	24	6	30	30	37	37	19	37	6
8	2	4	6	24	6	30	30	37	37	6	620	1,080
9	2	4	6	24	14	37	30	44	30	6	1,020	.....
10	2	4	6	24	14	37	30	44	37	6	1,140	.....
11	4	4	6	24	14	37	30	44	37	37	620	.....
12	4	4	8	24	14	37	24	44	37	148	3,720	92
13	1,310	4	10	24	14	37	24	44	37	37	620	52
14	505	5	12	24	19	37	24	44	37	2,720	306	52
15	37	5	14	24	19	37	24	44	37	199	180	37
16	14	5	14	30	19	37	24	44	37	70	180	30
17	10	6	14	30	19	37	24	44	37	44	92	24
18	10	6	14	30	19	37	24	44	37	1,970	70	24
19	10	6	14	30	19	37	30	44	37	970	61	10
20	10	6	14	30	19	37	30	14	37	61	52	14
21	10	6	14	70	19	37	30	19	37	180	52	239
22	10	6	14	105	19	44	30	19	37	52	52	164
23	10	6	14	61	24	44	30	24	10	24	37	44
24	6	6	15	30	24	44	30	30	37	5,180	30	30
25	6	6	16	24	24	44	30	30	37	825	30	19
26	6	6	17	14	24	44	37	37	44	2,250	199	10
27	6	6	18	6	30	44	37	37	44	306	105	10
28	6	6	19	2	30	44	37	37	44	620	62	10
29	4	6	20	2	.....	44	37	37	44	180	19	10
30	4	6	21	2	.....	44	37	44	44	180	19	10
31	4	.....	22	2	.....	44	.....	44	.....	180	19	.....

NOTE.—No gage-height record Nov. 12–18, Dec. 12–24 and 24–31, Aug. 8, and Sept. 2; discharge interpolated. Sept. 9–11 mean discharge estimated 300 second-feet from study of precipitation data and records on other streams.

Monthly discharge of San Pedro River near Fairbank, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,310	2	64.7	3,980
November	6	4	5.0	298
December	22	6	11.9	732
January	105	2	26.7	1,640
February	30	2	15.5	861
March	44	24	36.3	2,230
April	44	24	30.3	1,800
May	44	14	37.2	2,290
June	44	10	37.0	2,200
July	5,180	6	559	34,400
August	3,840	19	552	33,900
September	1,080	6	98.3	5,850
The year	5,180	2	125	90,200

QUEEN CREEK NEAR SUPERIOR, ARIZ.

LOCATION.—One mile below dam site near Whitlow's ranch and 12 miles below Superior, Pinal County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 14, 1915, to September 30, 1917.

GAGE.—Inclined staff on left bank 1 mile below dam site, installed September 15, 1916. Observer, W. C. Mullins. Original gage was a vertical staff painted on rock ledge on right bank at lower end of box canyon about 500 feet above Whitlow's ranch house, installed February 14, 1916. This gage was read until October 17, 1915, when it was replaced by an inclined staff on left bank about 700 feet upstream, at a different datum. On March 30, 1916, a vertical staff was installed at practically the same location as the original gage at a datum 1.65 feet higher. On August 6, 1916, this gage was replaced by an inclined and vertical staff at same location and datum, read until September 15, 1916, when the present gage was installed 1 mile below at a different datum.

DISCHARGE MEASUREMENTS.—Made from cable at dam site or by wading.

CHANNEL AND CONTROL.—At the dam site the channel is confined between high rocky banks about 300 feet apart. At present gage site left bank is subject to overflow at extreme high stages. Bed of stream composed of constantly shifting sand and gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 6 feet at 9 a. m. May 20 (discharge, determined from extension of rating curve, about 2,800 second-feet); channel dry for long periods during the year. (See footnote to monthly discharge table.) Floods, with considerable greater discharge, have occurred during previous years, but no reliable record is available showing maximum stage or discharge. Channel is dry at the present gage for considerable period each year. At dam site about 1 mile above gage the discharge seldom, if ever, gets less than about 1 second-foot.

DIVERSIONS.—Water diverted above gage to irrigate a few acres; amount unknown.

ACCURACY.—Stage-discharge relation seriously affected by floods in January and May and slightly at numerous other times during year. Standard rating curve applicable from January 20 to May 19 is fairly well defined below 45 second-feet. Extension based on discharge computed by Kutter's formula, assuming "n" to be equal to 0.03. Rating curves used before and after January 20 are based on low-stage measurements and direction of standard curve and are liable to considerable error. Gage read to hundredths twice daily. Daily discharge, which was ascertained by applying mean daily gage heights to rating table, is not sufficiently accurate to warrant publication. Monthly figures subject to considerable error.

Discharge measurements of Queen Creek near Superior, Ariz., during the year ending Sept. 30, 1917.

Date	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 26	C. E. Ellsworth	1.60	0	Apr. 2	W. C. Mullins	1.14	2.9
Jan. 20	W. C. Mullins	1.76	45.0	13	do	1.14	1.6
24	do	1.40	12.1	May 19	do	1.13	1.0
Mar. 10	C. E. Ellsworth	1.20	3.3	June 26	do	.70	.3
12	Ellsworth and Mullins	1.17	3.4	July 23	do	1.15	13.5

Monthly discharge of Queen Creek near Superior, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	84	1	5.4	332
November	1	0	.4	24
December	0	0	0	0
January	910	0	40.2	2,470
February	48	1	7.6	422
March	4	2	2.4	148
April	5	2	2.4	143
May	1,100	1	39.0	2,400
June	4	1	2.9	173
July	440	0	15.1	928
August	710	0	44.2	2,720
September	65	0	2.2	131
The year	1,100	0	13.7	9,890

NOTE.—Results liable to large errors and should be used with care. See "Accuracy" in station description. No flow Nov. 13 to Jan. 19, July 16–20 and 22, Aug. 25 to Sept. 9, and Sept. 13–30. Gage heights missing Feb. 5 and 6, discharge interpolated.

SANTA CRUZ RIVER NEAR NOGALES, ARIZ.

LOCATION.—Just below proposed dam site on Yerba Buena ranch, half a mile above city pumping plant and about 7 miles northeast of Nogales, Pima County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 22 to November 30, 1907, and April 1, 1909, to September 30, 1917 (incomplete).

GAGE.—Richard Frères water-stage recorder on left bank about half a mile above city pumping plant installed January 3, 1916. Original gage, a vertical staff on right bank about 500 feet below the intake of a small irrigation ditch and about one-fourth mile above the present gage, was used until January 18, 1912, when a Richard Frères water-stage recorder was installed at the same location as the present gage. This gage was used until December 18, 1914, when it was replaced by a Stevens water-stage recorder which was used until March 13, 1915. A vertical staff on right bank at pumping plant was read from March 13 to December 4, 1915. During the interval December 4, 1915, to January 3, 1916, all readings were made on staff gage attached to the present gage well. Gage elevations have been as follows: Original gage and gage at pumping plant at different elevations and no relation to other gages; Stevens recorder and present Richard Frères recorder at approximately the same datum, which is 1.3 feet higher than that of the first Richard Frères recorder installed January 18, 1912.

DISCHARGE MEASUREMENTS.—Made by wading.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 3.2 feet at 3 p. m. July 22 (discharge approximately 520 second-feet determined from extension of rating curve). No dependable records of maximum floods during previous years. Channel is generally dry during a part of each year.

DIVERSIONS.—Water is diverted above station for irrigation of about 140 acres.

ACCURACY.—Stage-discharge relation continually changing. Standard rating curve defined by 32 discharge measurements made during year from which the changes in stage-discharge relation were determined with fair accuracy for low stages. Changes during high stages not well defined. The water-stage recorder was not sensitive and gage heights are liable to errors as great as .05 at any time. Otherwise, its operation was fairly satisfactory except as noted in the footnote to daily discharge table. Daily discharge ascertained by indirect method for shifting control. Records fair for low stages and poor for high stages.

Discharge measurements of Santa Cruz River near Nogales, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	Anderson and Coons	1.25	2.3	Mar. 20	W. W. Coons	1.25	3.2
20	W. W. Coons	1.3	1.5	30	do	1.25	3.8
30	do	1.3	2.2	Apr. 10	do	1.20	3.5
Nov. 10	do	1.3	2.0	20	do	1.10	3.1
20	do	1.3	2.1	30	do	1.10	2.1
29	do	1.3	3.1	July 21	do	1.45	25.0
Dec. 10	do	1.35	9.0	27	do	2.35	220
22	do	1.30	20.2	Aug. 5	do	1.90	122
29	do	1.40	9.6	17	do	1.50	38.6
Jan. 9	do	1.35	11.6	28	do	1.35	20.1
22	do	1.45	27.2	30	J. B. Spiegel	1.39	18.6
30	do	1.35	14.6	30	do	1.39	18.0
Feb. 9	do	1.35	9.6	Sept. 7	W. W. Coons	1.55	48.2
20	do	1.40	16.5	14	do	1.60	50
28	do	1.40	12.4	21	do	1.70	59
Mar. 9	do	1.30	4.8	28	do	1.40	21.1

Daily discharge, in second-feet, of Santa Cruz River near Nogales, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	July.	Aug.	Sept.
1	5	2	4	8	14	9	4	2	.....	98	22
2	4	2	4	8	13	6	4	2	.....	297	23
3	4	2	4	9	13	6	7	2	.....	267	24
4	4	2	4	13	12	5	5	2	.....	192	25
5	4	2	5	13	11	5	5	2	.....	148	22
6	4	2	5	14	11	5	3	2	.....	74	24
7	4	2	5	14	11	5	3	2	.....	65	47
8	4	2	6	11	10	5	3	2	.....	72	129
9	2	2	12	11	10	5	4	2	.....	96	80
10	2	2	12	12	10	5	4	2	.....	74	129
11	2	2	10	13	7	5	4	2	.....	148	124
12	3	2	11	13	7	5	2	2	.....	99	217
13	3	2	16	13	11	5	3	2	.....	99	154
14	2	2	13	14	11	5	3	.....	.....	91	111
15	2	2	15	15	11	3	4	.....	1	80	45
16	2	2	16	16	8	3	4	.....	1	53	42
17	2	2	17	16	9	5	4	.....	1	39	29
18	2	2	18	17	9	5	4	.....	3	39	29
19	2	2	20	17	13	5	3	.....	6	32	28
20	2	2	21	22	16	5	3	.....	2	27	28
21	2	2	23	43	16	5	3	.....	24	27	45
22	2	2	20	27	16	5	3	.....	142	26	43
23	2	2	18	22	15	6	3	.....	91	26	31
24	2	2	16	22	14	6	3	.....	116	30	26
25	2	3	13	21	13	6	2	.....	142	30	26
26	2	3	11	16	13	6	2	.....	116	30	25
27	2	3	8	16	13	6	2	.....	220	20	21
28	2	3	9	16	12	4	2	.....	160	20	21
29	2	3	10	16	.....	4	2	.....	98	20	21
30	2	4	10	15	.....	4	2	.....	89	19	20
31	2	.....	11	14	.....	4	.....	.....	91	20	.....

NOTE.—Feb. 24 to Mar. 1 gage heights estimated. May 14 to July 14 recorder not in operation, mean discharge estimated from study of weather records and discharge of other streams as follows: May 14–31, 2 second-feet; June 1–30, 1 second-foot; July 1–14, 0.5 second-foot. July 21 and 22 and Aug. 3 gage heights partly estimated. Because of lack of sensitiveness of recorder all gage heights are liable to errors of 0.05 or less.

Monthly discharge of Santa Cruz River near Nogales, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	5	2	2.6	160
November	4	2	2.2	131
December	23	4	11.8	726
January	43	8	16.0	984
February	16	7	11.8	655
March	9	3	5.1	314
April	7	2	3.3	196
May	.....	.....	2.0	123
June	.....	.....	1.0	60
July	220	.....	42.3	2,600
August	297	19	76.1	4,680
September	217	20	53.7	3,200
The year	297	.....	19.1	13,800

SANTA CRUZ RIVER AT TUCSON, ARIZ.

LOCATION.—In sec. 13, T. 14 S., R. 13 E., at Congress Street Bridge in Tucson, Pima County.

RECORDS AVAILABLE.—October 15, 1905, to September 30, 1917 (incomplete).

DRAINAGE AREA.—Not measured.

GAGE.—Staff on bridge pier installed September 7, 1916. Original gage was painted on bridge pier on left bank. During 1911 and up to September 30, 1912, gage heights were observed from temporary staff or by measuring to water surface from reference point on bridge. October 1, 1912, to July 7, 1913, a chain gage installed on the bridge was used. Original datum was maintained until November 22, 1913, when it was lowered 2 feet. From December 12, 1914, to September 7, 1916, gage heights were obtained from reference point at elevation of 19.28 above new datum. During January flood the bridge settled, lowering the reference point to 16.73 feet above datum. During the summer of 1916 a new bridge was constructed and the present gage was installed September 7 on one of the piers at a different datum. Observer, J. O. Kenny.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand, wide and shallow; shifts badly at all stages.

EXTREMES OF DISCHARGE.—Stream is dry part of each year at this point. On December 24, 1914, maximum gage height was 9.8 feet, indicating a discharge of approximately 9,000 second-feet. This was probably maximum ever recorded at station.

DIVERSIONS.—Some flood water is diverted above station for irrigation; amount unknown.

ACCURACY.—Stage-discharge relation not permanent. Loose sand channel and control continually changing. Gage read to half-tenths several times daily during flow periods. Daily discharge computed by indirect methods. Monthly figures fair. Daily discharge not sufficiently accurate for publication.

COOPERATION.—Daily discharge record furnished by University of Arizona through G. E. P. Smith, irrigation engineer.

Discharge measurements of Santa Cruz River at Tucson, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
July 2	Schwalen and Sharman	5.8	82	July 25	Pickrell and Schwalen.	5.3	725
9	Schwalen, Wilson, and Sharman	4.4	9.2	28	Schwalen and Sharman	4.45	114
30	Wilson, Hubbard, and Schwalen	4.52	48.0	Aug. 3	Sharman and Luke	6.7	3,280
16	Brooks and Schwalen	4.3	34.5	3	do	7.05	3,520
22	Wilson and Schwalen	4.85	224	3	do	7.2	3,010
23	Sharman and Schwalen	4.5	83	4	Hubbard and Luke	6.0	931
23	Schwalen and Schwalen	4.68	192	4	do	5.0	951
24	Sharman and Schwalen	6.5	1,920	9	Luke and Schwalen	4.65	103
24	Sharman, Hubbard, and Schwalen	5.8	1,600	11	Wilson, Luke, and Schwalen	5.42	1,170
24	Sharman and Schwalen	5.28	892	11	do	5.15	908
				14	Luke and Schwalen	4.5	30.3
				16	Wilson and Schwalen	4.83	281

Monthly discharge of Santa Cruz River at Tuscon, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	60	0	2.3	141
July	1,170	0	139	8,550
August	2,070	0	169	10,400
September	2,710	0	157	9,340
The year	2,710	0	39.2	28,400

NOTE.—Stream dry on days of no record except during part of the winter when there was a small flow due to waste from irrigation ditch which never exceeded 5 second-feet. Monthly discharge computed by engineer of U. S. Geological Survey from daily-discharge record furnished by University of Arizona through G. E. P. Smith, irrigation engineer. See "Accuracy" in station description.

RILLITO CREEK NEAR TUCSON, ARIZ.

LOCATION.—In sec. 23, T. 13 S., R. 13 E., at highway bridge on Oracle Road, 4 miles north of Tucson, Pima County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—1911 to September 30, 1917 (incomplete).

GAGE.—Staff painted on bridge pier; read by C. H. Goetz. A Richard Frères water-stage recorder attached to right abutment of bridge was used part of the time prior to July 21, 1916, when it was destroyed by fire.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand, wide and shallow; shifts badly at all stages.

EXTREMES OF DISCHARGE.—Maximum discharge during year was about 10,000 second-feet at 9 a. m. August 11 (mean for day approximately 1,100 second-feet).

1911–1916: Maximum mean daily discharge about 16,000 second-feet on December 23, 1914 (no record of discharge at peak of flood). The stream is dry the greater part of each year.

DIVERSIONS.—Some flood water is diverted for irrigation above the station; amount unknown.

ACCURACY.—Stage-discharge relation not permanent. Loose sand channel and control continually changing. Gage read to half-tenths several times daily during flow periods. Daily discharge computed by indirect methods. Monthly results fair. Daily discharge not sufficiently accurate for publication.

COOPERATION.—Daily-discharge record furnished by University of Arizona through G. E. P. Smith, irrigation engineer.

Discharge measurements of Rillito Creek near Tucson, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 20	Enger and Mathews	3.2	640	July 26	Schwalen and Sherman	4.15	779
21	Wilson and Mathews	1.9	102	26	do	4.05	618
Feb. 27	J. W. Mathews	4.0	44	26	do	3.58	209
Mar. 1	do	3.6	4.1	30	Sherman and Luke	3.67	41.4
July 2	Smith, Sherman, and Schwalen.	3.85	46.7	31	do	3.5	31.0
4	Schwalen and Schwalen	4.25	187	Aug. 2	do	3.6	114
19	H. C. Schwalen	3.71	16.4	8	Schwalen and Luke	3.65	95
21	Schwalen and Wilson	3.2	4.1	9	do	3.9	163

Monthly discharge of Rillito Creek near Tucson, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	8	0	0.5	31
January	700	0	27.8	1,710
February	45	0	4.9	272
March	4	0	.1	6
July	1,410	0	82.4	5,070
August	1,130	0	46.3	2,850
September	240	0	10.7	637
The year	1,410	0	14.6	10,600

NOTE.—Stream dry on days of no record. Monthly discharge computed by engineers of U. S. Geological Survey from daily-discharge record furnished by University of Arizona, through G. E. P. Smith, irrigation engineer. See "Accuracy" in station description.

BLACK RIVER NEAR FORT APACHE, ARIZ.

LOCATION.—Three-fourths mile above bridge on road from Rice to Fort Apache, 2½ miles above junction with White River, and 18 miles west of Fort Apache, Gila County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 24, 1912, to September 30, 1917 (incomplete).

GAGE.—Gurley water-stage recorder on left bank three-fourths mile above bridge installed December 7, 1917. November 24, 1912, to October 16, 1913, and May 12, 1916, to December 6, 1917, vertical staff on right bank about 400 feet above bridge; October 16, 1913, to December 19, 1914, Gurley recorder half a mile below bridge; January 20, 1915, to January 8, 1916, staff gage on recorder well below bridge. Independent datum at each location.

DISCHARGE MEASUREMENTS.—From cable or by wading.

CHANNEL AND CONTROL.—Practically permanent for both gages that were located above the bridge. Below the bridge control shifted considerably during high stages and slightly during low stages.

EXTREMES OF DISCHARGE.—Maximum stage on record at this station was 15.9 feet December 20, 1914, determined from flood marks (discharge, determined from extension of rating curve, about 18,000 second-feet); minimum discharge on record was 47.4 second-feet during a discharge measurement made October 12, 1917.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined from 50 to 120 second-feet. The operation of the water-stage recorder was satisfactory. Mean daily gage heights found by inspecting gage heights registered every 15 minutes by Gurley weight-driven water-stage recorder. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Black River near Fort Apache, Ariz., during the year ending Sept. 30, 1917.

[Made by J. B. Spiegel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Dec. 6	1.50	103
6	1.50	107

Daily discharge, in second-feet, of Black River near Fort Apache, Ariz., for the year ending Sept. 30, 1917.

Day.	Dec.	Jan.	Day.	Dec.	Jan.	Day.	Dec.	Jan.
1		112	11	66	91	21	85	
2		90	12	73	90	22	86	
3		96	13	92	101	23	90	
4		98	14	104	96	24	91	
5		109	15	72	101	25	88	
6		89	16	74	105	26	96	
7		86	17	85	100	27	88	
8	102	114	18	81	102	28	93	
9	90	104	19	75	113	29	92	
10	72	98	20	79		30	86	
						31	106	

NOTE.—No record Jan. 20 to Sept. 30 account of impracticability of obtaining proper gage attendance. Oct. 1 to Dec. 7 daily readings on staff gage near bridge were reported but are considered too unreliable to publish.

SALT RIVER NEAR ROOSEVELT, ARIZ.

LOCATION.—At diversion dam for power canal, 10 miles above upper end of Roosevelt reservoir and 20 miles east of town of Roosevelt, Gila County.

DRAINAGE AREA.—4,222 square miles (measured by U. S. Reclamation Service).

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1917 (including all water diverted for power development but not flow of Tonto Creek); February 7, 1901, to December 9, 1907, at site of Roosevelt dam (including flow of Tonto Creek); 1910–1913, discharge at Roosevelt dam computed from records of flow into and out of the reservoir (representing natural flow of Salt River, including Tonto Creek and water diverted for power development).

GAGE.—Principal gage is vertical staff on left bank, bolted to concrete wall at head of canal. Temporary gages are used from time to time on account of channel shifting away from main gage.

DISCHARGE MEASUREMENTS.—Made from cable at dam site or by wading near dam site. Previous to January 19, 1916, when the dam was destroyed by flood, low-water measurements were made by wading below the dam. Above wading stage discharge was determined from elevation of water surface in reservoir, taking into account known outflow and computed inflow from other sources besides Salt River.

CHANNEL AND CONTROL.—Shifting sand and gravel. Prior to its destruction by flood on January 19, 1916, the dam formed a permanent control.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 23,600 second-feet, on January 21; minimum discharge, 170 second-feet, September 5. 1913–1917: Maximum mean daily discharge, 79,200 second-feet, on January 15, 1916; minimum discharge, 164 second-feet, on June 29, 1914.

DIVERSIONS.—None.

ACCURACY.—Reclamation Service states that discharge measurements are made nearly every day when discharge is less than about 3,000 second-feet, and results should be excellent. For flow greater than 3,000 second-feet there are no facilities for making discharge measurements. Discharge determined from extension of rating curve and study of reservoir contents, and records are liable to considerable error.

COOPERATION.—Daily-discharge records furnished by U. S. Reclamation Service.

Daily discharge, in second-feet, of Salt River near Roosevelt, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	390	680	380	330	920	3,000	2,400	2,000	620	320	720	231
2	390	600	390	320	890	2,100	2,350	1,700	600	305	815	220
3	390	600	390	330	750	1,600	2,050	1,600	580	280	640	220
4	375	570	385	380	740	1,590	1,780	1,400	580	317	650	190
5	362	560	380	350	740	1,350	1,700	1,300	562	437	718	170
6	390	540	380	350	645	1,000	1,500	1,220	560	1,360	570	190
7	390	480	320	360	650	820	1,550	1,250	500	590	530	210
8	474	500	375	350	645	740	1,640	1,300	490	415	556	210
9	936	500	310	350	650	720	1,750	1,250	480	370	862	210
10	1,530	470	315	310	700	700	2,000	1,200	480	540	610	210
11	1,530	450	300	320	640	680	2,350	1,200	480	370	610	210
12	1,500	450	280	320	550	780	2,200	1,250	480	370	620	210
13	1,620	450	275	310	550	820	1,750	1,300	480	370	452	242
14	2,000	425	250	320	550	790	1,700	1,200	460	370	510	359
15	6,240	415	240	320	550	750	1,910	1,150	460	550	460	331
16	6,100	415	240	330	600	800	1,900	1,050	460	430	310	286
17	3,300	415	245	400	600	780	1,875	1,050	494	370	320	755
18	2,900	400	225	410	800	780	8,200	1,050	485	370	364	454
19	1,800	382	240	420	750	740	8,000	1,050	507	410	308	454
20	1,300	390	250	540	900	740	4,000	1,050	507	365	335	335
21	1,075	385	250	23,564	1,000	760	2,500	1,200	500	515	335	335
22	925	385	250	5,300	1,000	1,040	2,100	1,200	494	980	290	335
23	850	400	250	2,940	1,680	1,110	2,000	1,200	446	492	269	335
24	1,100	400	260	938	3,500	1,200	1,750	1,250	420	456	255	335
25	1,057	390	285	1,262	5,200	1,240	1,700	1,200	395	430	254	335
26	1,010	395	360	1,182	6,200	1,200	1,850	1,200	385	394	272	335
27	780	395	370	950	6,600	1,330	1,800	1,100	370	370	265	335
28	780	390	360	870	5,100	1,530	1,850	1,100	365	476	252	335
29	760	385	350	870	.....	1,780	1,900	900	360	870	270	277
30	735	388	340	930	.....	2,200	2,000	770	340	468	261	277
31	700	.....	320	920	.....	2,400	.....	750	.....	490	254	.....

NOTE.—Record of daily discharge furnished by U. S. Reclamation Service. Flow of Tonto Creek record of which is given on page 172, not included.

Monthly discharge of Salt River near Roosevelt, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	6,240	362	1,410	86,700
November	680	382	454	27,000
December	390	225	309	19,000
January	23,600	310	1,510	92,800
February	6,600	550	1,580	87,800
March	3,000	680	1,190	73,200
April	8,200	1,500	2,400	143,000
May	2,000	750	1,210	74,400
June	620	340	478	28,400
July	1,360	280	479	29,500
August	862	252	450	27,700
September	755	170	298	17,700
The year	23,600	170	977	702,000

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from daily-discharge record furnished by U. S. Reclamation Service.

NORTH FORK OF WHITE RIVER AT WHITERIVER, ARIZ.

LOCATION.—At power plant half a mile from Fort Apache Indian School at Whiteriver, Navajo County, three-fourths mile above highway bridge, and 4 miles northeast of Fort Apache.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 1, 1916, to September 30, 1917. Discharge measurements began September 22, 1916.

GAGE.—Vertical staff on right bank just below tailrace of power plant; read by Floyd Toggie.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from highway bridge.

CHANNEL AND CONTROL.—Sand and gravel; probably fairly permanent except during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 3.5 feet at 8 a. m. October 14 (discharge, determined from extension of rating curve, about 695 second-feet); minimum stage recorded, 1.6 feet on December 9 to 12 (discharge, 23 second-feet).

ICE.—None reported during year.

DIVERSIONS.—Practically none except water diverted for power development which is returned to stream above the gage.

REGULATION.—Gage heights may occasionally be slightly affected by operation of power plant just above gage.

ACCURACY.—Stage-discharge relation practically permanent, probably not seriously affected by ice during year. Rating curve well defined from 35 to 150 second-feet. Extension of the curve is believed to be fairly accurate up to about 250 second-feet, above that point the probability of error rapidly increases. Gage read twice daily to half-tenths prior to August 11, and to hundredths since that date. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good except for extremely high and low stages.

COOPERATION.—Gage-height record furnished by United States Indian Service.

Discharge measurements of North Fork of White River at Whiteriver, Ariz., Sept. 22, 1916, to Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1916.		*Feet.*	*Sec.-ft.*	1917.		*Feet.*	*Sec.-ft.*
Sept. 22	C. E. Ellsworth	2.24	128	Aug. 5	S. B. Spiegel	2.29	138
22	do	2.24	127	5	do	2.29	142
Dec. 5	J. B. Spiegel	2.00	76				
Dec. 5	do	2.00	72				

Daily discharge, in second-feet, of North Fork of White River at Whiteriver, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	91	143	66	58	66	117	338	385	203	75	143	48
2	83	117	58	52	75	117	315	410	203	75	256	49
3	75	117	75	58	66	117	275	360	188	75	130	50
4	75	117	95	52	75	117	238	315	172	75	106	48
5	75	117	66	39	66	117	275	338	172	95	117	50
6	85	117	58	45	75	95	315	315	172	95	95	53
7	220	117	58	52	66	106	385	315	172	95	95	169
8	295	117	39	52	58	106	492	295	172	95	95	57
9	275	117	23	52	58	106	548	275	203	95	95	55
10	295	95	28	52	66	106	465	295	203	95	117	58
11	410	95	23	58	75	117	438	256	203	117	106	75
12	275	95	28	58	75	95	385	238	203	106	91	63
13	256	95	39	58	85	95	385	275	172	95	95	104
14	635	66	52	58	75	106	438	238	172	95	91	65
15	438	58	45	58	66	95	465	275	172	95	87	57
16	385	58	39	52	75	85	385	315	172	95	91	66
17	315	85	52	58	75	95	360	275	172	95	89	58
18	275	75	45	58	75	95	338	256	172	143	83	55
19	238	95	39	75	66	117	338	238	143	465	75	58
20	220	85	52	275	75	130	338	275	143	143	75	60
21	203	75	52	130	85	158	360	295	130	130	55	58
22	203	75	52	106	85	158	385	256	117	117	53	55
23	188	75	58	85	95	158	338	256	117	106	70	57
24	172	66	58	75	106	172	360	238	117	95	54	54
25	172	66	58	66	172	188	385	238	106	130	50	53
26	172	75	52	75	188	220	338	238	95	143	50	50
27	143	75	58	66	172	220	410	238	95	143	50	48
28	143	75	52	75	143	295	360	238	85	117	53	50
29	143	75	52	75	.....	315	410	203	75	117	50	46
30	143	85	52	75	.....	438	385	203	75	117	50	35
31	143	.....	52	75	.....	385	.....	203	.....	238	49	.....

Monthly discharge of North Fork of White River at Whiteriver, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	635	75	221	13,600
November	143	66	90.8	5,400
December	95	23	50.8	3,120
January	275	39	71.7	4,410
February	188	58	87.8	4,880
March	438	85	156	9,590
April	548	238	375	22,300
May	410	203	276	17,000
June	203	75	153	9,100
July	465	75	122	7,500
August	256	49	87.6	5,390
September	169	35	60.1	3,580
The year	635	23	146	106,000

WHITE RIVER AT FORT APACHE, ARIZ.

LOCATION.—At highway bridge on Fort Apache Military Reserve, just below junction of North and East forks, at Fort Apache, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 23, 1912, to September 30, 1917 (incomplete).

GAGE.—Vertical staff fastened to downstream end of left abutment of bridge; read by C. W. Larzelere or S. R. Cowart. Datum of gage raised 4.40 feet January 20, 1915, and lowered 0.64 foot December 5, 1916.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand and gravel, fairly permanent at low stages, likely to shift during floods. Right bank high, is not overflowed. Left bank subject to overflow during extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 1.9 feet at 9.30 a. m. April 9 (discharge, 820 second-feet); minimum stage 0.20 foot on several days during August and September (discharge, 58 second-feet).

1912–1917: Maximum stage and discharge not determined; minimum discharge 25 second-feet, November 3 and 4, 1915.

ICE.—None reported during year.

DIVERSIONS.—A small quantity of water is diverted for irrigation by the Indians several miles above the station. Amount not known.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 30 and 200 second-feet and fairly well defined up to 1,400 second-feet. Gage read twice daily to half-tenths prior to August 5; since that date to hundredths. Readings are believed to be subject to error on account of unreliability of observer. Daily discharge ascertained by applying mean daily gage heights to rating curve except as indicated in footnote to daily-discharge table. Records good except as affected by errors in gage readings.

COOPERATION.—Gage-height record furnished by United States Army.

Discharge measurements of White River at Fort Apache, Ariz., during the year ending Sept. 30, 1917.

[Made by J. B. Spiegel.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Dec. 5	[a] 0.40	[b] 96
Aug. 5	[a] .70	[c] 173

[a] New datum.
[b] Measured above East Fork, and discharge of East Fork (22 second-feet) measured and added.
[c] Measured above East Fork, and discharge of East Fork (33 second-feet) measured and added.

Daily discharge, in second-feet, of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	385	650	275	96	170	58	16	550	550	275	143	128	72
2	385	650	275	96	170	58	17	550	490	255	130	111	84
3	410	580	275	100	143	58	18	580	460	235	130	109	76
4	385	580	295	104	143	58	19	460	435	218	130	96	82
5	410	550	295	107	154	58	20	520	460	200	130	82	84
6	490	520	295	138	165	58	21	615	435	185	243	74	84
7	615	490	295	107	148	62	22	650	460	170	235	76	84
8	650	460	275	107	143	65	23	580	460	156	200	71	84
9	730	435	315	107	123	65	24	580	410	143	170	74	76
10	615	410	338	118	114	65	25	615	435	138	156	96	69
11	520	385	315	138	275	65	26	650	410	130	200	96	67
12	460	360	315	135	196	74	27	650	410	118	207	85	65
13	580	385	295	132	116	116	28	580	360	107	200	74	62
14	580	410	295	130	107	88	29	730	360	96	188	69	62
15	580	490	295	136	98	80	30	615	315	96	176	64	58
							31	.....	315	.....	200	60	.....

NOTE.—No record from Oct. 1 to Apr. 1. Discharge estimated Apr. 1 and interpolated July 3, 4, 12, 13, 15, and 29; Aug. 5, 12, 27, and 30; Sept. 2 and 26, because of missing gage heights.

Monthly discharge of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April	730	385	557	33,100
May	650	315	455	28,000
June	338	96	232	13,800
July	243	96	148	9,100
August	275	60	117	7,190
September	116	58	71.2	4,240
The period				95,400

EAST FORK OF WHITE RIVER AT FORT APACHE, ARIZ.

LOCATION.—On Fort Apache Military Reserve at Fort Apache, Navajo County, about half a mile above junction with North Fork of White River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 8, 1912, to September 30, 1917 (incomplete).

GAGE.—Vertical staff fastened to ash tree on left bank opposite officers' quarters. Datum raised 5 feet June 27, 1915, and lowered 0.40 foot August 5, 1917.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Boulders and gravel, slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 0.95 foot at 10 a. m., April 27 (discharge, 131 second-feet); minimum stage recorded 0.24 foot (new datum) September 4 to 7 (discharge, 8 second-feet).

1912–1917: Maximum stage and discharge not recorded; minimum discharge, 5 second-feet February 14–16, 1914.

ICE.—None reported during year.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined for all stages. Gage read twice daily to half-tenths prior to August 5 and to hundredths since that date. Readings believed to be subject to error on account of unreliability of observer. Daily discharge ascertained by applying mean daily gage heights to rating curve except as indicated in footnote to daily-discharge table. Records good except as affected by errors in gage readings.

COOPERATION.—Gage-height record furnished by United States Army.

Discharge measurements of East Fork of White River at Fort Apache, Ariz., during the year ending Sept. 30, 1917.

[Made by J. B. Spiegel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Foot.	*Sec.-ft.*		*Foot.*	*Sec.-ft.*
Dec. 5	0.05	21.1	Aug. 5	0.65	33.7
5	.05	23.6	5	.65	32.3

NOTE.—Datum lowered 0.40 foot Aug. 5, 1917.

Daily discharge, in second-feet, of East Fork of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	86	106	79	20	43	10	16	92	114	92	38	31	15
2	86	106	79	20	38	10	17	92	106	86	38	22	22
3	82	106	79	21	38	9	18	89	99	79	38	24	16
4	82	106	79	22	38	8	19	82	92	72	38	19	18
5	76	106	79	24	38	8	20	82	106	64	38	14	18
6	86	99	86	31	41	8	21	86	92	52	60	10	18
7	99	92	86	28	37	8	22	82	86	43	48	12	18
8	106	92	82	28	32	9	23	92	106	38	54	11	18
9	114	86	92	24	27	9	24	106	106	38	43	10	16
10	106	79	99	24	26	10	25	106	106	35	38	12	14
11	86	72	106	31	33	10	26	122	92	33	54	14	14
12	86	66	106	34	28	12	27	122	92	28	52	13	13
13	89	72	99	36	22	30	28	122	89	24	54	12	12
14	86	79	99	38	22	18	29	122	82	20	48	12	12
15	82	106	92	38	19	16	30	106	82	20	43	11	11
							31	.....	79	.....	48	10	.....

NOTE.—No record Oct. 1 to Apr. 1. Discharge estimated Apr. 1 and interpolated July 3, 4, 12, 13, 15, and 29; Aug. 12, 19, 27, and 30; and Sept. 2 and 26; account of missing gage heights.

Monthly discharge of East Fork of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
April	122	76	95.2	5,660
May	114	66	93.6	5,760
June	106	20	68.9	4,100
July	60	20	37.1	2,280
August	43	10	23.2	1,430
September	30	8	13.7	815
The period				20,000

TONTO CREEK NEAR ROOSEVELT, ARIZ.

LOCATION.—In sec. 14, T. 6 N., R. 10 E., 6 miles above upper end of Roosevelt reservoir and 15 miles northwest of town of Roosevelt, Gila County.

DRAINAGE AREA.—1,004 square miles (furnished by United States Reclamation Service).

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1917.

GAGE.—Vertical staff on right bank. Site of gage is changed from time to time owing to shifting control.

DISCHARGE MEASUREMENTS.—Made by wading at low stages and by slope method at high stages.

CHANNEL AND CONTROL.—Bed composed of boulders and gravel; shifts at high stages. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 8,000 second-feet, April 19; minimum discharge, 10 second-feet on several days during July and September.

1913–1917: Maximum mean daily discharge, 15,800 second-feet, on January 19, 1916; minimum discharge, 2 second-feet, August 15–19, 1914.

DIVERSIONS.—No diversions in the vicinity of station. Entire flow discharged into Roosevelt reservoir.

ACCURACY.—United States Reclamation Service states that discharge measurements are made as often as appears necessary to determine changes in stage-discharge relation and that results are fair for low and medium stages. For high stages results are based on extension of rating curve, together with study of reservoir contents, and are roughly approximate.

COOPERATION.—Record of daily discharge furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Tonto Creek near Roosevelt, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20	30	15	40	60	220	250	350	150	12	148	13
2	18	30	15	40	40	200	250	300	180	10	115	10
3	18	30	15	40	20	150	200	250	120	10	270	10
4	20	30	15	50	20	140	200	220	90	10	280	10
5	18	30	15	40	20	100	180	200	70	20	330	10
6	40	30	15	30	15	100	150	280	50	150	105	20
7	50	30	15	30	20	80	150	280	50	15	96	110
8	120	25	15	35	15	60	150	280	40	10	73	77
9	200	25	15	35	20	50	175	250	40	10	52	34
10	200	15	15	25	60	40	200	250	35	20	50	34
11	160	25	20	20	80	40	300	250	30	10	50	74
12	38	15	20	20	80	50	250	250	20	10	38	70
13	30	15	20	20	100	60	200	250	20	25	36	45
14	200	15	20	20	100	50	200	250	20	22	78	99
15	170	15	20	20	100	50	180	220	20	130	60	100
16	170	15	20	30	100	40	180	220	40	60	38	38
17	100	15	20	60	100	40	180	220	40	48	35	48
18	90	15	20	60	300	40	4,000	220	40	38	67	18
19	60	15	20	80	300	40	8,000	220	26	38	74	51
20	54	15	20	100	300	40	3,000	220	26	39	38	34
21	50	15	20	1,500	300	40	2,100	240	26	24	28	34
22	48	15	20	3,200	200	60	1,500	250	26	10	26	23
23	43	15	20	1,300	250	80	1,200	240	26	10	25	16
24	40	15	20	500	300	100	1,460	240	22	16	25	23
25	40	15	20	200	300	100	950	240	20	49	25	12
26	45	15	50	150	300	100	600	260	18	155	37	12
27	33	15	50	100	300	100	400	260	18	160	30	11
28	33	15	55	80	275	100	400	250	12	125	25	11
29	33	15	50	70	.....	150	300	260	13	232	21	11
30	35	15	40	70	.....	150	350	250	13	280	16	11
31	30	.....	40	60	4,075	200	.....	250	.....	220	15	.....

Monthly discharge of Tonto Creek near Roosevelt, Ariz., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	200	18	71.2	4,380
November	30	15	19.5	1,160
December	55	15	23.7	1,460
January	3,200	20	259	15,900
February	300	15	146	8,110
March	220	40	89.4	5,500
April	8,000	150	922	54,900
May	350	200	249	15,300
June	180	12	43.4	2,580
July	280	10	63.5	3,900
August	330	15	74.4	4,570
September	110	10	35.6	2,120
The year	8,000	10	166	120,000

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from daily-discharge record furnished by United States Reclamation Service.

VERDE RIVER NEAR CLARKDALE, ARIZ.

LOCATION.—In T. 17 N., R. 3 E., 4 miles below mouth of Sycamore Creek and 5 miles above Clarkdale, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 18, 1915, to September 30, 1917 (incomplete). Discharge measurements began April 3, 1915.

GAGE.—Stevens water-stage recorder on left bank, installed June 18. A vertical staff was installed by the United Verde Copper Co. in April on the left bank about 30 feet above the water-stage recorder. All measurements and gage heights are referred to the staff gage datum.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Sand, gravel, and boulders; fairly permanent at low stages, shifts during high stages. Both banks are high, steep, and are not overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 11.4 feet at 4 a. m. October 7 (discharge, determined from extension of rating curve about 6,300 second-feet); minimum stage, from water-stage recorder, 2.05 feet, September 5 (discharge, 74 second-feet).

1915–1917: Maximum stage recorded 11.93 feet, January 18, 1916 (discharge, about 6,860 second-feet, determined from extension of rating curve); minimum discharge, 70 second-feet, on August 4, 11, and 15, 1915.

DIVERSION.—Water is diverted above and below station for irrigating a few small ranches, amount not known.

ACCURACY.—Stage-discharge relation changed some time during missing period (November 1 to May 21) and is assumed to have changed again during flood on August 5. Curve used from October 1–31 and August 5 to September 30 is fairly well defined below 2,000 second-feet. Curve used from May 22 to August 4 is based on two discharge measurements and slope of standard curve. Operation of water-stage recorder was satisfactory throughout the year except as indicated in the footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage heights determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging hourly gage heights. Records fair.

COOPERATION.—Station established and maintained in cooperation with United Verde Copper Co.

Discharge measurements of Verde River near Clarkdale, Ariz., during the year ending Sept. 30, 1917.

[Made by Ellsworth and Gittings.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
July 19	2.75	270
19	2.68	261

Daily discharge, in second-feet, of Verde River near Clarkdale, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	May.	June.	July.	Aug.	Sept.	Day.	Oct.	May.	June.	July.	Aug.	Sept.
1	87	.....	108	109	288	90	16	84	.....	105	147	207	96
2	87	.....	105	125	166	90	17	84	.....	105	124	185	88
3	90	.....	108	125	147	90	18	84	.....	105	233	168	84
4	90	.....	109	114	142	90	19	84	.....	104	285	152	82
5	96	.....	108	112	820	88	20	84	.....	107	183	140	83
6	432	.....	108	114	322	86	21	84	.....	108	133	128	82
7	2,530	.....	108	114	272	86	22	84	122	107	175	120	91
8	543	.....	108	118	268	82	23	84	115	107	175	115	.....
9	275	.....	109	119	268	79	24	84	108	108	135	108	.....
10	153	.....	107	122	268	87	25	84	108	105	209	102	.....
11	96	.....	105	122	268	91	26	84	108	107	183	102	.....
12	87	.....	108	127	268	112	27	84	108	105	245	100	.....
13	87	.....	107	127	620	116	28	86	109	104	366	96	.....
14	86	.....	107	125	290	96	29	84	108	107	199	96	.....
15	86	.....	107	127	242	109	30	84	108	104	197	92	.....
							31	84	109	.....	195	90	.....

NOTE.—No record Nov. 1 to May 21. Aug. 6-12 and Sept. 23-30 gage heights approximate account of silt in well. Sept. 23-30 mean daily discharge estimated 120 second-feet.

Monthly discharge of Verde River near Clarkdale, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2,530	84	199	12,200
May 22-31	122	108	110	2,190
June	109	104	107	6,370
July	366	109	161	9,900
August	820	90	215	13,200
September	.....	79	98.6	5,870

VERDE RIVER AT CAMP VERDE, ARIZ.

LOCATION.—In sec. 30, T. 14 N., R. 5 E., at steel highway bridge just above Camp Verde, Yavapai County, and above mouth of Beaver Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 5, 1912, to September 30, 1917.

GAGE.—Chain gage on downstream side of bridge installed November 12, 1915, at datum 1.80 feet above original gage; read by Nicholas A. Vyne. Original gage was a vertical staff painted on east bridge pier.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Straight channel; banks fairly high and wooded, not subject to overflow; clay and sand bottom, control likely to shift, particularly during high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 7.5 feet during night of April 17 (determined from flood marks on river bank). Probably some backwater from Beaver Creek. Under normal conditions a gage height of 7.5 feet would correspond to a discharge of about 8,200 second-feet. Minimum gage height recorded, 0.6 foot, June 16-20 and 23-30, and September 4-8 (discharge, 95 second-feet).

1912-1917: Maximum stage recorded, 17.0 feet on night of January 18, 1916 (discharge not determined); minimum discharge, 31 second-feet, June 28 and 29, 1914. Minimum stages for different years not comparable because of shifting control.

ACCURACY.—Stage-discharge relation apparently practically permanent during year, except for short periods in January, February, March, and April, when it was affected by backwater from Beaver Creek. More frequent discharge measurements would probably show that the stage-discharge relation changed slightly during low and medium stages and considerably during high stages. Rating curve well defined between 100 and 2,500 second-feet. Curve used above 2,500 second-feet based on logarithmic extension and is liable to considerable error. Gage read to half-tenths once daily; during high water oftener. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair.

Discharge measurements of Verde River at Camp Verde, Ariz., during the year ending Sept. 30, 1917.

[Made by C. E. Ellsworth.]

Date.	Gage height.	Discharge.
	Foot.	*Sec.-ft.*
Oct. 28	0.90	154
July 18	.65	98
18	.65	94

Daily discharge, in second-feet, of Verde River at Camp Verde, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	140	122	130	150	150	720	1,100	1,580	115	100	150	100
2	130	122	130	150	150	460	720	685	115	100	140	100
3	140	122	130	150	150	350	520	580	115	100	140	100
4	140	122	130	150	150	300	400	580	115	100	520	95
5	150	122	130	165	150	300	400	350	115	105	1,140	95
6	1,050	122	130	150	180	400	400	300	110	140	580	95
7	3,980	122	130	150	200	350	615	260	110	130	300	95
8	2,680	122	130	150	220	350	460	220	105	130	180	95
9	2,200	122	130	150	220	400	490	200	105	115	180	110
10	1,640	122	130	150	240	375	490	280	105	115	260	180
11	920	122	130	150	280	430	460	220	105	110	200	180
12	240	122	130	150	280	400	400	140	100	105	180	122
13	180	122	130	150	300	350	460	122	100	110	1,140	240
14	165	122	130	150	260	300	375	122	100	105	520	165
15	180	122	130	150	220	260	350	122	100	100	280	140
16	150	122	130	150	180	240	400	122	95	105	240	130
17	140	122	130	165	180	240	.....	122	95	105	180	122
18	140	122	130	165	200	240	.....	130	95	240	150	122
19	140	130	130	165	180	350	5,010	150	95	165	150	122
20	150	130	130	.....	180	.....	3,640	165	95	140	150	122
21	140	130	130	.....	180	.....	4,700	150	100	140	140	122
22	140	130	130	.....	180	.....	5,680	140	100	130	130	122
23	130	130	130	960	180	.....	7,650	140	95	115	115	140
24	130	130	130	520	430	580	5,870	140	95	110	115	130
25	130	130	130	260	.....	720	5,500	140	95	350	115	122
26	130	130	140	180	.....	1,580	4,260	140	95	400	110	122
27	130	130	150	180	.....	1,530	3,840	130	95	300	110	122
28	130	130	150	180	960	1,970	3,500	130	95	180	110	115
29	130	130	150	180	.....	2,620	2,620	122	95	180	105	115
30	130	130	150	165	.....	2,800	2,380	122	95	140	105	115
31	130	.....	150	165	.....	2,140	.....	115	.....	220	100	.....

NOTE.—Mean daily discharge estimated from study of records of Verde River near Clarkdale, at Childs; and near McDowell, because of backwater from Beaver Creek, as follows: Jan. 20-22, 2,000 second-feet, Feb. 25-27, 1,000 second-feet; Mar. 20-23, 700 second-feet; and Apr. 17 and 18, 4,000 second-feet.

Monthly discharge of Verde River at Camp Verde, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	3,980	130	520	32,000
November	130	122	125	7,440
December	150	130	134	8,240
January	.....	150	377	23,200
February	.....	150	321	17,800
March	2,800	240	760	46,700
April	7,650	350	2,360	140,000
May	1,580	115	255	15,700
June	115	95	102	6,070
July	400	100	151	9,280
August	1,140	100	259	15,900
September	240	95	125	7,440
The year	.....	95	456	330,000

VERDE RIVER AT CHILDS, NEAR CAMP VERDE, ARIZ.

LOCATION.—Just below power plant of Arizona Power Co. at Childs, 3 miles above mouth of Fossil Creek and 18 miles southeast of Camp Verde, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 25, 1911, to September 30, 1917.

GAGE.—Inclined staff in three sections on left bank about 300 feet below power plant of Arizona Power Co. Read by power-plant engineer.

DISCHARGE MEASUREMENTS.—Made from cable a mile above gage or by wading. No discharge measurements have been made at this station since October 18, 1913.

CHANNEL AND CONTROL.—Boulders and bedrock; appears fairly permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year 16.5 feet at 7.03 a. m. April 23; minimum stage 4.7 feet at 6 a. m. and 7 p. m. July 3.

1911–1917: Maximum stage recorded 23 feet at 7.25 a. m. January 19, 1916; minimum stage 3.2 feet on April 27 and 28, 1911.

DIVERSIONS.—Water is diverted above the station for irrigation. (See Verde at Camp Verde.)

REGULATION.—A fairly constant flow of approximately 48 second-feet is diverted from Fossil Creek for power development and discharged into the river above gage.

ACCURACY.—The permanency of the stage-discharge relation is not known, as no discharge measurements have been made at this station since October 18, 1913. Gage read to half-tenths twice daily. Daily discharge not determined.

COOPERATION.—Gage-height record furnished by Arizona Power Co.

Daily gage height, in feet, of Verde River at Childs, near Camp Verde, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.0	5.1	5.05	.....	5.35	6.7	7.1	7.75	5.05	4.8	5.5	5.0
2	5.05	5.1	5.05	.....	5.3	6.4	6.6	7.6	5.05	4.8	5.6	5.1
3	5.1	5.0	5.05	.....	5.3	6.1	6.3	7.0	4.9	4.7	5.9	5.0
4	5.0	5.0	5.05	.....	5.25	6.2	6.2	6.6	5.0	5.3	5.3	5.0
5	5.1	5.05	5.1	.....	5.25	5.65	6.0	6.3	5.0	5.25	9.25	4.9
6	5.55	5.1	5.1	.....	5.25	5.65	6.0	6.05	5.05	5.2	6.2	5.05
7	9.15	5.05	5.1	.....	5.25	5.8	6.3	5.95	5.0	5.1	5.65	5.0
8	7.75	5.05	5.1	5.2	5.6	5.8	6.4	5.8	5.1	5.0	5.7	5.0
9	6.7	5.05	5.05	5.2	5.7	6.0	6.4	5.75	4.95	5.0	5.55	5.0
10	5.9	5.05	5.1	5.2	5.7	6.3	6.3	6.4	4.9	5.0	5.5	5.0
11	5.65	5.1	5.1	5.2	5.7	6.2	6.1	6.6	4.95	5.0	5.6	5.1
12	5.45	5.05	5.1	5.15	5.9	5.75	6.05	6.0	4.95	5.0	5.5	5.25
13	5.3	5.05	5.1	5.2	5.95	5.75	6.0	5.7	4.95	5.1	7.0	6.1
14	5.3	5.0	5.05	5.2	5.75	5.55	5.8	5.6	4.95	5.1	6.2	5.6
15	5.35	5.0	5.05	5.2	5.65	5.35	5.75	5.5	4.95	5.1	5.7	5.35
16	5.3	5.0	5.05	5.2	5.6	5.3	5.75	5.4	4.9	5.1	5.7	5.3
17	5.2	5.0	5.1	5.35	5.3	5.2	11.75	5.25	4.9	5.1	5.5	5.4
18	5.2	5.0	5.1	5.35	5.5	5.25	14.75	5.2	4.9	5.2	5.5	5.2
19	5.2	5.0	5.05	5.3	5.6	5.3	11.0	5.2	4.9	5.1	5.35	5.25
20	5.2	5.0	5.1	7.25	5.45	6.2	10.15	5.25	4.9	5.4	5.3	5.4
21	5.2	5.0	5.1	6.75	5.35	6.7	11.35	5.3	4.9	5.3	5.35	5.3
22	5.2	5.0	5.05	6.05	5.4	7.15	13.75	5.3	4.8	5.2	5.2	5.25
23	5.2	5.0	5.1	5.75	5.6	6.9	14.0	5.4	4.9	6.45	5.3	5.3
24	5.15	5.0	5.1	5.6	6.1	6.45	12.75	5.3	5.0	5.75	5.2	5.55
25	5.15	5.0	5.1	5.4	7.0	6.75	11.25	5.2	4.85	5.3	5.1	5.35
26	5.1	5.1	5.1	5.4	8.1	7.45	10.0	5.2	4.9	5.7	5.1	5.3
27	5.1	5.1	5.1	5.35	8.35	7.35	8.75	5.2	4.8	5.8	5.2	5.3
28	5.05	5.1	5.15	5.35	7.7	7.65	7.9	5.1	4.85	5.75	5.1	5.3
29	5.05	5.1	5.1	5.3	.....	8.2	9.85	5.1	4.85	6.05	5.1	5.3
30	5.05	5.1	5.1	5.35	.....	8.75	9.0	5.1	4.9	6.3	5.1	5.3
31	5.1	.....	5.1	5.3	.....	7.7	.....	5.0	.....	5.5	5.1	.....

VERDE RIVER NEAR McDOWELL, ARIZ.

LOCATION.—At dam site in Salt River Indian Reservation, three-fourths mile above junction with Salt River and 5½ miles below McDowell, Maricopa County.

DRAINAGE AREA.—6,000 square miles. (Furnished by United States Reclamation Service.)

RECORDS AVAILABLE.—August 14 to September 30, 1889; April 20, 1897, to November 11, 1899; January 1, 1901, to April 19, 1902; July 23–26, 1902; January 1, 1903, to September 30, 1917.

GAGE.—Painted directly on granite rocks on right bank.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading. Since November, 1913, measurements have been made regularly 3 or 4 times a week by a man stationed at gage.

CHANNEL AND CONTROL.—Sand; shifts.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 26,600 second-feet April 18; minimum discharge, 128 second-feet on July 5.

1897–1917: Maximum mean daily gage height, 17.0 feet on November 27, 1905 (discharge, 61,500 second-feet); minimum mean daily discharge, 32 second-feet on July 19 and 20, 1904.

DIVERSIONS.—See Verde River at Camp Verde. Water is also diverted 5 miles above station for use on Indian Reservation.

ACCURACY.—Reclamation Service states that daily discharge was determined by indirect method for shifting control from fairly well-defined rating curves and by discharge measurements made 3 or 4 times a week, and that records are good.

COOPERATION.—Daily-discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Verde River near McDowell, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	250	350	328	410	750	3,950	3,410	5,650	372	155	880	241
2	225	350	325	390	725	3,025	2,625	3,750	372	143	750	246
3	230	350	325	300	705	2,400	2,200	3,350	372	135	549	231
4	235	345	325	428	690	2,550	1,975	2,600	350	135	699	213
5	238	345	350	430	640	1,550	1,800	2,030	338	128	552	199
6	245	332	340	420	620	1,250	1,700	1,750	310	129	2,125	188
7	305	325	340	420	670	1,125	1,200	1,800	280	320	1,605	550
8	3,992	325	325	378	660	998	1,225	1,285	270	329	1,125	440
9	4,650	325	325	372	690	920	1,550	925	290	285	775	348
10	1,140	325	325	370	710	900	1,550	825	265	240	695	273
11	930	325	325	360	725	912	1,475	775	260	218	620	266
12	888	325	325	360	790	1,110	1,375	1,375	255	202	512	342
13	802	325	325	360	790	1,175	1,150	1,400	225	210	842	809
14	710	325	325	360	880	975	1,200	850	220	253	2,025	765
15	630	320	325	360	870	870	1,135	832	205	272	1,500	750
16	658	320	325	375	830	700	950	700	220	261	1,010	480
17	650	320	325	412	760	715	1,075	655	205	240	818	575
18	625	310	325	475	760	670	26,600	585	192	230	648	406
19	590	310	325	615	815	640	24,500	580	195	225	589	388
20	500	315	325	912	1,525	600	8,950	630	182	245	567	376
21	485	320	320	15,200	1,350	650	8,362	640	168	252	404	367
22	465	320	320	4,390	1,350	1,280	9,050	975	165	266	374	367
23	460	320	320	2,100	1,650	2,400	13,650	815	170	595	350	358
24	422	325	320	1,362	2,200	2,620	15,200	680	170	548	345	351
25	405	325	320	1,200	2,400	2,175	12,500	650	170	787	315	375
26	400	325	360	960	4,025	1,675	9,650	535	165	665	318	460
27	385	325	400	920	6,750	3,000	6,450	520	165	1,046	265	382
28	382	325	400	860	6,550	2,525	5,500	440	165	1,015	259	340
29	380	325	400	860	.....	2,975	4,900	450	161	640	255	306
30	368	328	418	780	.....	3,875	7,250	430	155	1,535	238	264
31	358	.....	418	750	.....	4,350	.....	376	.....	1,230	233	.....

Monthly discharge of Verde River near McDowell, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	4,650	225	742	45,600
November	350	310	327	19,500
December	418	320	340	20,900
January	15,200	300	1,220	75,000
February	6,750	620	1,490	82,800
March	4,350	600	1,760	108,000
April	26,600	950	6,000	357,000
May	5,650	376	1,250	76,900
June	372	155	234	13,900
July	1,540	128	417	25,600
August	2,120	233	727	44,700
September	809	188	388	23,100
The year	26,600	128	1,240	893,000

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from daily-discharge record furnished by United States Reclamation Service.

BEAVER CREEK AT CAMP VERDE, ARIZ.

LOCATION.—In sec. 30, T. 14 N., R. 5 E., one-fourth mile above junction with Verde River and about a mile northeast of Camp Verde, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 1, 1912, to September 30, 1917.

GAGE.—Inclined and vertical staff on right bank installed August 14, 1916, at same datum and at practically same location as original gage which was washed out January 21, 1916. From January 22 to August 13, 1916, a temporary gage at a datum 1.46 feet above the original gage was used. All readings on temporary gage reduced to datum of original gage. Observer, Nicholas A. Vyne.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Sand, clay, and solid rock, likely to shift slightly during low stages and considerably at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 10.6 feet at 6.20 p. m., April 17 (discharge not determined); minimum discharge, 6 second-feet March 16 and September 20–22 and 30.

1912–1917: Maximum stage, 13 feet January 18, 1916 (discharge not determined); minimum discharge, 1.5 second-feet April 26–30, 1913.

DIVERSIONS.—Water is diverted for irrigation at several points above station; quantity unknown. A small amount of water is discharged into creek above gage at times by an irrigation ditch which diverts from Verde River above the mouth of Beaver Creek.

ACCURACY.—Stage-discharge not permanent. The principal change during the year is assumed to have occurred during the flood on April 17 and 18. Insufficient discharge measurements were made to determine accurately when or to what extent changes in control occurred. Stage-discharge relation liable to be affected by backwater during flood on Verde River but there is insufficient data to determine when such effect, if any, occurred. Rating curve used prior to April 17 fairly well defined between 10 and 800 second-feet; curve used after that date poorly defined except between 15 and 30 second-feet. Gage read to half-tenths once daily, during high water oftener. Discharge ascertained by applying mean daily gage height to rating table. Records poor.

Discharge measurements of Beaver Creek at Camp Verde, Ariz., during the year ending Sept. 30, 1917.

[Made by C. E. Ellsworth.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 28	4.12	14.5
July 18	4.15	30.5
18	4.14	32.0

Daily discharge, in second-feet, of Beaver Creek at Camp Verde, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	16	10	12	20	40	285	500	260	9	12	12	12
2	16	10	16	20	40	260	400	310	9	9	12	12
3	16	10	16	20	32	215	215	260	9	9	12	12
4	16	10	16	20	20	76	158	215	9	9	15	9
5	16	10	16	20	20	48	195	95	9	15	15	8
6	175	10	16	20	48	57	260	77	9	15	15	8
7	1,300	10	12	20	66	48	370	62	9	15	12	8
8	142	10	12	20	99	32	400	62	12	15	12	8
9	99	10	12	20	142	195	340	56	12	12	12	8
10	48	10	12	20	175	285	285	31	9	12	12	8
11	32	10	12	20	215	86	260	238	12	12	15	15
12	26	10	12	20	238	48	142	142	9	12	15	15
13	20	10	12	20	215	26	57	106	9	12	95	285
14	16	10	12	20	57	16	86	62	9	12	77	56
15	20	10	16	20	57	10	66	43	9	15	25	31
16	32	10	16	20	76	6	86	37	9	20	20	25
17	20	10	16	20	66	8	.....	37	12	56	20	20
18	20	10	16	20	57	6	.....	31	9	15	15	8
19	16	10	16	20	48	99	430	62	9	12	15	8
20	16	10	16	215	32	310	500	77	9	12	15	6
21	16	10	16	370	26	430	1,300	62	9	12	12	6
22	16	12	16	215	20	370	340	49	9	12	12	6
23	12	12	16	127	142	215	2,720	37	9	12	12	15
24	12	12	16	76	340	158	2,080	25	12	12	12	12
25	12	12	20	57	215	310	1,210	20	9	9	12	12
26	12	12	20	48	910	430	790	15	9	15	12	9
27	12	12	20	48	735	310	540	12	9	15	12	9
28	12	12	20	40	370	430	465	12	9	15	15	8
29	12	12	20	32	.....	580	260	12	9	15	15	8
30	12	12	20	40	.....	980	285	9	9	12	12	6
31	12	.....	20	40	.....	500	.....	9	.....	12	12	.....

NOTE.—Mean daily gage height Apr. 17 (9 feet) and Apr. 18 (8.95 feet) above limits of rating curve and discharge not determined.

Monthly discharge of Beaver Creek at Camp Verde, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,300	12	71.0	4,370
November	12	10	10.6	631
December	20	12	15.7	965
January	370	20	54.5	3,350
February	910	20	161	8,940
March	980	6	220	13,500
April[a]				
May	310	9	81.5	5,010
June	12	9	9.50	565
July	56	9	14.3	879
August	95	12	18.7	1,150
September	285	6	21.8	1,300

[a] See footnote to daily-discharge table.

AGUA FRIA RIVER NEAR GLENDALE, ARIZ.

LOCATION.—In sec. 28, T. 6 N., R. 1 E., at old diversion dam of Beardsley irrigation project at Camp Dyer, 4 miles below mouth of Castle Creek and 22 miles northwest of Glendale, Maricopa County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 10, 1910, to September 30, 1917.

GAGE.—Stevens water-stage recorder on right bank installed October 2, 1913. It was destroyed by flood on January 27, 1916, and replaced March 21, 1916. During that period incomplete staff gage readings were made by R. Jones. From August 28, 1913, to October 2, 1913, a Richard Frères water-stage recorder was used. Prior to August 28, 1913, gages were vertical staffs, either painted on or attached to the masonry diversion dam, with datum 20 feet lower than that used for water-stage recorders.

DISCHARGE MEASUREMENTS.—Made from cable about one-third mile below gage, or by wading near gage.

CHANNEL AND CONTROL.—Channel above and below the dam composed of shifting sand and gravel. Principal control is formed by the remains of old diversion dam, which failed during the flood of 1895, when a portion of masonry near each end was washed out. At low and medium stages entire stream flows through larger opening, which is near the right bank. This control shifted considerably because of the crevices in the dam filling in with sand and washing out during high stages. On October 18, 1914, an artificial control was completed across the right opening or gap in dam, but was partially destroyed by flood of January 29, 1915. It was repaired October 28, 1915, but was again partly destroyed during floods of January, 1916, and April, 1917.

EXTREMES OF DISCHARGE.—Maximum stage during year, 27 feet about 6 p. m. July 27, determined from flood marks on gage (approximate discharge, 80,000 second-feet determined from extension of rating curve); minimum discharge during year, 5 second-feet July 1 and 2. Minimum stages not comparable because of shifting control.

1910–1917: Maximum stage on record, 30 feet, January 27, 1916, determined from flood marks (approximate discharge, 105,000 second-feet, determined from extension of rating curve); a minimum discharge of about 2 second-feet has occurred at numerous times during period covered by records.

DIVERSIONS.—Water is diverted above gage for irrigating two or three small ranches; amount not known.

ACCURACY.—Stage-discharge relation not permanent account of shifting control. Forty discharge measurements were made during year which define standard rating curve fairly well below 13,000 second-feet. Numerous rating curves applicable for short periods were also defined with fair accuracy. Operation of water-stage recorder was satisfactory except for breaks in record as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage heights or by indirect method for shifting control. Mean daily gage heights determined by inspecting gage graph, or, on days of considerable fluctuation, by averaging hourly gage heights. Records fair for low and medium stages, poor for high stages.

Discharge measurements of Agua Fria River near Glendale, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	C. E. Ellsworth	2.80	77	Apr. 20	C. E. Ellsworth	6.70	1,410
14	do	2.16	29.4	21	do	6.3	941
14	do	2.16	33.7	May 21	do	3.85	106
Nov. 9	M. D. Anderson	1.68	15.5	21	do	3.85	102
Dec. 14	do	1.70	19.7	June 14	do	2.76	13.7
Jan. 22	C. E. Ellsworth	4.66	596	14	do	2.76	13.8
22	do	4.51	464	27	do	2.73	6.2
23	do	4.31	347	27	do	2.72	5.3
Feb. 6	do	3.14	64	July 2	do	2.68	3.6
6	do	3.14	72	8	do	2.83	18.6
17	do	2.95	53	8	do	2.82	15.5
17	do	2.95	61	29	do	10.3	6,120
18	do	3.77	195	30	do	6.02	752
19	do	4.40	365	Aug. 3	do	3.26	49.8
19	do	4.74	538	19	do	3.41	19.3
Mar. 18	do	3.55	57	19	do	3.41	19.4
23	do	3.64	63	Sept. 6	do	4.35	392
24	do	3.68	66	6	do	4.65	328
Apr. 18	do	11.2	[a] 12,300	23	do	3.16	13.5
19	do	8.0	3,100	23	do	3.16	12.6

[a] Surface velocity observed over part of section and coefficient of 0.90 used to reduce to mean.

Daily discharge, in second-feet, of Agua Fria River near Glendale, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	14	17	17	27	.....	428	80	215	28	5	158	25
2	23	17	17	27	.....	306	77	186	27	5	89	25
3	36	17	17	32	.....	230	75	162	27	6	61	25
4	20	17	17	37	.....	173	69	151	26	18	321	26
5	19	17	17	34	.....	152	62	140	25	109	1,860	26
6	650	17	17	29	73	142	61	134	25	35	230	507
7	2,860	17	17	28	73	127	60	129	24	37	89	462
8	.....	17	17	27	73	117	58	129	22	16	46	246
9	.....	17	17	26	72	109	57	129	20	9	35	162
10	78	17	17	26	72	106	57	150	18	8	46	129
11	66	17	17	26	70	.....	57	119	14	8	52	80
12	55	17	17	26	69	.....	57	109	14	8	59	31
13	44	16	17	26	69	.....	57	92	14	6	46	507
14	33	16	17	26	69	.....	56	77	12	6	46	36
15	30	16	17	26	68	.....	52	65	12	6	40	21
16	29	16	17	35	64	.....	61	60	11	9	30	16
17	28	16	17	32	57	.....	14,400	49	11	9	21	318
18	26	16	17	105	167	60	22,800	44	10	9	21	32
19	25	16	18	139	365	61	2,620	84	10	9	17	25
20	23	17	18	6,890	356	63	1,170	140	9	8	17	19
21	21	16	18	1,300	465	61	1,020	100	9	12	15	13
22	21	16	18	520	616	67	810	84	8	28	12	13
23	20	16	19	328	1,190	72	.....	65	8	600	11	13
24	20	17	19	256	1,390	75	.....	54	7	165	9	13
25	19	17	24	.....	1,270	75	.....	44	7	135	8	13
26	18	17	27	.....	820	72	.....	38	7	560	6	13
27	18	17	29	.....	960	71	.....	36	6	19,000	13	13
28	18	17	28	.....	600	72	.....	34	6	5,590	12	13
29	18	17	28	.....	.....	73	.....	30	6	4,360	9	13
30	18	17	27	.....	.....	76	262	29	6	1,090	925	13
31	17	.....	27	.....	.....	80	.....	28	.....	335	230	.....

NOTE.—Recorder not working properly; discharge determined from study of weather records and general observations by local resident as follows: Oct. 8 and 9, estimated mean 1,000 second-feet; Oct. 11–13 and Nov. 6 and 7, interpolated; Jan. 25–31, estimated mean 200 second-feet; Feb. 1–5, estimated mean 100 second-feet; Mar. 11–17, estimated mean 80 second-feet; Apr. 23–29, estimated mean 350 second-feet; May 4 and 6, Sept. 4, 11, and 19–20, interpolated. Gage heights partly estimated because of improper operation of recorder on the following days: Jan. 19–21, Apr. 17–19, July 27 to Aug. 3. Gage heights from staff-gage readings on the following days: Apr. 30 to May 3, May 5 and 7–9, Aug. 5–18 and Aug. 29 to Sept. 3, Sept. 5, 12–18, 21–22.

Monthly discharge of Agua Fria River near Glendale, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2,860	14	202	12,400
November	17	16	16.7	994
December	29	17	19.5	1,200
January	6,890	26	369	22,700
February	1,390	57	340	18,900
March	428	.....	111	6,820
April	22,800	52	1,550	92,200
May	215	28	93.7	5,760
June	28	6	14.3	851
July	19,000	5	1,040	64,000
August	1,860	6	146	8,980
September	507	13	94.9	5,650
The year	22,800	5	332	240,000

HASSAYAMPA RIVER NEAR WAGONER, ARIZ.

LOCATION.—Near line between secs. 23 and 26, T. 11 N., R. 3 W., at road crossing opposite Shride's ranch (Moore's prior to Aug. 20, 1916), 2½ miles above mouth of Milk Creek, 4½ miles above Wagoner, Yavapai County, 6 miles above Walnut Grove dam site, and about 25 miles northeast of Wickenburg.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 21, 1912, to September 30, 1917.

GAGE.—Vertical staff on right bank; read by E. W. Shride. On December 10, 1916, an auxiliary gage was installed on left bank about 300 feet below regular gage for use when stream shifts away from regular gage.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Sand and gravel; constantly shifting.

EXTREMES OF STAGE.—Maximum stage recorded during year 7 feet during night of April 17, determined from flood marks on gage. Minimum stages not comparable account of shifting control. Stream is dry at the gage for various periods nearly every year.

DIVERSIONS.—Nearly entire low-water flow is diverted for irrigation above station.

ACCURACY.—Stage-discharge relation not permanent. Channel and control consists of sand which is continually changing. Rating curve not developed. Gage read to quarter-tenths twice daily. Readings may be in error during October account of observer not thoroughly understanding how gage was graduated. Daily discharge not determined.

Discharge measurements of Hassayampa River near Wagoner, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.		Discharge.
		Regular gage.	Auxiliary gage.	
		Feet.	*Feet.*	*Sec.-ft.*
Oct. 30	C. E. Ellsworth	4.86	.....	2.6
30	....do	4.88	.....	3.0
Jan. 30	W. A. Farish	4.90	0.75	3.7
30	....do	4.90	.75	3.8
Feb. 3	....do	4.90	.85	3.7
July 16	C. E. Ellsworth	5.05	.44	9.4
16	....do	5.04	.42	8.0
Sept. 21	....do	4.98	.38	1.6
21	....do	4.98	.38	1.9

Daily gage heights, in feet, of Hassayampa River near Wagoner, Ariz., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.8	5.0	5.0	1.00	0.80	0.95	5.30	5.65	1.20	0.92	5.3	0.30
2	5.85	5.0	5.0	1.00	.80	.94	5.30	5.50	1.20	.92	6.3	.30
3	5.8	5.0	5.0	1.00	.80	.85	5.28	5.40	1.20	.92	5.9	.30
4	5.8	5.0	5.0	.80	.80	5.22	5.22	5.40	1.20	1.26	5.65	.30
5	5.85	5.0	5.0	.80	.78	.82	5.21	5.40	1.15	1.35	5.6	.30
6	6.5	5.0	5.0	.80	.76	.80	5.12	5.40	1.12	1.30	5.35	.30
7	5.9	5.0	5.05	.90	.75	.80	5.10	5.40	1.08	1.30	.40	.30
8	5.05	5.0	5.05	.90	.75	.80	5.10	5.55	1.10	1.22	.40	.30
9	5.0	5.0	5.0	.90	.75	.80	5.10	1.50	1.10	1.37	.40	.30
10	5.0	5.0	1.01	.90	.75	.80	5.10	1.50	1.00	1.45	.40	.30
11	5.0	5.0	1.01	.90	.75	5.80	5.00	1.50	1.00	1.22	.40	.30
12	5.0	5.0	1.01	.90	.75	5.80	5.00	1.50	1.00	1.28	.40	.30
13	4.95	5.0	1.01	.90	.75	5.80	5.00	1.50	.99	1.30	.40	.30
14	4.95	5.0	1.01	.90	.75	5.80	5.00	1.45	.91	1.38	.35	.30
15	5.0	5.0	1.01	.95	.75	5.80	5.10	1.40	.90	.35	.32	.30
16	5.0	5.0	1.01	.95	.75	5.80	5.85	1.40	.90	.42	.30	.30
17	5.0	5.0	1.01	1.00	.75	5.80	6.90	1.40	.95	.45	.30	.35
18	5.0	5.0	1.01	.95	.75	5.75	6.71	1.40	.95	.45	.30	.40
19	5.0	5.0	1.00	1.00	.78	5.75	6.72	1.40	.95	.42	.30	.40
20	5.0	5.0	1.01	1.20	.78	5.69	5.65	1.40	.92	.40	.30	.40
21	5.0	5.0	1.01	.90	.79	5.59	5.65	1.45	.92	.40	.30	.40
22	5.0	5.0	1.00	.89	.80	5.40	5.62	1.48	.92	.40	.30	.40
23	5.0	5.0	1.00	.80	.82	5.39	5.60	1.40	.92	.40	.30	.40
24	5.0	5.0	1.00	.80	.89	5.28	5.60	1.40	.92	.42	.30	.40
25	5.0	5.0	1.02	.80	.96	5.25	5.58	1.40	.92	.40	.30	.40
26	5.0	5.0	1.00	.80	1.00	5.25	5.55	1.40	.92	.40	.30	.40
27	5.0	5.0	1.00	.80	1.00	5.25	5.88	1.38	.92	.42	.30	.40
28	5.0	5.0	1.00	.80	1.00	5.25	5.90	1.30	.92	.48	.30	.42
29	5.0	5.0	1.02	.80	.....	5.29	5.78	1.24	.92	.45	.30	.42
30	5.0	5.0	1.00	.80	.....	5.30	5.72	1.20	.92	.45	.30	.42
31	5.0	.....	1.00	.80	.....	5.30	.....	1.20	.....	5.22	.30	.....

NOTE.—All gage heights less than 2.0 feet refer to auxiliary gage (see "Station description").

SEEPAGE INVESTIGATIONS ON GILA RIVER.

The following table shows the essential results of a seepage investigation on Gila River in the Safford Valley, September 6–11, 1917. These data are computed from duplicate, and in some cases triplicate, measurements of the main stream and all diversions and surface inflow. Gage heights at the United States Geological Survey gaging station on Gila River near Solomonville show that the river remained practically constant during the period covered by the investigation.

Seepage measurements on Gila River in Safford Valley from Brown canal, in SE. ¼ sec. 30, T. 6 S., R. 27 E., to Consolidated canal, in NW. ¼ sec. 4, T. 6 S., R. 24 E., 1917.

Place of measurements.	Date.	Distance.	Amount in river.	Section.		Section gain or loss.	Total gain or loss.
				Inflow.	Diversion.		
		Miles.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
Gila River above Brown canal	Sept. 6	0	97.6				
Brown canal below wasteway	do	.2			4.1		
Gila River above Fourness canal	do	2.4	88.8			−4.7	
Fourness canal	do	2.4			4.0		
San Jose canal	do	2.6			71.0		
Gila River above Michellena canal	do	4.4	18.3			+4.5	−0.2
Michellena canal	do	4.4			5.1		
San Jose canal wasteway	do	5.2		52.0			
Gila River above Montezuma canal	do	7.0	64.4			−.8	−1.0
Montezuma canal	Sept. 7	7.0			61.1		
Gila River above Montezuma wasteway	do	7.8	4.5			+1.2	+.2
Montezuma wasteway	do	7.8		31.0			
Gila River above Union canal	do	8.8	40.4			+4.9	+5.1
Union canal	Sept. 8	8.8			29.5		
San Simon wash at mouth	do	10.0		3.0			
Graham canal	Sept. 10	13.6			26.5		
Gila River below Graham canal	do	13.6	6.8			+19.4	+24.5
Smithville canal	do	17.1			16.1		
Gila River below Smithville canal	do	17.1	3.2			+12.5	+37.0
Dodge canal	Sept. 11	22.7			21.4		
Gila River below Dodge canal	do	22.7	6.8			+25.0	+62.0
Curtis canal	do	24.9			26.2		
Gila River below Curtis canal	do	24.9	3.4			+16.8	+78.8
Curtis canal wasteway	do	28.5		4.0			
Consolidated canal	do	29.5			12.0		
Gila River below Consolidated canal	do	29.5	1.3			+5.9	+84.7

WHITEWATER BASIN.

WHITEWATER DRAW NEAR DOUGLAS, ARIZ.

LOCATION.—In sec. 10, T. 24 S., R. 27 E., opposite city pumping plant, one-quarter mile above highway bridge, about same distance above El Paso & Southwestern Railroad bridge, 1 mile above electric-railway bridge, and 1½ miles west of Douglas, Cochise County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 24 to October 10, 1911 at electric-railway bridge; July 21, 1912, to February 15, 1916, at highway bridge; and February 16 to September 30, 1917, at present location.

GAGE.—Vertical and inclined staff on right bank opposite city pumping plant read by Mrs. L. E. King. Original gage installed August, 1911 at electric-railway bridge was read until October 10, 1911. On July 21, 1912 station was moved about three-quarters of a mile upstream to highway bridge, where gage readings were obtained until February 16, 1916. The datum of this gage, which bears no definite relation to gage on the electric-railway bridge, was raised 3 feet on January 20, 1915. On February 16, 1916, station was moved one-quarter of a mile upstream to its present location and gage set at an independent datum.

DISCHARGE MEASUREMENTS.—By wading or from cable near gage.

CHANNEL AND CONTROL.—Sand and gravel, fairly permanent. Dumping of slag into the channel below the gage has caused backwater effect at various times at gages until about July 1, 1916, when a new channel was dug around the slag and since then no backwater effect has been experienced.

EXTREMES OF DISCHARGE.—Maximum stage during year 7 feet August 9, determined mined from flood marks on gage (discharge determined from extension of rating curve, about 720 second-feet).

1911–1917: Maximum stage recorded, 13.6 feet at 9 a. m., December 23, 1914 (discharge, determined from extension of rating curve 3,000 second-feet). Stream dry or carries less than 0.5 second-feet the greater part of each year.

DIVERSIONS.—Some flood water is diverted above station for irrigation, quantity unknown.

ACCURACY.—Stage-discharge relation changed during floods from July 9–13. Curve used during October is fairly well defined below 65 second-feet. Curve used during July, August, and September is drawn parallel to October curve through low-water measurements made from July 21 to August 28, and may be considerably in error, particularly for discharges above 65 second-feet. On days when the discharge was greater than the ordinary seepage flow (about 0.5 second-feet) the gage was read once daily to half-tenths, and, during rapidly fluctuating stages, oftener. On account of the extremely flashy character of flow, assumption that mean of the observed gage heights was mean for day may cause considerable error. Daily discharge determined by applying mean daily gage heights to rating curve, except as indicated in footnote to the monthly discharge table, and is not sufficiently accurate to publish. Records roughly approximate.

Discharge measurements of Whitewater Draw near Douglas, Ariz., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	M. D. Anderson	3.8	0.1	July 22	J. B. Spiegel	3.50	2.0
July 21	J. B. Spiegel	3.49	.2	Aug. 28	do	3.47	.1

Monthly discharge of Whitewater Draw near Douglas, Ariz., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet (mean).	Run-off in acre-feet.
October 8–17	7.8	155
July 9–31	45.5	2,080
August 1–28	40.1	2,230
September 7–27	34.3	1,430

NOTE.—On days of no record stream was either dry or carried less than 0.5 second-foot (total run-off probably not over 200 acre-feet). Discharge estimated Oct. 9, 10, 12, and 13 and Sept. 19 and 20. Discharge interpolated Aug. 26, 27, and Sept. 17, 24, and 26. Daily discharge not sufficiently accurate to publish. See "Accuracy" in station description.

MISCELLANEOUS MEASUREMENTS.

In addition to the records of flow obtained at the gaging stations and reported in the preceding pages, many measurements were made at other points, as shown by the following table:

Miscellaneous measurements in Colorado River drainage basin during the year ending Sept. 30, 1917.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Apr. 26	Green River	Colorado River	Ouray, Utah	10.0	13,000
May 2	....do	....do	....do	9.0	11,400
3	....do	....do	....do	8.8	10,700
7	....do	....do	....do	8.2	9,430
9	....do	....do	....do	7.8	8,790
25	....do	....do	....do	13.4	25,500
29	....do	....do	....do	12.9	24,800
31	....do	....do	....do	12.1	24,900
June 2	....do	....do	....do	12.3	21,800
7	....do	....do	....do	12.4	22,500
12	....do	....do	....do	13.8	25,400
14	....do	....do	....do	14.2	32,900
21	....do	....do	....do	15.6	31,200
25	....do	....do	....do	16.6	33,200
July 2	....do	....do	....do	15.4	31,800
6	....do	....do	....do	13.9	26,600
14	....do	....do	....do	11.2	17,800
Aug. 14	....do	....do	....do	5.5	3,760
30	....do	....do	....do	4.5	2,350
Apr. 27	Duchesne River	Green River	....do	6.5	1,690
May 7	....do	....do	....do	4.7	826
11	....do	....do	....do	5.3	1,120
17	....do	....do	....do	8.5	2,710
18	....do	....do	....do	8.9	2,940
21	....do	....do	....do	9.7	2,790
24	....do	....do	....do	10.7	3,550
June 6	....do	....do	....do	9.7	3,190
11	....do	....do	....do	12.0	5,970
16	....do	....do	....do	13.2	6,980
May 22	....do	....do	....do	9.9	2,760
30	....do	....do	....do	8.9	2,050
10	Unita River	Duchesne River	Bridge 10 miles northeast of Whiterocks, Utah.	.....	87
11	....do	....do	Former gaging station in sec. 35, T. 2 S., R. 1 E., 2 miles south of Fort Duchesne, Utah.	1.51	75
26	....do	....do	....do	2.45	455
June 27	....do	....do	....do	4.52	4,050
July 13	....do	....do	....do	.83	337
May 9	Farm Creek	Unita River	3 miles above mouth, 5 miles northwest of Whiterocks, Utah.	.....	11
Sept. 19	....do	....do	....do	.....	2.4
May 9	Whiterocks Creek	....do	50 feet below head gates of Whiterocks Indian canal, 6 miles north of Whiterocks, Utah.	.....	41
June 28	White River	Green River	Ouray, Utah	13.0	3,240
July 21	....do	....do	....do	6.7	1,220
Aug. 13	....do	....do	....do	3.5	627
Oct. 1	Grand Lake outlet	Grand River	Outlet of Grand Lake, Colo.	1.90	47
2	South Fork of Grand River.	Colorado River	Above North Fork, Colo	.....	118
Sept. 13	Mill Creek	Grand River	600 feet below power plant 2 miles southeast of Moab, Utah.	.....	14
Dec. 13	North Fork of North Montezuma Creek.	San Juan River	Monticello, Utah	.....	.3
Sept. 12	....do	....do	....do	.....	.2
12	Middle canal	North Fork of North Montezuma Creek.	Head of canal at Monticello, Utah.	.....	.4
Dec. 15	South Fork of North Montezuma Creek.	North Montezuma Creek.	Half a mile above mouth at Monticello, Utah.	.....	1.0
Sept. 12	....do	....do	....do	.....	.0
12	South canal	South Fork of North Montezuma Creek.	Three-fourths mile west of Monticello, Utah, in sec. 35, T. 33 S., R. 23 E.	.....	.6

Miscellaneous measurements in Colorado River drainage basin during the year ending Sept. 30, 1917—Continued.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Dec. 15	Spring Creek	North Montezuma Creek.	SE. ¼ sec. 7, T. 33 S., R. 23 E., 8 miles northwest of Monticello, Utah.		0.0
14	Verdure Creek	Montezuma Creek	Sec. 27, T. 34 S., R. 23 E., 2½ miles west of Verdure, Utah.		.4
14	Recapture Creek	San Juan River	Sec. 12, T. 36 S., R. 22 E., 4 miles northeast of Grayson, Utah.		.2
Apr. 6	Little Colorado River	Colorado River	Holbrook, Ariz.		16.1
Nov. 3	Ash Creek	Virgin River	SW. ¼ sec. 2, T. 41 S., R. 13 W. at Toquerville, Utah.		17
3	do	do	do		18
Mar. 10	do	do	do		18
July 9	do	do	do		1.2
Nov. 4	La Verkin Creek	Ash Creek	State road crossing near La Verkin, Utah.		5.8
July 9	Savage canal	Leeds Creek	Leeds, Utah		5.2
6	Central canal	Santa Clara Creek	Central, Utah		8.7
Mar. 7	St. George and Santa Clara canal.	do	Santa Clara, Utah		7.4
Nov. 12	Muddy River	Virgin River	Former gaging station near St. Thomas, Nev.	5.60	9.2
Dec. 2	do	do	do	5.79	12.5
Mar. 20	do	do	do	6.85	17.4
May 9	do	do	do	6.85	14.7
July 14	do	do	do	1.60	.51
Aug. 14	do	do	do	1.80	13.5
31	do	do	do	1.59	2.9
June 2	Gila River	Colorado River	Below heading of Consolidated canal near Fairview, Ariz.		3.7
2	do	do	do		3.6
Oct. 7	do	do	SW. ¼ sec. 9, T. 4 S., R. 11 E., Gila and Salt River base and meridian, just above heading of Florence canal, 11 miles northeast of Florence, Ariz.		150
7	do	do	do		150
10	do	do	do		581
10	do	do	do		518
Nov. 4	do	do	do		726
8	do	do	do		639
11	do	do	do		583
17	do	do	do		497
21	do	do	do		469
21	do	do	do		433
24	do	do	do		393
27	do	do	do		361
Dec. 14	do	do	do		366
19	do	do	do		363
22	do	do	do		354
29	do	do	do		441
Jan. 10	do	do	do		470
13	do	do	do		402
Feb. 16	do	do	do		652
Mar. 7	do	do	do		1,090
10	do	do	do		786
15	do	do	do		662
21	do	do	do		553
24	do	do	do		467
28	do	do	do		583
Apr. 6	do	do	do		695
June 28	do	do	Sec. 32, T. 1 N., R. 1 W., Gila and Salt River base and meridian, just below Buckeye canal heading about 2 miles east of Liberty, Ariz.		41.6
28	Gila River	Colorado River	Sec. 8, T. 1 S., R. 3 W., Gila and Salt River base and meridian, just below heading of Arlington canal 1 mile south of Buckeye, Ariz.		.0
28	do	do	Sec. 26, T. 2 S., R. 5 W., Gila and Salt River base and meridian, just below heading of Enterprise canal, 6 miles south of Arlington, Ariz.		35.8

Miscellaneous measurements in Colorado River drainage basin during the year ending Sept. 30, 1917—Continued.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 9	Michellena canal	Gila River	Near head of canal, 4 miles above Solomonville, Ariz.	.....	8.8
9	do	do	do	.....	6.8
13	do	do	do	0.38	5.1
18	do	do	do	.18	2.6
Mar. 28	Union canal	do	Near head of canal 1½ miles northwest of Solomonville, Ariz.	.....	125
May 23	Graham canal	do	Near head of canal 1½ miles north of Safford, Ariz.	.55	7.2
24	do	do	do	.55	7.5
31	do	do	do	1.43	52
31	do	do	do	1.39	46.7
June 4	do	do	do	1.45	51
8	do	do	do	1.41	45.9
20	do	do	do	1.05	32.9
May 22	Smithville canal	do	Near head of canal 1½ miles north of Thatcher, Ariz.	2.58	48.5
June 2	Curtis canal	do	Near head of canal, 2 miles northwest of Fairview, Ariz.	2.09	38.3
2	Consolidated canal	do	Near head of canal 2½ miles northwest of Fairview, Ariz.	.49	22.2
2	do	do	do	.46	21.7
Nov. 24	San Pedro River	do	Mouth, 1 mile below Winkelman, Ariz.	.....	34.3
Mar. 7	Florence canal	do	Head of canal, 10 miles northeast of Florence, Ariz.	.....	89
29	O. T. canal	do	Head of canal near Florence, Ariz.	.....	33.0
Nov. 26	Queen creek	do	Dam site, 12 miles below Superior, Ariz.	.....	1.9
Mar. 10	do	do	do	.....	4.8
Sept. 9	Black River[a]	do	Sec. 14, T. 4 N., R. 28 E., Gila and Salt River base and meridian, just below junction of East and West forks, Ariz.	.....	15.6
7	West Fork of Black River[a]	Black River	Sec. 35, T. 6 N., R. 27 E., Gila and Salt River base and meridian, about 10 miles above mouth.	.....	4.3
7	do	do	Sec. 12, T. 4 N., R. 28 E., Gila and Salt River base and meridian, near mouth.	.....	8.3
7	Reservation Creek[a]	do	T. 5 N., R. 26½ E., Gila and Salt River base and meridian, 6½ miles above mouth.	.....	4.8
7	Pachete Creek[a]	do	T. 5 N., R. 26½ E., Gila and Salt River base and meridian, 9 miles above mouth.	.....	5.6
June 28	Buckeye canal	Gila River	Sec. 32, T. 1 N., R. 1 W., Gila and Salt River base and meridian, at head of canal, near Liberty, Ariz.	.....	134
28	Arlington canal	do	Sec. 8, T. 1 S., R. 3 W., Gila and Salt River base and meridian, at head, 1 mile south of Buckeye, Ariz.	.....	74
Jan. 30	Hassayampa River[b]	do	Sec. 23, T. 10 N., R. 3 W., Gila and Salt River base and meridian, at Walnut Grove dam site, 2½ miles south of Wagoner, Ariz.	.....	20.0
Feb. 3	do	do	do	.....	12.4
June 28	Enterprise canal	do	Sec. 28, T. 2 S., R. 5 W., Gila and Salt River base and meridian, at head of canal, 6 miles south of Arlington, Ariz.	.....	18.5

[a] Furnished by W. L. Huber, civil engineer, San Francisco, Calif.
[b] Furnished by W. A. Farish, civil engineer, Los Angeles, Calif.

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART IX.—COLORADO RIVER BASIN

187042°—21—WSP 459——13

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, ground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, monographs, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features, as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic slope and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins, in three volumes:
A. Pacific slope basins in Washington and Upper Columbia River basin.
B. Snake River basin.
C. Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will furnish lists giving prices.

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

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., 704 Journal Building.
Harrisburg, Pa., care of Water-Supply Commission.
Asheville, N. C., 32–35 Broadway.
Chattanooga, Tenn., Temple Court Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Chicago, Ill., 1404 Kimball Building.
Ames, Iowa, care of State Highway Commission.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Topeka, Kans., 23 Federal Building.
Salt Lake City, Utah, 313 Federal Building.
Boise, Idaho, 615 Idaho Building.
Idaho Falls, Idaho, 228 Federal Building.
Austin, Tex., Capitol Building.
Portland, Oreg., 606 Post Office Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Calif., 328 Customhouse.
Los Angeles, Calif., 602 Federal Building.
Honolulu, Hawaii, 25 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,510 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

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	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Description, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 2	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.
W 451 to 464	do	1917.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1917. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1917, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, 431, and 451, which contain records for the New England streams from 1903 to 1917. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for Mississippi River are given in four parts, as indicated on page III, and the records for large lakes are presented in order of streams around the rim of the lake.

Number of water-supply papers containing results of stream measurements, 1899–1917.

Year.	I North Atlantic slope basins (St. John River to York River).	II South Atlantic slope and eastern Gulf of Mexico basins (James River to the Mississippi).	III Ohio River basin.	IV St. Lawrence River and Great Lakes basins.	V Hudson Bay and upper Mississippi River basins.	VI Missouri River basin.	VII Lower Mississippi River basin.	VIII Western Gulf of Mexico basins.	IX Colorado River basin.	X Great Basin.	XI Pacific slope basins in California.	XII North Pacific slope basins.		
												Pacific slope basins in Washington and upper Columbia River basins.	Snake River basin.	Lower Columbia River basin and Pacific slope basins in Oregon.
1899[a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 78	66, 78	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	55	55	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332–A	332–B	332–C
1913	351	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917	451	452	453	454	455	456	457	458	459	460	461	462	463	464

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific slope basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables of monthly discharge estimates for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill rivers to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California, except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

PART IX. COLORADO RIVER BASIN.

PRINCIPAL STREAMS.

The largest tributaries of the Colorado River are Green River (considered the continuation of the main stream), Grand River, Dolores, San Juan, Little Colorado, Virgin, and Gila rivers. The principal streams flowing into the Green are East Fork, Yampa River, Ashley Creek, Duchesne River, and White River. The principal tributaries of Grand River are Grand Lake, Frazier River, Williams Fork, Blue River, and Gunnison River. The streams of the Colorado basin drain wholly or in part the States of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. XXII.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained Sept. 30, 1917. Period after a date indicates discontinuance.

Green River (head of Colorado River) near Kendall, Wyo., 1910–1912.
Green River near Daniel, Wyo., 1915–
Green River at Green River, Wyo., 1915–1906; 1915–
Green River at Bridgeport, Utah, 1911–1915.
Green River at Jensen, near Vernal, Utah, 1903–1906; 1914–1915.
Green River at Ouray, Utah, 1904–5.
Green River at Green River (formerly Blake), Utah, 1894–1899; 1905–1911.
Green River at Little Valley, near Green River, Utah, 1910–
Colorado River at Bulls Head, near Mohave, Ariz., 1902–3.
Colroado River at Hardyville, Ariz., 1905–1907.
Colorado River near Topock, Ariz., 1917–
Colorado River at Yuma, Ariz., 1891–
Horse Creek at Daniel, Wyo., 1915–
Cottonwood Creek near Big Piney, Wyo., 1916–
East Fork at East Fork canal, Wyo., 1916–
East Fork at Newfork, Wyo., 1905–6; 1915–
New Fork at Alexander's ranch, near Cora, Wyo., 1910–11.
New Fork at Pinedale crossing, near Cora, Wyo., 1905.
New Fork near Boulder, Wyo., 1915–
Pine Creek at Fremont Lake outlet near Pinedale, Wyo., 1905–1906; 1910–1912; 1915–
Pine Creek at Pinedale, Wyo., 1915–
Pole Creek near Fayette, Wyo., 1904–1906.
Pole Creek near Pinedale, Wyo., 1910.
Fall Creek at Fayette, Wyo., 1904–5.
Boulder Creek near Boulder (Newfork), Wyo., 1904–1906; 1915–

[1] Flows into Gulf of California in Mexico.

REPORTS ON WATER RESOURCES OF COLORADO RIVER BASIN.

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*2. Irrigation near Phoenix, Ariz., by A. P. Davis. 1897. 98 pp., 31 pls. 15c.

Describes physiographic features, temperature, rainfall, stream flow, soils, and projected irrigation works in Gila River basin; discusses briefly possible use of ground water for irrigation and gives data concerning wells in Pinal and Maricopa counties. Chiefly of historic interest, as indicated by the date of publication.

*33. Storage of water on Gila River, Arizona, by J. B. Lippincott. 1900. 98 pp., 33 pls. 15c.

Describes conditions existing in 1896–99, available water supply, silt, and reservoir sites (Buttes, Riverside, San Carlos, and Queen Creek); contains section on cement, and treats of irrigable land, distribution canals, and organization of irrigation. Interest chiefly historic.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes various types of canals for irrigation.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distances along Colorado, Little Colorado, San Juan, Mancos, La Plata, Animas, Los Pinos, Grand, Gunnison, Dolores, Uncompahgre, Lake Fork, Roaring Fork, and Eagle rivers; also brief descriptions of several of the streams.

*57. Preliminary list of deep borings in the United States, Part I (Alabama–Montana), by N. H. Darton. 1902. 60 pp. 5c.

*61. Preliminary list of deep borings in the United States, Part II (Nebraska–Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

A second, revised, edition of Nos. 57 and 61 was published in 1905 as Water-Supply Paper 149 (q. v.).

*73. Water storage on Salt River, Arizona, by A. P. Davis. 1903. 54 pp., 25 pls. 20c.

Discusses Verde and Salt River basins and McDowell and Salt River reservoirs.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses drainage and irrigation; gives records of stream flow.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. Contains:

Investigations in Arizona, by A. P. Davis. Describes the proposed storage reservoir on Salt River at the mouth of Tonto Creek.

Salt River Valley Water Users' Association, by B. A. Fowler. Contains Judge Kibbey's address presenting a plan for the organization of the owners of lands to be irrigated.

Topographic work in the Grand Canyon of the Gunnison, by I. W. McConnell. Discusses the proposed diversion of water from Gunnison River into Uncompahgre Valley.

The Colorado River, by J. B. Lippincott.

Colorado River reclamation projects, by E. T. Perkins. Describes the site of the Yuma dam and summarizes the advantages of the Yuma site.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. Superseded by 152.

Cites statutory restrictions of water pollution in Colorado, Nevada, Utah, New Mexico, and Wyoming.

104. The underground waters of Gila Valley, Arizona, by W. T. Lee. 1904. 71 pp. 5 pls. 10c.

Presents information concerning the topographic features and surficial geology of the area between The Buttes, 12 miles east of Florence, and the junction of the Gila and Salt rivers; treats of the source, amount, quality, and methods of securing the underflow.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Cites legislative acts relating to ground waters in Colorado, Nevada, New Mexico, Utah, and Wyoming.

136. Underground waters of Salt River valley, Arizona, by W. T. Lee. 1905. 196 pp., 23 pls. 25c.

Describes the physiography and geology of the Mesa and Phoenix regions, gives many well records, and discusses the amount and chemical character of the ground waters, duty of water and cost of pumping.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Troxton Canyon flood, Arizona, by E. C. Murphy. Globe flood, Arizona, by O. T. Reedy. La Plata River flood, Colorado, from report of Theo. Tobish.

*149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties) location, depth, diameter, yield, height of water, and other valuable information concerning wells 400 feet of more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in Colorado, Nevada, Utah, New Mexico, and Wyoming.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Contains accounts of floods on Colorado, Green, Grand, Gunnison, San Juan, Little Colorado, Gila, San Francisco, Verde, San Pedro, and Salt rivers, and of the flow of the Colorado into Salton Sink; gives index to literature on floods on American streams.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analysis; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analysis of waters of Colorado, Green, Grand, Gunnison, Animas, Little Colorado, Gila, San Francisco, Salt, and Verde rivers.

*320. Geology and water resources of the Sulphur Spring Valley, Arizona, by O. E. Meinzer and F. C. Kelton, with a section on agriculture, by R. H. Forbes. 1913. 231 pp., 15 pls. 45c.

Describes the physiography and drainage of the region, geologic formations, and geologic history; discusses the seasonal and geographic distribution of rainfall, the occurrence and level of ground waters, the flowing and nonflowing wells, the quality of ground waters, the effect of alkali on plant life and on waters for irrigation, the relation of zones for vegetation to water supply and geographic controls, and the plants used for pumping water; treats also of the early history of agriculture and agricultural methods.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of spring and well waters from Colorado and New Mexico and of mine waters from Dunton, Colo., and Tombstone, Ariz.

365. Ground water in southeastern Nevada, by Everett Carpenter. 1915. 86 pp., 5 pls. 15c.

Describes an area in Clark, Lincoln, White Pine, and Nye counties, drained in part by streams tributary to Colorado River and in part by streams discharging into the Great Basin. Discusses stream, lake, and wind topography; vegetation, crops, and industrial development; rainfall; water in bedrock and unconsolidated sediments; source and permanence of artesian waters, and character and distribution of springs; also the quality of waters for domestic use and for irrigation, and gives analyses. Contains details of water supply by areas in Las Vegas and Virgin river basins and the Great Basin. Gives information in regard to watering places on routes of travel.

375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c. Contains:

(*b*) Ground water in Paradise Valley, Ariz., by O. E. Meinzer and A. J. Ellis, pp. 51–75, pls. 3–5. Describes an area north of Phoenix, in Maricopa County, between Phoenix Mountains on the west and McDowell Mountains on the east, terminated on the north by a rocky upland, but on the south opening into the Salt River Valley. Discusses briefly physiography and drainage, soil and vegetation, climate, occurrence, source, and disposal of ground water, artesian prospects, quality of water, wells, and irrigation.

380. The Navajo country—a geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah, by Herbert E. Gregory. 1916. 219 pp., 29 pls. 80c.

Contains a historical sketch of the Navajo country, and discusses geographic provinces, climate, soil, stream flow, the utilization of the streams, the source of the ground water, springs, wells, and artesian areas; gives a table of geographic names and a bibliography of books, and phamphlets examined in connection with the study.

395. Colorado River and its utilization, by E. C. La Rue. 1916. 231 pp., 25 pls. 50c.

Assembles the principal facts relating to the water resources and gives the result of a study of the "possibility of controlling the flow of the whole river by means of storage reservoirs in order to avoid further danger from overflow to the Salton Sink and to render available for profitable use the enormous quantity of water which now flows unused and largely unusuable to the Gulf of California in the form of floods."

396. Profile surveys in the Colorado River basin in Wyoming, Utah, Colorado, and New Mexico, prepared under the direction of W. H. Herron, acting chief geographer, 1917. 6 pp., 43 pls. 50c.

Consists chiefly of maps showing outlines of river banks, islands, position of rapids, falls, and shoals, and existing dams. The streams to which the surveys relate are fully described in Water-Supply Paper 395.

*425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. Contains:

*(*a*) Ground water in San Simon Valley, Arizona and New Mexico, by A. T. Schwennesen, with a section on agriculture, by R. H. Forbes, pp. 1–35, pls. 1–3. 1917.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Ninth annual Report of the United States Geological Survey, 1887–88, J. W. Powell, Director. 1889. xiii, 717 pp., 88 pls. $2. Contains:

*On the geology and physiography of a portion of northwestern Colorado and adjacent parts of Utah and Wyoming, by C. A. White, pp. 677–712, pl. 8. Describes the canyons of Green, Yampa, Snake, and White rivers.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II—Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90. J. W. Powell, Director. 1981. 2 parts. Pt. II—Irrigation, xiv, 395 pp., 30 pls., and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall, and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II—Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, pls. 58–106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II, Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, pls. 35–39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, x, 756 pp., 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, pls. 48–102. Describes the Agua Fria dam, Arizona, and reservoir projects on Rio Verde, Salt River, Queen Creek, Hassayampa River, and Little Colorado River, Arizona, and in the Tonto basin; gives tables of reservoir capacities and areas.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xix, 498 pp., 159 pls., 8 maps in separate case. $2.80. Contains:

*White River Plateau timber land reserve, by G. B. Sudworth, pp. 117–179, pls. 49–58. Battlement Mesa forest reserve, by G. B. Sudworth, pp. 181–243, pls. 59–75. Describes briefly the streams and lakes in the reserves.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*56. Geography and geology of a portion of southwestern Wyoming, with special reference to coal and oil, by A. C. Veatch. 1907. 178 pp., 26 pls. 60c.

Covers the southwest corner of Wyoming and a small adjacent portion of Utah. Gives a detailed description of the geology and a brief discussion of the water-bearing formations. Includes a geologic map with structure contours.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated record of well in Sweetwater County, Wyo.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arizona, California, Colorado, New Mexico, Utah, and Wyoming and detailed record of well near Phoenix, Maricopa County, Ariz. The well of which a detailed section is given was selected because it affords valuable stratigraphic information.

*350. Geology of the Rangely oil district, Rio Blanco County, Colo., with a section on the water supply, by H. S. Gale. 1908. 61 pp., 4 pls. 20c.

Discusses White River and its tributaries as sources of water supply and the possibility of obtaining artesian flows; treats of the quality of the water of White River and gives analyses.

*352. Geologic reconnaissance of a part of western Arizona, by W. T. Lee, with notes on the igneous rocks of western Arizona, by Albert Johannsen. 1908. 99 pp., 11 pls. 25c.

Describes the geography and geology and contains a geologic sketch map of western Arizona north of longitude 33° 30′, including the valley of Colorado River and Hualpai, Big Sandy, Detrital-Sacramento, Williams, and McMullen valleys. Contains a section on water supplies, which includes well data and discussion of ground-water prospects.

*531. Contributions to economic geology, 1911, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1913. 361 pp., 24 pls. 45c.

Issued also in separate chapters. The following papers contain information on ground water: *(c) Geology and petroleum resources of the De Beque oil field, Colo., E. G. Woodruff (pp. 54–68, Pl. VI). Contains a description of the geology and a geologic map of a square area covering Tps. 7 and 8 S., Rs. 97 and 98 W., in the vicinity of De Beque in Mesa and Garfield counties. Includes a brief statement on artesian water in the area (p. 61).

*541. Contributions to economic geology, 1912, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1914. 532 pp., 29 pls. 50c.

Issued also in separate chapters. The following paper contains information on ground water: * (d) Oil and gas near Green River, Grand County, Utah, by C. T. Lupton (pp. 115–133, Pl, VI). Describes the geology and contains a geologic map of an area of about 300 square miles southeast of the town of Green River. Contains meager data in regard to wells, water supplies, and artesian conditions (pp. 117–123).

*543. Geology and geography of a portion of Lincoln County, Wyo., by A. R. Schultz. 1914. 141 pp., 11 pls. 50c.

Describes the geology and contains a geologic map of an area in the central part of Lincoln County, between Green River and the Salt River Range (Tps. 22–39 N., Rs. 113–117 W.) Includes a brief discussion of ground water and artesian prospects (pp. 134, 135).

628. Geology and and coal resources of Castle Valley, in Carbon, Emery, and Sevier counties, Utah, by C. T. Lupton. 1916. 88 pp., 12 pls. 20c.

Describes the geology and contains a geologic map of an area lying between the Wasatch Plateau and the San Rafael Swell, in east-central Utah, and extending from the vicinity of Mounds, on the Denver & Rio Grande Railroad, southwestward about 80 miles. Describes the drainage and water resources, including the prospects of finding water in the Dakota sandstone and underlying McElmo formation.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folois if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for geologic folios amounting to $5 at the retail price—that is, 20 of the 25-cent folios (or their equivalent in higher priced folios) will be sold for $3. The discount is allowed on an order for folios alone, either of one kind or in any assortment, or for folios together with topographic maps but no discount is allowed on the damaged folios sold at 5 cents each.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

[1] Index maps showing areas in the Colorado River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

*111. Globe, Arizona.
112. Bisbee, Arizona. 25c. Reprinted in 1914.
*120. Silverton, Colorado.
*129. Clifton, Arizona.

Gives analyses of spring water from San Francisco River.

*130. Rico, Colorado.
*153. Ouray, Colorado.

Describes the river waters used for irrigation, the underground waters, and the thermal springs, gives analyses of water from Hot Spring at Ouray.

171. Engineer Mountain, Colorado. 5c.
199. Silver City, New Mexico. 25c.

"The Continental Divide passes through the quadrangle from its southwest to its northeast corner. All northerly drainage reaches Gila River and ultimately the Gulf of California and the Pacific Ocean. All southerly drainage flows toward the Rio Grande," but is lost in the sands of a desert region. The underground-water resources are discussed by N. H. Darton. The discussion of the surface waters is restricted to Mimbres River, one of the southward-flowing streams.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the Colorado River basin are the reports of the State engineers of Colorado, Nevada, New Mexico, and Wyoming, and the annual reports of the United States Reclamation Service. The following reports deserve special mention.

Canyons of the Colorado, by J. W. Powell. 1895. A popular, revised, and enlarged edition of his original journal of exploration, which appeared as part of a report entitled "Exploration of the Colorado River of the West and its tributaries, explored in 1869, 1870, 1871, and 1872," published by the Smithsonian Institution in 1875.

A canyon voyage; the narrative of the second Powell expedition down the Green-Colorado River from Wyoming, and the explorations on land, in the years 1871–72, by Frederick S. Dellenbaugh, artist and assistant topographer of the expedition. 1908.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the chief of engineers, together with a report of Capt. Chittenden. 55th Cong., 2d sess., House Doc. 141. 1898.

Irrigation pumping in Nevada, etc., by Charles A. Norcross: Nevada bureau of industry, agriculture, and irrigation Bull. 8, 1913.

Report of irrigation investigations in Utah under the direction of Elwood Mead: U. S. Dept. Agr. Office Exper. Sta., Bull. 124, 1903.

Irrigation in Utah, Utah Irrigation Commission, 1894.

Irrigation and agricultural practice in Arizona, by R. H. Forbes: Univ. Arizona Agr. Exper. Sta. Bull. 63, 1911.

Ground-water supply and irrigation in Rillito Valley, Arizona: Univ. Arizona, College of Agriculture, Exper. Sta., Bull. 64, 1910.

Oil engines for pump irrigation and the cost of pumping, by G. E. P. Smith: Univ. Arizona Agr. Exper. Sta. Bull. 74, 1915.

The lower Colorado River and the Salton Basin, by C. E. Grunsky: Am. Soc. Civil Eng. Trans., vol. 59, pp. 1–51; discussion, pp. 52–62, December, 1907.

Irrigation and River control in the Colorado River delta, by H. T. Cory: Am. Soc. Civil Eng. Trans., vol. 76, pp. 1204–1453; discussion, pp. 1454–1571, December, 1913.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines, also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden City, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, compares wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill; its efficiency and economic use, Part I, by C. E. Murphy. 1901. 72 pp., 14 pls. 5c.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. See also Nos. 64, 94, and 95.

*64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing wells; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall run-off, and evaporation formulas; discusses effects of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this report should be addressed to the U. S. Reclamation Service.]

Contains the following papers of more or less general interest:
Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.

*95. Accuracy of stream measurements (second, enlarged, edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. See also No. 94.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

*110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., and the contamination of rock wells and of streams by waste oil and brine.

*114. Underground waters of eastern United States: M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amounts, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey. 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Calif., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls. 5c.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drill wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1905. 267 pp. 15c. [Requests for this report should be addressed to the Reclamation Service.]

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.

Power engineering applied to irrigation problems, by O. H. Ensign.

Estimates on tunneling in irrigation projects, by A. L. Fellows.

Collection of stream-gaging data, by N. C. Grover.

Diamond-drill methods, by G. A. Hammond.

Mean-velocity and area curves, by F. W. Hanna.

Importance of general hydrographic data concerning basins of streams gaged, by H. E. Horton.

Effect of aquatic vegetation of stream flow, by R. E. Horton.

Sanitary regulations governing construction camps, by M. O. Leighton.

Necessity of draining irrigated land, by Thos. H. Means.

Alkali soils, by Thos. H. Means.

Cost of stream-gaging work, by E. C. Murphy.

Equipment of a cable gaging station, by E. C. Murphy.

Silting of reservoirs, by W. M. Reed.

Farm-unit classification, by D. W. Ross.

Cost of power for pumping irrigating water, by H. A. Storrs.

Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and area of cross section.

*150. Weir experiments, coefficients, and formula, R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

*152. A review of the laws forbidding pollution of inland waters in the United States, second edition, by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuations due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905, lists publications relating to ground waters, and contains the following brief reports of general interest:
Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

*185. Investigations on the purification of Boston sewage, * * * with a history of the sewage disposal problem, by C. E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification and treatment of sewages and tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and of resulting litigation; discusses effect of acid-iron liquors on sewage purification processes, recovery of copperas from acid iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amount and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas (revision of paper No. 150), by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effients, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer and glue.

236. The quality of surface waters in the United States: Part I. Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water and municipal water softening.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

*(*e*) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage well shelters, and structures for making discharge measurements and artificial controls.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914.

*(*c*) The relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W Davenport, pp. 77–84.

(*e*) A method of correcting river discharge for a changing stage, by B. E. Jones, pp. 117–130.

(*f*) Conditions requiring the use of automatic gages in obtaining records of stream flow, C. H. Pierce, pp. 131–139.

*400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer. 1917. 108 pp., 7 pls. —c. Contains:

(*a*) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.

*(*c*) The measurement of silt-laden streams, by R. C. Pierce, pp. 39–51.

(*d*) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53–59.

416. The divining rod, a history of water witching, with a bibliography, by A. J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continuously being received from all parts of the country" as to the efficacy of the divining rod for locating underground water.

*425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

*(c) Hydraulic conversion tables and convenient equivalents, pp. 71–94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173 pl. 21. Scope indicated by title.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. *Pt. II, Irrigation, xvii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363–561, pls. 107 to 146. See Water-Supply Paper 87.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III. Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. 111 to 146. Discusses the economic aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of eastern United States, by W. J. McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analyses of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v. 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. 6 to 16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, and the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium and through sand, sandstones, and silts; discusses results obtained by other investigators and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effect, and remedies or erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee River basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahooche, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

*86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Calif., and, as undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris." A highly technical report.

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 50c.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses.

*319. Summary of the controlling factors of artesian flows, by M. L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of ground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

*616. The data of geochemistry (third edition), by F. W. Clarke. 1916. 821 pp. 45c.

Earlier editions were published as Bulletins 330 and 491. Contains a discussion of the statement and interpretation of water analyses and a chapter of "Mineral wells and springs" (pp. 179–216). Discusses the definition and classification of mineral waters, changes in the composition of water, deposits of calcareous, ocherous, and siliceous materials made by water, vadose and juvenile waters, and thermal springs in relation to volcanism. Describes the different kinds of ground water and gives typical analyses. Includes a brief bibliography of papers containing water analyses.

INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

INDEX OF STREAMS.

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