Water-Supply and Irrigation Paper No. 85 Series P, Hydrographic Progress Reports, 23

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1902

BY

F. H. NEWELL

PART IV.—INTERIOR BASIN, PACIFIC COAST, AND HUDSON BAY DRAINAGE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1903

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists may be had on application.

The Bulletins, Professional Papers, and Water-Supply Papers treat of a variety of subjects and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports. The following Water-Supply Papers are out of stock, and can no longer be supplied: Nos. 1–14, 19, 20, 22, 29–33, 46, 57–64. Complete lists of papers relating to water supply and allied subjects follow. (B=Bulletin; PP=Professional Paper; WS=Water-Supply Paper.)

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WS 70. Geology and water resources of the Patrick and Goshen Hole quadrangles, Wyoming, by G. I. Adams. 1902. 50 pp., 11 pls.
WS 71. Irrigation systems of Texas, by T. U. Taylor. 1902. 137 pp., 9 pls.
WS 74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls.

SERIES J—WATER STORAGE.

WS 33. Storage of water on Gila River, Arizona, by J. B. Lippincott. 1900. 98 pp., 33 pls.
WS 40. The Austin dam, by Thomas U. Taylor. 1900. 51 pp., 16 pls.
WS 45. Water storage on Cache Creek, California, by A. E. Chandler. 1901. 48 pp., 10 pls.
WS 46. Physical characteristics of Kern River, California, by F. H. Olmsted, and Reconnaissance of Yuba River, California, by Marsden Manson. 1901. 57 pp., 8 pls.
WS 58. Storage of water on Kings River, California, by J. B. Lippincott. 1902. 100 pp., 32 pls.
WS 68. Water storage in Truckee Basin, California-Nevada, by L. H. Taylor. 1902. 90 pp., 8 pls.
WS 73. Water storage on Salt River, Arizona, by A. P. Davis. 1902. 54 pp., 25 pls.

The following paper also should be noted under this heading: Reservoirs for irrigation, by J. D. Schuyler, in Eighteenth Annual, Part IV.

SERIES K—PUMPING WATER.

WS 1. Pumping water for irrigation, by Herbert M. Wilson. 1896. 57 pp., 9 pls.
WS 8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls.
WS 14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.
WS 20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls.
WS 29. Wells and windmills in Nebraska, by E. H. Barbour. 1899. 85 pp., 27 pls.
WS 41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls.
WS 42. The windmill, Part II (continuation of No. 41). 1901. 73–147 pp., 15–16 pls.

[Continued on third page of cover.]

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DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
DIVISION OF HYDROGRAPHY,
Washington, D. C., June 29, 1903.

SIR: I have the honor to transmit herewith Water-Supply Paper No. 85, which is Part IV of and completes the report of progress of stream measurements for the year 1902. This paper contains the data which has been received during 1902 from that portion of the territory west of the Mississippi River which does not drain into either the Mississippi River or the western Gulf of Mexico.

This paper contains for the various gaging stations the original data as collected and the results obtained from the discussion of this data, also such other information as is of interest in hydrographic studies.

Very respectfully,

F. H. NEWELL,
Hydrographer in Charge.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1902.

PART IV.

By F. H. NEWELL.

INTRODUCTION.

This paper contains data collected during 1902 from that portion of the territory west of Mississippi River which does not drain into either Mississippi River or the western Gulf of Mexico. It completes the Report of the Progress of Stream Measurements for the Year 1902, which report is made up of Water-Supply Papers Nos. 82–85, inclusive.

Water-Supply Papers Nos. 82 and 83 contain the data collected in the territory east of Mississippi River, and papers Nos. 84 and 85 that collected west of Mississippi River. The material in each of these papers consists of both the original data as collected at the various river stations and the results obtained from the discussion of these data; also brief descriptions and facts regarding such other subjects as are allied to hydrographic studies.

For convenience in arrangement the data in this paper have been grouped into the following drainage areas and arranged in the order given: Colorado River drainage, Interior Basin, San Francisco Bay drainage, Southern California drainage, Columbia River drainage, Puget Sound drainage, and Hudson Bay drainage.

On figs. 1 and 2 the dots show the locations of the stations at which the United States Geological Survey is collecting hydrographic data. The section west of the shaded line comprises those States which are covered by the national irrigation act of June 17, 1902 (32 Stat. L., 388–390), and the cross-lined areas show the location of the irrigation projects which are now under investigation.

In collecting hydrographic data the Geological Survey has received the hearty cooperation of various individuals, corporations, and States, as mentioned hereafter. This cooperation has made possible the pub-

lication of many valuable records, which could not otherwise have been obtained.

A brief historical sketch of the stream measurements made by the United States Geological Survey is published on pages 11–15 of Water-Supply Paper No. 75.

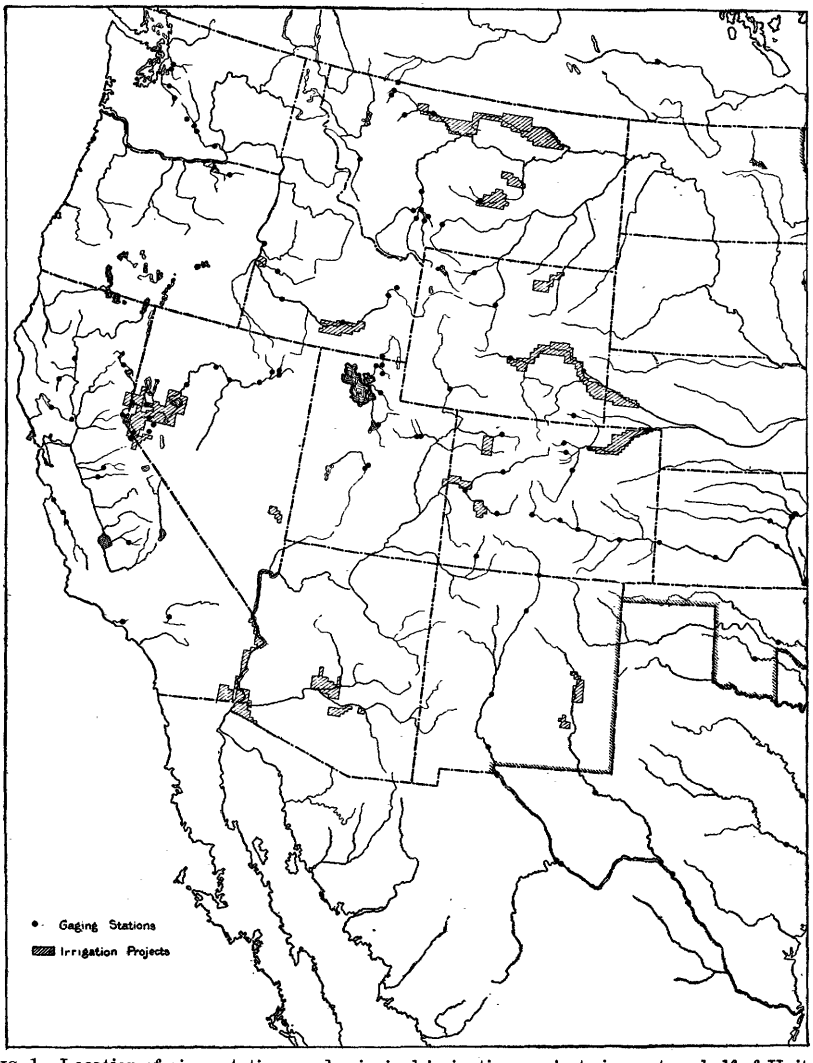

FIG. 1.—Location of river stations and principal irrigation projects in western half of United States, 1902–3

The results of the stream measurements made during the past years by the United States Geological Survey can be found in the following publications, which may be consulted at the public libraries in most of our cities:

1893. Bulletin No. 131.
1894. Bulletin No. 131.

1895. Bulletin No. 140.

1896. Water Supply Paper No. 11, Part IV of the Eighteenth Annual Report.

1897. Water Supply Papers Nos. 15 and 16, Part IV of the Nineteenth Annual Report.

1898. Water Supply Papers Nos. 27 and 28, Part IV of the Twentieth Annual Report.

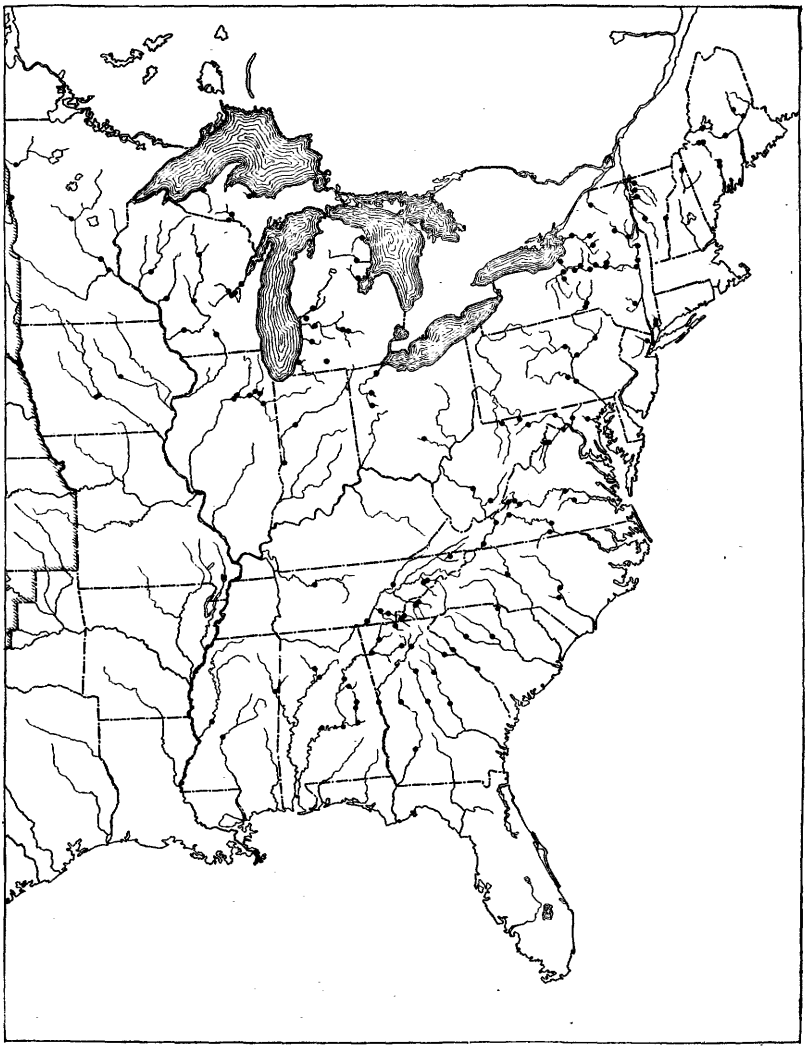

FIG. 2.—Location of river stations in eastern half of United States, 1902–3.

1899. Water Supply Papers Nos. 35 to 39, inclusive, Part IV of the Twenty-first Annual Report.

1900. Water Supply Papers Nos. 47 to 52, inclusive, Part IV of the Twenty-second Annual Report.

1901. Water Supply Papers Nos. 65, 66, and 75.

1902. Water Supply Papers Nos. 82 to 85, inclusive.

ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers and engineers. Acknowledgment is due to each of these persons, and thanks are extended to other persons and corporations who have assisted local hydrographers, or who have cooperated in any way, either by furnishing records or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Arizona.—The data on Colorado River were collected by J. B. Lippincott and his assistant. That upon the Salt and Gila rivers and Tonto Creek by Stephen Janus and Osburn Richins.

California.—Resident hydrographers, J. B. Lippincott, assisted by Samuel G. Bennett, and L. H. Taylor, assisted by E. C. Murphy and D. W. Hays. Acknowledgments are also due to the following individuals and corporations for assistance rendered and data furnished: To H. F. Parkinson, water overseer for the irrigators in the vicinity of Azusa, Cal., for voluntary observations on San Gabriel River and canals; the Kern County Land Company, through its chief engineer, Walter James, and engineer in charge of water measurements, A. K. Warren, for the record of Kern River; the Southern Pacific Company, through its chief engineer, William Hood, for river stage records of San Joaquin River at Herndon, Cal., and the King River at Kingsburg, also for transportation furnished the resident hydrographers and assistants; to the officials of the Santa Fe Route and Lake Tahoe Railway and Transportation Company for transportation of the resident hydrographers and assistants.

Colorado.—Resident hydrographer, A. L. Fellows, assisted by M. C. Hinderlider. Acknowledgments for assistance rendered and data furnished are due to Hon. A. J. McCune, State engineer of irrigation; A. F. Reeves, superintendent of irrigation, and to various water commissioners who are located in this division and who have given their assistance from time to time. Transportation has been furnished by the Denver and Rio Grande; Atchison, Topeka and Santa Fe; Colorado and Southern, and Rio Grande Southern railroads. Special assistance was also rendered by William H. Richardson at Glenwood Springs.

Idaho.—Resident hydrographer, N. S. Dils. Acknowledgments are due to the Oregon Short Line Railway Company for transportation furnished N. S. Dils.

Minnesota.—The data from this State were collected by the late C. M. Hall.

Montana.—Resident hydrographer, J. S. Baker, assisted by H. B. Waters.

Nevada.—Resident hydrographer, L. H. Taylor, assisted by E. C. Murphy and D. W. Hays. Acknowledgments are also due to the Southern Pacific Railroad Company and Lake Tahoe Railway and Transportation Company for transportation furnished.

North Dakota.—The data from this State were collected by the late C. M. Hall.

Oregon.—Resident hydrographer, Sydney Arnold.

Utah.—Resident hydrographers, Howard S. Reed and George L. Swendsen, assisted by W. D. Beers, Caleb Tanner, and W. G. Swendsen. Acknowledgments for assistance rendered and data furnished are due to the Utah Light and Power Company, Ogden, Utah; the Hercules Power Company, Logan, Utah, and the Bear River Canal Company, Corinne, Utah.

Washington.—Resident hydrographers, T. A. Noble, assisted by H. W. Quinan; and Sydney Arnold. Acknowledgments are also due to the following individuals

for assistance rendered and data furnished: To Reginald H. Thomson, city engineer of Seattle, Wash.; to Louis G. Heybrock, who has been voluntary observer at the station of the south fork of Skykomish River, and to A. A. Batcheller, who has been voluntary observer at the station on Cedar River at Cedar Lake, and to James J. Hill, who has furnished transportation to the resident hydrographer in the State of Washington over the Great Northern Railway. Transportation has been furnished to Sydney Arnold by Thomas Cooper, general manager of the Northern Pacific Railway, thus greatly facilitating the extension of the field work.

Wyoming.—Resident hydrographer, A. J. Parshall. Acknowledgments are also due to H. G. Burt, president of Union Pacific Railroad Company, for transportation furnished over its lines in Wyoming to the resident hydrographer.

COLORADO RIVER DRAINAGE BASIN.

Topographically considered, this is the largest hydrographic basin lying wholly within the arid region, having a total area above the town of Yuma, Ariz., of over 225,000 square miles.

This basin is situated in Wyoming, Utah, Colorado, Arizona, New Mexico, Nevada, and California, but the principal water supply comes from the melting snows of the high mountains of Wyoming, Utah, and Colorado. The minimum flow is less than 3,000 cubic feet per second. The maximum reaches more than 50,000 cubic feet per second.

This stream has been called the Nile of America. Like the Nile, the Colorado is subject to an annual summer rise, which comes at a time when it is most needed for irrigation. Its waters carry a large amount of sediment, reaching as high as 2,000 parts of sediment to 100,000 parts of water. The minimum amount is carried during the winter months and probably is never less than 60 parts of sediment to 100,000 parts of water.

Prof. R. H. Forbes, in Bulletin No. 44, University of Arizona Agricultural Experiment Station, says:

> On the basis of the profile constructed from available data for the volume of flow of the Colorado, and of the year's silt determinations made in this laboratory, it is estimated conservatively that the river during 1900 brought down about 61,000,000 tons of sedimentary material, which, condensed to the form of solid rock, is enough to cover 26.4 square miles 1 foot deep, or to make 53 square miles of dry, alluvial soil 1 foot deep, or to make about 164 square miles of recently settled, submerged mud 1 foot deep, reckoning the whole amount of mud for the year to average 6.2 times the bulk of the solid sediment.

Comparatively a small amount of land is irrigated by the waters of Colorado River, owing to the fact that the main stream and both of its tributaries are situated so far below the level of the irrigable lands as to render their diversion extremely difficult or impracticable.

There are two pumping plants that lift water for irrigation at Yuma and several at other points on the river above Yuma. The Imperial canal diverts water at a point on the right bank of the river 6 miles below Yuma. It is the intention of the owners of this canal to reclaim a large tract of fertile land situated in Mexico and in California.

The system is still in process of construction. On December 4, 1902, this canal was carrying 494 second-feet of water.

During December, 1901, and January, 1902, a reconnaissance of Colorado River and valley was made from the Needles and Yuma by J. B. Lippincott and others. In October, 1902, a reconnaissance was made by Mr. Lippincott, beginning at a point called Greggs Ferry, Mohave County, Ariz., and extending to the Needles, Cal.

Numerous dam and reservoir sites and diversion points for canals were discovered, together with large tracts of fertile land capable of being irrigated. In November, 1902, extensive topographical, soil, and hydrographic surveys were begun in Colorado River Valley by the Reclamation Service of the Geological Survey.

Colorado River is formed by Grand and Green rivers, in the southeastern part of Utah. Of its tributaries, Gila River rises in the western part of New Mexico and flows west into the Colorado, at Yuma, Ariz., draining the southern half of Arizona. Salt River, its principal tributary, joins it about 15 miles west of Phœnix, Ariz. Rio Verde and Tonto Creek are tributaries of Salt River from the north. The San Juan River, with its tributaries, drains southwestern Colorado, northwestern New Mexico, and northeastern Arizona. It takes a generally westward course into the Colorado, north of the Utah-Arizona boundary. Animas, Los Pinos, and Florida rivers are tributaries in southwestern Colorado. Grand River has its source on the Continental Divide, in the northern part of Colorado, and flows southwest to its junction with Green River. Gunnison River, its principal tributary, joins it from the south, a short distance south of Grand Junction, Colo. Dolores River rises in southwestern Colorado and flows northwest into the Grand, in eastern Utah. Green River rises in the Wind River Range of mountains in the western central part of Wyoming, its main source being in the lofty peaks of the Continental Divide. The source of its tributaries is also among the higher snow-covered ranges, maintaining the volume of this stream late into the summer. The principal branches of White River rise in the White River Plateau, a well-forested tract in the White River Forest Reserve. A number of lakes, among which are Oyster, Marvin, Traverse, and Deep lakes, furnish important reservoir sites, if such are ever needed. Duchesne River, with its tributaries, the Uinta, Lake Creek, and Whiterocks River, flows into the Green, near the mouth of White River, and near Ouray, Utah. The Ashley is a small tributary of the Green, in northeastern Utah. Yampa River rises in the eastern part of Routt County, Colo., and flows in a general westerly direction through the entire county and empties into Green River, near the western boundary. The stream is somewhat peculiar in its character, the upper branches having considerable fall, and the water, therefore, flowing rapidly over shoals of gravel and rock, is thus easily taken out for utiliza-

tion. The following is a list of the stations in the Colorado River drainage basin:

Colorado River at Yuma, Ariz.
Colorado River at Bulls Head, Ariz.
Verde River near McDowell, Ariz.
Salt River at McDowell, Ariz.
Salt River at reservoir site, below Tonto Creek, near Livingstone, Ariz.
Tonto Creek near Livingstone, Ariz.
Gila River at San Carlos, Ariz.
Animas River at Durango, Colo.
Florida River near Durango, Colo.
Los Pinos River, at Ignacio, Colo.
Dolores River at Dolores, Colo.
Gunnison River at Whitewater, Colo.
Gunnison River at Iola, Colo.
Grand River at Palisades, Colo.
Grand River at Glenwood Springs, Colo.
White River at Meeker, Colo.
Uinta River at Ouray School, near Leland, Utah.
Duchesne River at Price Road Bridge, Utah.
Lake Creek at Wagon Bridge (near mouth), Utah.
Uinta River at Fort Duchesne, Utah.
Uinta River near Whiterocks, Utah.
Whiterocks River near Whiterocks, Utah.
Ashley Creek near Vernal, Utah.
Yampa River at Craig, Colo.
Green River at Greenriver, Wyo.

COLORADO RIVER AT YUMA, ARIZ.

Records of river height have been maintained by the Southern Pacific Railroad Company at their bridge since April 1, 1878. The gage at this point, reading from 10 to 22 feet, is nailed to the lower side of the first pier from the south bank of the river; the portion reading from 22 feet to 40 feet is nailed to an 8-inch by 8-inch post on the north side east of the bridge. The gage height plus 100 feet is the Southern Pacific elevation above sea level. The channel of the river shifts very rapidly, the bed silting and scouring with every change of river height, so that the relation of gage height to discharge is not constant.

Meter measurements have been made at this point by the Survey at various times since April, 1895, but on account of the shifting character of the channel no rating table has been constructed until this year. This rating table, which is applicable from January 1 to October 10, 1902, is approximate only. The discharge from October 10 to December 31 was estimated from numerous meter measurements.

Discharge measurements of Colorado River at Yuma, Ariz.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
January 9	J. B. Lippincott	17.20	3,637
February 20	S. G. Bennett	17.15	3,239
May 30	do	23.00	38,400
July 7	W. W. Follett	21.06	18,350
July 9	S. G. Bennett	20.52	14,799
October 11	do	18.50	6,030
October 14	R. P. H. Laney	17.90	4,798
October 17	do	17.50	3,559
October 21	do	17.60	4,203
October 24	do	17.50	3,547
November 12	S. G. Bennett	17.40	3,614
November 13	do	17.50	3,865
November 15	W. D. Smith	18.55	5,276
November 18	do	18.05	4,213
November 20	do	18.00	4,368
November 22	do	18.10	4,600
November 24	do	18.45	5,500
November 26	do	18.40	4,979
November 28	do	18.50	5,544
December 1	do	20.00	12,596
December 3	do	19.25	7,862
December 5	do	18.85	6,347
December 8	do	18.30	4,825
December 10	do	18.20	5,081
December 12	do	18.00	4,669
December 15	do	17.65	3,818
December 16	do	17.50	3,589
December 18	do	18.30	5,361
December 19	do	18.05	4,607
December 20	do	18.05	5,237
December 22	do	17.70	4,698
December 24	do	18.00	4,863
December 26	do	18.10	5,356
December 27	do	18.30	5,497
December 29	do	18.00	4,588
December 31	do	17.70	4,176

Daily gage height, in feet, of Colorado River at Yuma, Ariz.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	17.10	18.00	17.90	18.20	20.00	22.30	22.00	18.40	17.50	18.90	17.40	20.00
2	17.00	18.00	17.90	18.00	20.70	22.20	21.70	18.30	17.30	18.50	17.30	19.50
3	17.00	18.00	18.00	17.90	20.80	22.20	21.50	18.30	17.00	18.40	17.30	19.30
4	17.00	17.90	17.90	17.90	20.50	22.70	21.30	18.30	18.00	18.60	17.30	19.00
5	17.00	17.90	17.90	17.90	20.30	23.10	21.10	18.10	18.80	18.30	17.30	18.90
6	17.00	17.80	17.90	18.00	20.30	23.10	20.80	18.00	18.30	18.10	17.30	18.60
7	17.00	17.70	18.10	18.00	20.40	23.50	20.70	17.90	18.00	18.00	17.20	18.40
8	17.20	17.70	18.20	18.20	20.50	23.70	20.60	17.80	17.60	18.10	17.20	18.30
9	17.20	17.60	18.10	18.20	20.30	24.00	20.40	17.80	17.50	18.10	17.20	18.30
10	17.30	17.50	18.10	18.20	20.50	24.20	20.30	17.80	17.30	18.10	17.30	18.20
11	17.30	17.50	18.10	18.20	22.00	24.30	20.30	17.70	17.30	18.50	17.30	18.10
12	17.30	17.60	18.10	18.20	22.30	24.20	20.60	17.70	17.30	18.30	17.40	18.00
13	17.30	17.10	18.20	18.20	22.30	24.30	20.50	17.60	17.30	18.00	17.50	18.10
14	17.30	17.10	18.20	18.20	22.80	24.00	20.20	17.60	17.30	17.80	18.00	17.70
15	17.30	17.20	18.30	18.20	22.90	23.80	20.10	17.50	17.30	17.80	18.50	17.60
16	17.30	17.30	18.40	18.20	23.20	23.90	20.00	17.40	17.20	17.60	18.00	17.50
17	17.40	17.30	18.40	18.10	23.50	23.70	20.30	17.30	17.70	17.60	17.80	17.70
18	17.60	17.30	18.30	18.00	23.70	23.80	19.80	17.30	17.50	17.40	18.10	18.30
19	17.70	17.30	18.30	18.00	24.10	23.70	19.80	17.10	17.30	17.60	18.10	18.10
20	17.70	17.20	18.30	18.00	24.30	23.60	19.70	17.00	17.30	17.60	18.10	18.00
21	17.70	17.10	18.30	18.00	24.30	23.50	19.50	17.80	17.00	17.40	18.00	17.80
22	17.70	17.30	18.30	18.30	24.40	23.50	19.40	18.50	16.80	17.40	18.10	17.80
23	17.70	17.70	18.30	19.30	24.40	23.20	19.30	18.30	16.80	17.30	18.10	17.80
24	17.70	18.00	18.30	19.80	24.40	23.10	19.40	17.90	16.90	17.30	18.40	18.00
25	17.80	18.10	18.30	19.80	24.40	23.00	19.10	17.80	17.10	17.30	18.50	18.20
26	17.90	18.10	18.20	19.80	24.50	22.70	19.30	18.00	16.80	17.30	18.40	18.10
27	17.90	18.10	18.30	19.90	24.30	22.60	19.00	17.90	16.70	17.30	18.50	18.30
28	17.90	18.00	18.30	20.00	24.00	22.50	18.80	17.70	16.60	17.30	18.50	18.20
29	17.80	------	18.30	19.80	23.50	22.30	18.50	17.30	17.50	17.20	18.50	18.00
30	18.00	------	18.30	19.80	23.00	22.20	18.40	17.20	19.40	17.20	18.30	17.80
31	18.00	------	18.30	------	22.70	------	18.30	17.20	------	17.30	------	17.70

Rating table for Colorado River at Yuma, Ariz., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
16.5	3,030	18.2	4,920	20.4	13,800	22.6	33,400
16.6	3,050	18.4	5,340	20.6	15,200	22.8	35,800
16.7	3,080	18.6	5,790	20.8	16,600	23.0	38,200
16.8	3,120	18.8	6,310	21.0	18,200	23.2	40,800
16.9	3,170	19.0	6,910	21.2	19,800	23.4	43,400
17.0	3,230	19.2	7,590	21.4	21,500	23.6	46,100
17.2	3,380	19.4	8,360	21.6	23,300	23.8	48,900
17.4	3,580	19.6	9,300	21.8	25,100	24.0	51,700
17.6	3,850	19.8	10,300	22.0	27,000	24.2	54,700
17.8	4,160	20.0	11,400	22.2	29,000	24.4	57,700
18.0	4,520	20.2	12,600	22.4	31,200	------	------

Estimated monthly discharge of Colorado River at Yuma, Ariz.

[Drainage area, 225,049 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	4,520	3,230	3,727	229,164	0.017	0.020
February	4,720	3,300	3,955	219,650	.018	.019
March	5,340	4,340	4,903	301,474	.022	.025
April	11,400	4,340	6,179	367,676	.027	.030
May	59,200	11,400	35,961	2,211,156	.160	.184
June	56,200	29,000	42,520	2,530,115	.189	.211
July	27,000	5,130	12,527	770,255	.056	.065
August	5,560	3,230	4,183	257,203	.019	.022
September	8,360	3,050	3,819	227,246	.017	.019
October	6,600	3,140	4,299	264,335	.019	.022
November	5,540	3,140	4,187	249,144	.019	.021
December	12,600	3,590	5,412	332,771	.024	.028
The year	59,200	3,050	10,973	7,960,189	.049	.666

COLORADO RIVER AT BULLS HEAD, ARIZ.

A gaging station was established at a point of rocks on Colorado River, known as the Bulls Head, by E. T. Perkins, engineer. The station is situated at the Bulls Head, 35 miles north of Needles, Cal., and is accessible only by wagon road up the Arizona side of the river. A cable was stretched across the river at this point on December 1, 1902. T. M. Whedbee, hydrographic aid, was assigned as observer. He resided at the engineering camp, which had headquarters at this locality.

The river was measured with a Price electric-current meter three times a week, and rod readings were taken daily. Mr. Whedbee is believed to be a reliable and accurate observer. The equipment consisted of a five-eighths-inch cable and a gaging car and tag wire. The station was maintained as long as the engineering camp remained at the Bulls Head, and then the material was removed and stored at the Needles, with the exception of the gage rod.

The gage is an inclined wooden rod divided into tenths of a foot. It is well painted and is fastened to the left rock bank of the river. A bronze bench-mark tablet is set on the Arizona side in the rock about 20 feet above low-water mark and about 50 feet downstream from the gage rod. The elevation of the bench mark is 530.523 feet

above sea level and the zero of the rod equals an elevation of 499.902 feet. The initial point for soundings is the left bank. The river channel is straight for about 1,000 feet above and 500 feet below the cable station and the current is rather swift. The banks are high and rocky, but the channel of the river is shifting silt. A determination was made of the value of "*n*" at this gaging station. It was found that "*n*" equaled 0.010.

Discharge measurements of Colorado River at Bulls Head.

Date.	Hydrographer	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
December 5	J. T. Whistler	3.00	5,786
December 10	L. M. Barnes	2.65	4,051
December 13	do	2.45	3,222
December 17	do	2.95	4,138
December 20	do	3.50	4,792
December 24	do	3.23	4,939
December 29	do	2.45	3,366
December 31	do	2.20	2,913

VERDE RIVER NEAR M'DOWELL, ARIZ.

A number of large irrigation enterprises have been planned, designed to divert water from the lower stretch of this river to irrigate lands north of Phœnix, but none has been constructed. The results of measurements of this river combined with those of Salt River show the amount of water available for the irrigable lands of Phœnix Valley. The dam of the Arizona Canal Company is located on Salt River immediately below the mouth of the Verde. The gaging station on the Verde is located three-fourths of a mile above its mouth and 30 miles northeast of Phœnix. It was established April 20, 1897. The station is equipped with a cable, car, and tagged wire. The gage consists of a 2 by 4 inch inclined rod fastened to posts driven into the east bank of the river about 400 feet below the gaging cable. The bench mark is on a cat's-claw tree (*Acacia*) about 100 feet southeast of the old gage, on a cottonwood tree, which is 60 feet below the cable. The elevation of the bench mark is 27.02 feet above gage datum. The channel of the river is similar to that of Salt River—sandy and liable to change during a slight rise, and a large number of measurements are necessary in order to accurately determine the discharge.

Discharge measurements of Verde River near McDowell, Ariz.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 4	J. Fred Appleby	5.33	224
January 11	do	5.36	222
January 19	do	5.29	197
January 25	do	5.35	263
January 27	do	5.41	239
February 1	do	5.45	241
February 8	do	5.35	253
February 15	do	5.32	241
February 22	do	5.31	239
March 1	do	5.40	245
March 8	W. Richins	5.40	251
March 15	do	5.41	233
March 22	do	5.35	208
March 26	do	5.48	281
March 29	do	5.50	273
April 1	do	5.95	426
April 5	do	5.52	252
April 8	do	5.42	241
April 10	do	5.50	256
April 15	do	5.20	150
April 19	do	5.10	116
July 14	Frank P. Trott	4.47	37
July 19	do	4.58	42
July 26	do	5.00	148

Daily gage height, in feet, of Verde River near McDowell, Ariz.

Day.	Jan.	Feb.	Mar.	Apr.	July.
1902.					
1	5.33	5.44	5.40	5.93	
2	5.34	5.43	5.42	5.93	
3	5.34	5.43	5.42	5.68	
4	5.33	5.40	5.43	5.63	
5	5.33	5.39	5.44	5.51	
6	5.33	5.39	5.42		
7	5.39	5.40	5.40	5.42	
8	5.35	5.34	5.40	5.44	
9	5.34	5.36	5.37	5.55	
10	5.32	5.38	5.40	5.49	
11	5.36	5.36	5.40	5.42	
12	5.35	5.35	5.47	5.39	
13	5.36	5.38	5.43		
14	5.35	5.38	5.42	5.27	
15	5.33	5.32	5.41	5.20	
16	5.29	5.32	5.41	5.17	
17	5.29	5.31	5.41	5.15	
18	5.29	5.33	5.41	5.11	
19	5.29	5.36	5.41	5.10	
20	5.31	5.34	5.40		
21	5.32	5.32	8.39		
22	5.33	5.31	5.35		
23	5.33	5.33			4.90
24	5.33	5.32	5.35		4.85
25	5.36	5.37	5.40		7.44
26	5.45	5.42	5.52		5.00
27	5.41	5.39	5.47		
28	5.38	5.36	5.49		
29	5.39		5.49		
30	5.45				
31	5.43		5.42		

SALT RIVER AT M'DOWELL, ARIZ.

Irrigation is practiced to a small extent on Salt River in what is known as Tonto Valley, but shortly after Tonto Creek joins it the river enters a canyon and continues in it until a short distance above the mouth of Verde River. At this point the river reappears from its canyon, and its course is thence across the Plains district until it enters Gila River at the northwest corner of Gila River Indian Reservation. From the mouth of Verde River down to Gila River a number of large canals divert the water of Salt River and serve the extensively irrigated lands in the vicinity of Phœnix on the north side and Mesa on the south side of the river. During ordinary seasons all of the water of Salt River is diverted, and at the present time there is a shortage in the summer months. The gaging station, established April 20, 1897, is located 4,000 feet above the mouth of the Verde and 30 miles northeast of Phœnix. The gage consists of a 2 by 6 inch scantling bolted to rocks on the south side of the river about 300 feet above the cable. The bench mark is a nail in a palo verde tree

about 75 feet west of the north cable anchorage and is 17.33 feet above gage zero The bed of the river is sandy and shifting, and it is necessary to make a large number of measurements in order to obtain an accurate estimate of the discharge.

The station was temporarily discontinued during 1900, but measurements were resumed in 1901.

Discharge measurements of Salt River at McDowell, Ariz.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 4	J. Fred Appleby	0.82	154
January 11	do	.79	157
January 19	do	.82	153
January 25	do	.85	170
January 27	do	1.03	214
February 1	do	.99	179
February 8	do	.92	185
February 15	do	.90	180
February 22	do	.89	191
March 1	do	.97	194
March 8	W. Richins	.91	193
March 15	do	.87	194
March 22	do	.85	206
March 26	do	1.02	238
March 29	do	.96	229
April 1	do	.92	206
April 5	do	1.00	231
April 8	do	1.12	282
April 10	do	1.35	357
April 15	do	1.26	333
April 19	do	1.12	272
July 14	F. P. Trott	.13	56
July 19	do	.61	126
December 24	W. Richins	1.30	417

Daily gage height, in feet, of Salt River at McDowell, Ariz., for 1902.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	0.79	0.99	0.96	0.91	17	0.82	0.91	0.88	1.19
2	.79	.97	.96	.91	18	.82	.90	.88	1.14
3	.79	.94	.94	.91	19	.81	.90	.85	1.12
4	.83	.91	.93	.93	20	.83	.89	.85	.....
5	.82	.90	92	.99	21	.83	.89	.85	.....
6	.81	.92	.92	1.03	22	.83	.89	.85	.....
7	.83	.93	.92	1.07	23	.83	.89	.89	.....
8	.81	.92	.91	1.14	24	.83	.89	.92	.....
9	.80	.92	.89	1.28	25	.85	.90	1.04	.....
10	.81	.91	.91	1.37	26	1.02	.93	1.01	.....
11	.78	.90	.88	1.40	27	1.03	.93	1.00	.....
12	.77	.90	.87	1.40	28	1.02	.96	.99	.....
13	.81	.90	.87	1.35	29	.98	.....	.96	.....
14	.81	.90	.87	1.30	30	1.06	.....	.93	.....
15	.81	.90	.87	1.24	31	1.03	.....	.90	.....
16	.81	.91	.88	1.21					

Estimated monthly discharge of Salt River at McDowell, Ariz.

[Drainage area, 6,260 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	250	137	176	10,816	0.028	0.032
February	231	193	198	11,020	.032	.033
March	250	174	197	12,131	.031	.036
April 1 to 19	.....	.....	287	10,816	.046	.032

SALT RIVER AT RESERVOIR SITE, NEAR LIVINGSTONE, ARIZ.

The station, established February 7, 1901, by H. G. Heisler, is 15 miles west of Livingstone, Ariz. The rod is on the left bank of the river at the upper end of the gorge. Gagings are made from a traveling car suspended from a cable.

Discharge measurements of Salt River at reservoir site near Livingstone, Ariz.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 4	W. Richins	7.02	174
January 8	do	7.00	174
January 11	do	6.98	164
January 14	do	7.03	188
January 17	do	7.01	174
January 20	do	7.02	176
January 24	do	7.02	172
January 27	do	7.19	235
January 31	do	7.13	215
February 4	Osburn Richins	7.09	192
February 7	do	7.10	200
February 11	do	7.09	187
February 14	do	7.10	192
February 18	do	7.09	190
February 21	do	7.09	192
February 25	do	7.10	185
February 28	do	7.19	215
March 4	do	7.13	193
March 7	do	7.09	181
March 11	do	7.12	200
March 14	do	7.09	181
March 19	do	6.90	174
March 21	do	6.92	173
March 25	do	7.20	214
March 28	do	7.17	193
April 4	do	7.24	244
April 7	do	7.30	267
April 10	do	7.51	361
April 14	do	7.41	304
April 18	do	7.30	259
April 21	do	7.23	222
April 25	do	7.19	199
April 30	do	6.98	158
May 5	do	6.89	147
May 8	do	6.90	147
May 13	do	6.80	118
May 15	do	6.80	125
May 19	do	7.47	324
May 23	do	6.92	166

Discharge measurements of Salt River at reservoir site near Livingstone, Ariz.—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
May 27	Osburn Richins	7.29	256
June 2	do	7.09	189
June 6	do	6.89	148
June 10	do	6.71	98
June 14	do	6.64	91
June 26	do	6.48	91
June 29	do	6.45	86
June 30	do	6.58	70
July 6	do	6.41	80
July 12	do	6.35	69
July 18	do	6.84	150
July 23	do	6.65	106
July 31	do	6.40	79
August 4	do	7.04	90
August 8	do	7.59	373
August 9	do	7.85	657
August 11	do	8.96	2,401
August 18	do	7.00	187
August 24	do	7.84	541
September 1	do	6.91	125
September 5	do	8.05	798
September 11	do	7.10	212
September 18	do	7.00	178
September 19	do	8.65	2,045
September 20	do	9.30	3,943
October 6	do	6.81	149
October 13	do	6.80	147
October 27	do	6.80	139
November 7	do	6.81	145
November 13	do	7.55	478
November 20	do	6.92	188
November 23	do	7.23	344
December 2	do	6.90	191
December 13	do	8.10	774
December 14	do	9.00	2,477
December 29	do	7.21	317

Daily gage height, in feet, of Salt River at the reservoir site near Livingstone, Ariz.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.99	7.13	7.19	7.12	6.83	7.10	6.44	6.37	6.91	7.04	6.81	6.90
2	6.98	7.12	7.14	7.12	6.48	7.65	6.43	6.35	6.86	7.00	6.81	6.90
3	7.01	7.10	7.15	7.19	6.55	6.98	6.42	7.23	6.83	6.91	6.81	6.90
4	7.02	7.09	7.13	7.24	6.80	6.92	6.42	6.95	6.80	6.86	6.81	6.90
5	7.01	7.10	7.13	7.24	6.89	6.90	6.42	6.43	7.85	6.81	6.81	6.90
6	7.01	7.10	7.12	7.29	6.87	6.87	6.41	6.90	7.30	6.81	6.81	6.90
7	7.01	7.11	7.10	7.32	6.89	6.82	6.40	7.38	7.25	6.81	6.81	6.90
8	7.00	7.11	7.09	7.43	6.90	6.80	6.40	7.85	6.93	6.80	6.81	6.90
9	7.00	7.11	7.13	7.51	6.88	6.80	6.38	7.58	6.90	6.80	6.81	6.90
10	6.99	7.11	7.11	7.51	6.83	6.73	6.36	7.43	7.10	6.80	6.83	6.92
11	6.98	7.11	7.05	7.50	6.81	6.71	6.36	8.55	7.16	6.80	6.95	6.92
12	7.01	7.11	7.11	7.47	6.81	6.68	6.35	9.68	7.07	6.80	7.37	6.92
13	7.03	7.11	7.11	7.47	6.80	6.66	6.33	7.90	6.99	6.80	7.50	8.80
14	7.04	7.11	7.09	7.39	6.80	6.65	6.31	7.30	6.98	6.80	7.12	8.95
15	7.01	7.10	7.09	7.38	6.80	6.65	6.31	7.23	7.14	6.78	7.09	8.45
16	7.02	7.10	7.11	7.31	6.80	6.64	6.41	7.17	7.08	6.78	7.00	7.95
17	7.01	7.10	7.10	7.31	6.80	6.64	6.45	7.05	7.03	6.78	6.99	7.55
18	7.01	7.09	6.65	7.29	6.83	6.62	6.78	6.98	7.00	6.79	6.94	7.42
19	7.02	7.10	6.85	7.29	7.30	6.60	6.62	6.94	7.75	6.80	6.92	7.42
20	7.02	7.10	6.94	7.25	7.00	6.58	6.60	6.90	9.50	6.80	6.92	7.60
21	7.03	7.10	6.91	7.23	6.97	6.54	6.58	6.83	9.59	6.80	7.66	7.52
22	7.03	7.10	6.99	7.22	6.95	6.52	6.56	6.80	9.46	6.80	7.64	7.48
23	7.02	7.10	7.06	7.22	6.93	6.51	6.67	6.77	9.29	6.80	7.26	7.38
24	7.02	7.11	7.17	7.21	7.02	6.49	6.97	8.32	9.13	6.80	7.12	7.28
25	7.09	7.10	7.20	7.19	7.19	6.49	6.79	7.95	9.00	6.80	7.10	7.24
26	7.20	7.13	7.20	7.19	7.25	6.48	6.84	7.56	8.75	6.80	7.02	7.20
27	7.19	7.20	7.19	7.19	7.29	6.46	6.76	7.40	8.43	6.80	6.99	7.20
28	7.13	7.18	7.15	7.18	7.29	6.45	6.73	7.27	7.75	6.80	6.98	7.20
29	7.14	.....	7.12	7.09	7.30	6.45	6.63	7.11	7.35	6.80	6.95	7.20
30	7.18	.....	7.12	6.97	7.19	6.44	6.51	7.07	7.15	6.81	6.94	7.18
31	7.13	.....	7.11	.....	7.14	.....	6.40	6.97	.....	6.81	.....	7.16

Rating table for Salt River at reservoir site near Livingstone, Ariz., for 1902.

Gage height.	Discharge.	Gage height.	Dischage.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.2	33	7.1	204	8.0	765	8.9	2,675
6.3	45	7.2	236	8.1	915	9.0	2,925
6.4	58	7.3	272	8.2	1,090	9.1	3,175
6.5	72	7.4	310	8.3	1,290	9.2	3,425
6.6	88	7.5	350	8.4	1,500	9.3	3,675
6.7	106	7.6	400	8.5	1,715	9.4	3,925
6.8	126	7.7	462	8.6	1,940	9.5	4,175
6.9	150	7.8	540	8.7	2,175	.....	.....
7.0	176	7.9	640	8.8	2,425	.....	.....

Estimated monthly discharge of Salt River at reservoir site near Livingstone, Ariz.

[Drainage area, 5,756 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	236	176	189	11,621	0.033	0.038
February	236	204	207	11,496	.036	.037
March	236	97	201	12,359	.035	.040
April	350	163	268	15,947	.047	.052
May	272	72	167	10,268	.029	.033
June	204	65	106	6,307	.018	.020
July	163	45	78	4,796	.014	.016
August	4,675	52	478	29,391	.083	.096
September	4,425	138	1,057	62,896	.184	.205
October	190	126	131	8,055	.023	.027
November	431	126	189	11,246	.033	.037
December	2,800	150	441	27,116	.077	.089
The year	4,675	45	293	211,498	.051	.690

TONTO CREEK NEAR LIVINGSTONE, ARIZ.

The station, established April 1, 1901, by H. G. Heisler, is 15 miles west of Livingstone, Ariz. It is about half a mile above the mouth. The gage is a vertical rod nailed to a cliff of cemented gravel on the left bank.

Discharge measurements of Tonto Creek near Livingstone, Ariz.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 4	W. Richins	2.90	3
January 17	do	2.90	3
January 24	do	2.90	3
January 27	do	2.95	3
February 4	O. Richins	2.95	3
February 7	do	2.95	3
February 11	do	2.95	3
February 14	do	2.95	3
February 18	do	2.95	3
February 21	do	2.95	3
February 25	do	2.93	3
February 28	do	2.95	3
March 4	do	2.94	3
March 7	do	2.94	3
March 11	do	2.95	3
March 14	do	2.91	2
March 19	do	2.92	2
March 21	do	2.90	2
March 28	do	2.91	2
April 4	do	2.91	3
April 7	do	2.91	3
April 14	do	2.91	3
April 25	do	2.91	3
May 5	do	2.91	3
May 19	do	4.05	114
August 6	do	3.70	241
August 8	do	3.50	127
August 11	do	4.00	301
August 24	do	4.35	431
September 5	do	3.51	98
September 19	do	4.70	910
November 13	do	3.90	203
November 21	do	4.82	740
November 23	do	3.78	154
December 13	do	4.90	1,078
December 14	do	5.30	1,773
December 29	do	3.20	84

Daily gage height, in feet, of Tonto Creek near Livingstone, Ariz.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.90	2.95	2.95	2.91	2.91	2.90	2.90	2.90	2.90	2.90	2.90	3.10
2	2.90	2.95	2.95	2.91	2.91	2.90	2.90	2.90	2.90	2.90	2.90	3.10
3	2.90	2.95	2.95	2.91	2.91	2.90	2.90	3.14	2.90	2.90	2.90	3.10
4	2.90	2.95	2.94	2.91	2.91	2.90	2.90	3.00	2.90	2.90	2.90	3.08
5	2.90	2.95	2.94	2.91	2.91	2.90	2.90	2.97	2.90	2.90	2.90	3.07
6	2.90	2.95	2.94	2.91	2.91	2.90	2.90	3.43	2.90	2.90	2.90	3.05
7	2.90	2.95	2.94	2.91	2.91	2.90	2.90	3.00	2.94	2.90	2.90	3.00
8	2.90	2.95	2.94	2.91	2.91	2.90	2.90	4.28	2.92	2.90	2.90	2.95
9	2.90	2.95	2.95	2.91	2.91	2.90	2.90	4.10	2.90	2.90	2.90	2.93
10	2.90	2.95	2.95	2.91	2.91	2.90	2.90	4.30	2.90	2.90	2.90	2.92
11	2.90	2.95	2.95	2.91	2.91	2.90	2.90	3.90	3.05	2.90	3.20	2.92
12	2.90	2.95	2.95	2.91	2.91	2.90	2.90	4.95	2.95	2.90	3.57	2.92
13	2.90	2.95	2.95	2.91	2.91	2.90	2.90	4.40	2.93	2.90	3.85	5.15
14	2.90	2.95	2.91	2.91	2.91	2.90	2.90	3.75	2.90	2.90	3.36	5.20
15	2.90	2.95	2.94	2.91	2.91	2.90	2.90	3.28	3.10	2.90	3.19	4.55
16	2.90	2.85	2.94	2.91	2.91	2.90	2.90	3.00	3.05	2.90	3.07	4.10
17	2.90	2.95	2.94	2.91	2.91	2.90	2.90	2.95	2.98	2.90	2.98	3.90
18	2.90	2.95	2.92	2.91	2.91	2.90	2.90	2.95	2.95	2 90	2.94	3.95
19	2.90	2.95	2.92	2.91	3.61	2.90	2.90	2.93	4.88	2.90	2.92	4.25
20	2.90	2.95	2.92	2.91	2.98	2.90	2.90	2.90	6.45	2.90	2.92	4.10
21	2.90	2.95	2.90	2.91	2.95	2.90	3.53	2.90	5.10	2.90	4.79	3.78
22	2.90	2.95	2.90	2.91	2.95	2.90	5.50	2.90	4.52	2.90	4.58	3.68
23	2.90	2.95	2.90	2.91	2.90	2.90	2.90	2.90	3.90	2.90	3.68	3.55
24	2.90	2.96	2.90	2.91	2.90	2.90	2.90	4.10	3.37	2.90	3.48	3.35
25	2.93	2.93	2.92	2.91	2.90	2.90	2.90	3.90	3.10	2.90	3.44	3.28
26	2.95	2.95	2.91	2.91	2.90	2.90	3.15	3.96	2.97	2.90	3.30	3.24
27	2.95	2.95	2.91	2.91	2.90	2.90	2.90	3.30	2.95	2.90	3.29	3.18
28	2.95	2.95	2.91	2.91	2.90	2.90	2.90	3.10	2.93	2.90	3.25	3.19
29	3.00	------	2.91	2.91	2.90	2.90	2.90	2.99	2.90	2.90	3.22	3.20
30	3.00	------	2.91	2.91	2.90	2.90	2.90	2.94	2.90	2.90	3.10	3.10
31	3.00	------	2.91	------	2.90	------	2.90	2.91	------	2.90	------	3.00

Estimated monthly discharge of Tonto Creek near Livingstone, Ariz.

[Drainage area, 1,030 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	8.0	2.7	3.3	200	0.003	0.004
February	4.0	2.5	3.0	168	.003	.003
March	2.8	2.3	2.6	159	.002	.003
April	2.6	2.6	2.6	152	.002	.003
May	116.0	2.4	6.3	387	.006	.007
June	2.4	2.4	2.4	146	.002	.003
July	1,708.0	2.4	42.2	2,597	.041	.047
August	1,158.0	2.4	143.7	8,837	.139	.160
September	1,308.0	2.4	138.8	8,258	.134	.150
October	2.4	2.4	2.4	151	.002	.003
November	1,008.0	2.4	93.8	5,583	.091	.102
December	1,408.0	2.6	188.4	11,582	.182	.210
The year	1,708.0	2.3	52.5	38,220	.051	.694

NOTE.—The daily discharges were obtained by interpolation from the measurements.

GILA RIVER AT SAN CARLOS, ARIZ.

The general character of the country through which Gila River flows is a high and rolling plateau, with the river flowing through it in a deep canyon, and with practically no agricultural lands within its area. The river emerges from its upper canyon about 10 miles before it reaches the Arizona line, and thence flows through a valley of considerable width, known as Duncan Valley, until just before it receives the waters of San Francisco River. Duncan Valley in which a number of ditches divert water for irrigation purposes was described at length in the Twenty-first Annual Report.

Gila River is in canyon for about 20 miles below the mouth of the San Francisco, or to within 10 miles of Solomonsville. At this point the hills separate, forming a large valley which has been extensively settled and is now one of the finest irrigated portions of the Territory. This valley extends from a point 10 miles above Solomonsville to 6 miles below the mouth of San Carlos River on the White Mountain Indian Reservation. At this latter place the mountains suddenly close in again and the river enters another canyon. Seven miles below the Indian agency at San Carlos the canyon boxes to a width of 100 feet, and at this point is located the San Carlos dam site,

which was studied by the United States Geological Survey during 1899, in connection with the investigation of the water supply of Gila River. The results of this investigation are published in Water-Supply and Irrigation Paper No. 33, entitled Storage of Water on Gila River, Arizona, by J. B. Lippincott. In connection with this investigation Cyrus C. Babb, on July 11, 1899, established a station on Gila River one-half mile south of the Indian agency at San Carlos and below the mouth of San Carlos Creek. An inclined rod securely fastened to posts driven into the bank was erected here. The bench mark is a 20-penny nail in the base of a mesquite tree 5 inches in diameter, 85 feet west of the gage rod, at an elevation of 12.67 feet above gage datum. Discharge measurements are made from a cable and car a short distance above the gage rod. The channel is straight for some distance above and below the station, and the water is comparatively swift. The right bank is high, but the left is low and liable to overflow. The bed of the stream is sandy and shifting.

Discharge measurements of Gila River at San Carlos, Ariz.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 21	Stephen Janus	1.90	60
January 31	do	1.90	61
February 28	do	1.70	27
March 31	do	(a)	9
Do	do	(a)	9
April 30	do	(a)	5
Do	do	(a)	9
August 7	do	2.50	454
August 15	do	3.20	738
August 22	do	2.50	447
August 26	do	3.40	3,118
September 1	do	2.20	375
September 9	do	1.70	70
September 21	do	2.30	431
September 26	do	1.20	62
October 15	do	(a)	6
November 15	do	(a)	12
December 14	do	3.40	2,485
December 21	do	2.90	1,315
December 31	do	2.20	365

a No water at gage.

Daily gage height, in feet, of Gila River at San Carlos, Ariz.

Day.	Jan.	Feb.	Mar.	July.	Aug.	Sept.	Dec.
1902.							
1	2.00	1.90	1.70	.....	1.00	2.20	.....
2	2.00	1.90	1.70	.....	1.50	2.20	.....
3	2.00	1.90	1.70	.....	1.50	2.10	.....
4	2.00	1.90	1.70	.....	1.50	2.10	.....
5	2.00	1.90	1.70	.....	1.50	2.00	.....
6	2.00	1.90	1.60	.....	1.50	2.00	.....
7	2.00	1.90	1.60	.....	2.45	1.90	.....
8	2.00	1.90	1.60	.....	1.85	1.80	.....
9	2.00	1.90	1.60	.....	1.85	1.70	.....
10	2.00	1.90	1.50	.....	2.10	1.70	.....
11	2.00	1.90	1.50	.....	2.20	1.70	.....
12	2.00	1.90	1.50	.....	2.10	1.70	.....
13	2.00	1.90	1.50	.....	3.35	1.60	.....
14	2.00	1.90	1.45	.....	3.30	1.60	3.55
15	2.00	1.88	1.45	.....	3.10	1.60	2.95
16	2.00	1.85	1.45	.....	2.25	1.60	2.80
17	2.00	1.85	1.40	.....	2.40	1.60	2.80
18	2.00	1.83	1.40	.....	2.40	1.60	2.80
19	2.03	1.80	1.40	.....	2.05	1.60	2.80
20	1.93	1.80	1.40	.....	1.85	1.60	2.80
21	1.90	1.80	.....	.....	1.65	2.15	2.90
22	1.90	1.80	.....	2.35	1.50	1.45	2.70
23	1.90	1.80	.....	1.95	1.50	1.30	2.70
24	1.90	1.75	.....	1.70	3.45	1.30	2.60
25	1.90	1.70	.....	1.40	3.65	1.20	2.50
26	1.90	1.70	.....	1.45	3.60	1.20	2.40
27	1.90	1.70	.....	.....	2.80	1.10	2.40
28	1.90	1.70	.....	.....	2.90	.....	2.40
29	1.90	.....	.....	.....	3.25	.....	2.30
30	1.90	.....	.....	.....	2.60	.....	2.30
31	1.90	.....	.....	.....	2.30	.....	2.20

NOTE.—No water at gage Mar. 23 to July 21, July 27 to 31, Oct. 1 to Dec. 14.

Rating table for Gila River at San Carlos, Ariz., for 1902.

JANUARY 1 to JULY 31.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.4	8	2.0	115	2.6	780	3.2	2,010
1.5	12	2.1	190	2.7	955	3.3	2,245
1.6	18	2.2	285	2.8	1,130	3.4	2,480
1.7	26	2.3	395	2.9	1,320	3.5	2,715
1.8	40	2.4	515	3.0	1,540	.....	.....
1.9	70	2.5	640	3.1	1,775	.....	.....

Rating table for Gila River at San Carlos, Ariz., for 1902—Continued.

AUGUST 1 TO DECEMBER 31.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	3	1.7	75	2.4	520	3.1	1,775
1.1	6	1.8	108	2.5	640	3.2	2,010
1.2	11	1.9	150	2.6	780	3.3	2,245
1.3	17	2.0	200	2.7	955	3.4	2,480
1.4	25	2.1	260	2.8	1,130	3.5	2,715
1.5	35	2.2	334	2.9	1,320	3.6	2,950
1.6	50	2.3	420	3.0	1,540	.....	.....

Estimated monthly discharge of Gila River at San Carlos, Ariz.

[Drainage area, 13,455 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	152	70	99.51	6,118.6	0.0074	0.0085
February	70	26	55.43	3,078.4	.0041	.0043
March 1–20	.....	.....	[a]15.60	625.5	.0011	.00082
April	.....	.....	(a)	.....	.....	.....
May	.....	.....	(a)	.....	.....	.....
June	.....	.....	(a)	.....	.....	.....
July 22–26	.....	.....	[a]118.50	1,308.5	.0089	.0017
August	3,067	3	792.00	48,698.0	.0588	.0670
September 1–27	.....	.....	[a]108.70	5,821.3	.0080	.0080
October	.....	.....	(a)	.....	.....	.....
November	.....	.....	(a)	.....	.....	.....
December 14–31	.....	.....	[a]961.00	34,286.1	.0714	.0480

[a] For these portions of the year there was no water at the gage.

ANIMAS RIVER AT DURANGO, COLO.

The station was first established June 20, 1895, and has been maintained during the greater part of each year since.

The original gage was located at the old wagon bridge one-quarter of a mile west of the railroad station at Durango, and about 200 feet above the Rio Grande Southern Railroad bridge. It was spiked to the west side of the south end of the middle pier of the wagon bridge. The head of a bolt at the east abutment of the railroad bridge is 17.24 feet above gage datum. During the early part of 1899 the old wagon

bridge was removed and a new one erected a short distance below. April 1, 1899, on the central pier of this bridge a new rod, which is a vertical piece of timber graduated to feet and tenths, was fastened. The bench marks are three horizontal strips, opposite the 10-, 14-, and 16.7-foot marks of the rod, respectively. Owing to this change in location and height of the rod there is no apparent relation between the rating tables before 1899 and the rating table for 1899 and after. On June 25, 1900, the gage was referred to a new bench mark—a point chiseled on the lower side of the left-hand abutment of the bridge 16.84 feet above the zero of the rod. Lightner Creek enters the river from the right about 100 feet below the bridge. The channel at the station is straight, the bed is of gravel and bowlders, and the banks are sufficiently high that there is little danger of overflow. The observer is C. G. Graden, of Durango.

The following discharge measurements were made during 1902 by A. L. Fellows:

March 20: Gage height 6.15 feet; discharge, 148 second-feet.
July 12: Gage height 6.72 feet; discharge, 302 second-feet.

Daily gage height, in feet, of Animas River at Durango, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	6.10	8.50	9.10	6.80	6.40	6.80	6.90	6.50
2	6.10	9.00	8.80	6.80	6.40	6.80	7.00	.....
3	6.10	9.30	8.90	6.80	6.40	6.70	6.90	.....
4	6.20	8.90	9.20	6.80	6.30	6.70	7.00	.....
5	6.40	8.70	8.90	6.80	6.30	6.60	6.60	.....
6	6.50	9.20	8.80	6.80	6.20	6 50	6.50	.....
7	6.60	9.50	8.60	6.80	6.20	6.50	6.40	.....
8	6.60	9.20	8.90	6.80	6.20	6.60	6.50	.....
9	6.70	9.00	8.80	6.80	6.20	6.50	6.50	.....
10	6.90	9.00	8.60	6.80	6.20	6.50	6.70	.....
11	6.90	9.50	8.50	6.70	6.20	6.50	6.50	.....
12	7.00	9.00	8.50	6.70	6.20	6.60	6.50	.....
13	6.90	8.70	8.40	6.70	6.30	6.60	6.50	.....
14	6.90	8.60	8.40	6.60	6.40	6.50	6.40	.....
15	6.80	8.70	8.00	6.60	6.40	6.50	6.40	.....
16	6.80	9.00	7.90	6.60	6.30	6.50	6.50	.....
17	7.10	9.00	7.90	6.60	6.30	6.40	6.50	.....
18	7.00	8.90	7.80	6.50	6.30	6.30	6.50	.....
19	7.20	8.20	7.70	6.50	6.30	6.40	6.50	.....
20	7.50	7.90	7.50	6.50	6.30	6.40	6.50	.....
21	7.50	7.60	7.30	6.50	6.30	7.00	6.50	.....
22	7.40	7.50	7.30	6.50	6.30	6.90	6.50	.....
23	7.60	7.50	7.20	6.50	6.40	6.70	6.50	.....
24	7.00	7.90	7.20	6.40	6.90	7.00	6.50	.....
25	7.00	8.00	7.10	6.40	7.50	7.00	6.50	.....
26	6.90	8.10	7.10	6.40	7.50	7.00	6.50	.....
27	7.10	8.90	7.00	6.40	7.40	7.00	6.50	.....
28	7.30	8.30	7.00	6.40	7.20	6.80	6.50	.....
29	7.70	8.50	6.90	6.40	7.10	6.90	6.50	.....
30	8.30	8.70	6.90	6.40	7.00	6.90	6.50	.....
31	.....	8.40	.....	6.40	6.80	.....	6.50	.....

Rating table for Animas River at Durango, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.6	50	6.4	206	7.2	540	8.0	1,076
5.7	63	6.5	232	7.3	597	8.2	1,244
5.8	80	6.6	263	7.4	655	8.4	1,427
5.9	100	6.7	300	7.5	717	8.6	1,622
6.0	120	6.8	342	7.6	782	8.8	1,829
6.1	140	6.9	387	7.7	850	9.0	2,050
6.2	160	7.0	435	7.8	922	9.2	2,300
6.3	182	7.1	486	7.9	997	9.4	2,590

Estimated monthly discharge of Animas River at Durango, Colo.

[Drainage area, 812 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	1,334	146	445	26,479	0.549	0.61
May	2,750	717	1,699	104,467	2.092	2.41
June	2,300	387	1,179	70,155	1.452	1.62
July	342	206	271	16,663	.334	.38
August	717	160	273	16,786	.336	.39
September	435	182	299	17,792	.368	.41
October	435	206	256	15,741	.315	.36

FLORIDA RIVER NEAR DURANGO, COLO.

During 1899 work was being done on a large storage project near the head of the river, and on this account a gaging station was established by A. L. Fellows May 19, 1899. It is located at a wagon bridge at Stewart's ranch, which is about 6½ miles east of Durango and is reached by driving. The gage rod consists of a vertical 4-inch strip 7½ feet long, graduated to feet and tenths and spiked to the east abutment of the bridge. The bench mark was established April 15, 1901, and consists of a spike in an 8-inch cottonwood stump, 50 feet south from and 5.86 feet above the zero of the rod. Gagings are made at the wagon bridge, except at low water, when they may be made by wading. Information derived at this point is of importance, as it is desired that the excess water of this stream shall be made available by means of storage reservoirs in the upper part of this drainage basin. Much valuable land can be irrigated if this water is properly conserved. The station was discontinued during 1900. The observer is Mrs. Annie Stewart, who lives near by.

The following discharge measurement was made in 1902 by A. L. Fellows:

July 11: Gage height, 0.80 foot; discharge, 11 second-feet.

Daily gage height, in feet, of Florida River near Durango, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							
1	0.80	2.40	1.65	0.90	0.70	0.85	1.00
2	.80	2.50	1.50	.95	.65	.80	1.00
3	.85	2.45	1.45	.95	.60	.80	1.00
4	.90	2.55	1.35	.95	.60	.80	1.00
5	.90	2.10	1.20	.90	.60	.80	1.00
6	1.00	2.10	1.10	.90	.60	.80	1.00
7	1.10	2.20	1.00	.90	.60	.75	1.00
8	1.10	2.05	1.05	.85	.60	.70	.95
9	1.15	1.90	.95	.75	.60	.70	.90
10	1 15	1.80	.85	.70	.60	.70	.90
11	1.30	1.95	.75	.75	.75	.70	.90
12	1.40	1.95	.85	.70	.90	.70	.90
13	1.35	1.90	.75	.70	.90	.65	.90
14	1.35	1.80	.70	.70	.90	.50	.90
15	1.15	1.75	.70	.70	.85	.50	.90
16	1.30	1.80	.70	.70	.80	.60	.90
17	1.50	1.70	.80	.70	.80	.50	.90
18	1.65	1.50	.85	.70	.75	.55	.90
19	1.95	1.35	.80	.70	.70	.55	.90
20	1.90	1.20	.75	.70	.70	.50	.90
21	1.85	1.15	.75	.70	.70	1.20	.70
22	1.45	1.15	.75	.70	.70	1.85	.70
23	1.25	1.10	.70	.70	.85	1.70	.70
24	1.25	1.30	.80	.75	1.90	1.75	.70
25	1.35	1.55	.75	.70	1.75	1.40	.70
26	1.55	1.50	.85	.80	1.45	1.25	.60
27	1.50	1.95	.85	.75	1.35	1.10	.60
28	1.90	1.90	.80	.75	1.20	1.00	.60
29	2.05	1.85	.85	.70	1.15	1.00	.60
30	2.45	1.70	.80	.70	1.00	1.00	.60
31	-------	1.75	-------	.70	1.00	-------	.60

Rating table for Florida River near Durango, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	5	1.4	45	2.3	248	3.2	482
.6	7	1.5	56	2.4	274	3.3	508
.7	9	1.6	74	2.5	300	3.4	534
.8	11	1.7	98	2.6	326	3.5	560
.9	15	1.8	122	2.7	352	3.6	586
1.0	19	1.9	146	2.8	378	3.7	612
1.1	24	2.0	170	2.9	404		
1.2	30	2.1	196	3.0	430		
1.3	37	2.2	222	3.1	456		

Estimated monthly discharge of Florida River near Durango, Colo.

[Drainage area, 136 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	287	11	63	3,749	0.46	0.51
May	313	24	134	8,239	.99	1.14
June	86	9	19	1,131	.14	.16
July	17	9	11	676	.08	.09
August	146	7	21	1,291	.15	.17
September	134	5	23	1,369	.17	.19
October	19	7	13	799	.10	.12

LOS PINOS RIVER AT IGNACIO, COLO.

The station was established April 22, 1899, at the request of the Commissioner of Indian Affairs, for the purpose of ascertaining the quantity of water available for irrigation along the stream. It is located at the wagon bridge at Ignacio, the subagency of the Southern Ute Indian Reservation, 2 miles north of the Denver and Rio Grande Railroad station. The rod is a vertical 2 by 4 inch timber, 10 feet long, spiked to the bridge, the marks being strips of brass securely nailed to the post. Bench mark No. 1 is the 8-foot mark on the gage rod, which is level with the top of the lower end of a 6 by 8 inch timber protruding downstream from the pier on the right-hand side. Bench mark No. 2, placed April 7, is an iron bench-mark post set 30 feet northwest from the northwest corner of the bridge, its top being 7.64 feet above the zero of the gage. The observer is John Wesch, the clerk at the agency. The banks are low, but not subject to overflow; the bed of the stream is of gravel, but not liable to radical change.

The following discharge measurements were made during 1902 by A. L. Fellows:

March 27: Gage height, 2.44 feet; discharge, 57 second-feet.
July 11: Gage height, 2.15 feet; discharge, 39 second-feet.

Daily gage height, in feet, of Los Pinos River at Ignacio, Colo.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1902.				1902.			
1	2.40	3.60	3.30	17	3.00	3.35	
2	2.40	3.70	3.30	18	3.05	3.35	
3	2.40	3.75	3.25	19	3.30	3.35	
4	2.40	3.60	3.15	20	3.40	3.35	
5	2.40	3.50	3.05	21	3.30	3.25	
6	2.45	3.60	3.05	22	3.30	3.25	
7	2.70	3.65	3.05	23	3.35	3.25	
8	2.80	3.65	3.05	24	3.20	3.35	
9	2.85	3.45	3.00	25	3.10	3.35	
10	3.00	3.45	2.95	26	3.00	3.25	
11	3.10	3.50	2.90	27	3.00	3.25	
12	3.00	3.50	2.85	28	3.15	3.35	
13	2.95	3.50	2.85	29	3.30	3.35	
14	2.95	3.45	2.80	30	3.50	3.40	
15	2.90	3.45	(a)	31		3.40	
16	2.95	3.35					

a No observer available.

Rating table for Los Pinos River at Ignacio, Colo.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	25	2.9	259	3.8	795	4.7	1,352
2.1	32	3.0	315	3.9	856	4.8	1,414
2.2	43	3.1	375	4.0	918	4.9	1,476
2.3	56	3.2	435	4.1	980	5.0	1,538
2.4	73	3.3	495	4.2	1,042	5.1	1,600
2.5	95	3.4	555	4.3	1,104	5.2	1,662
2.6	125	3.5	615	4.4	1,166		
2.7	163	3.6	675	4.5	1,228		
2.8	208	3.7	735	4.6	1,290		

Estimated monthly discharge of Los Pinos River at Ignacio, Colo.

[Drainage area, 450 square miles.]

Month.	Discharge in second-feet.			Total in acre feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	615	73	312	18,565	0.69	0.77
May	765	465	577	35,478	1.28	1.48
June 1–14			341	9,469	.76	.40

DOLORES RIVER AT DOLORES, COLO.

This station was established by F. Cogswell in June, 1895. The gage is located about one-half mile above the railroad station, at the footbridge from which the measurements of discharge are made. The gage is vertical, and is spiked to the crib abutment of the bridge on the left bank. The bench mark consists of a nail driven into the base of a cottonwood tree 18 feet southwest from the gage. This is 1.57 feet above the 14-foot mark. The locality is especially good for accurate measurement, as the bed of the stream is apparently permanent and the banks are not liable to overflow at moderate stages.

The observer is Mary D. Smith.

The following discharge measurement was made in 1902 by A. L. Fellows:

July 14: Gage height, 2.65 feet; discharge, 47 second-feet.

Daily gage height, in feet, of Dolores River at Dolores, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							
1	2.70	4.60	3.95	2.80	2.50	2.80	2.60
2	2.70	4.55	3.85	2.80	2.50	2.80	2.60
3	2.80	4.45	3.75	2.85	2.50	2.75	2.60
4	2.90	4.25	3.75	2.90	2.50	2.70	2.60
5	3.00	4.05	3.70	2.90	2.50	2.65	2.60
6	3.00	4.05	3.70	2.90	2.50	2.60	2.55
7	3.10	4.15	3.55	2.90	2.50	2.60	2.50
8	3.20	4.15	3.55	2.85	2.45	2.60	2.50
9	3.25	4.15	3.50	2.80	2.40	2.60	2.60
10	3.35	4.05	3.45	2.80	2.45	2.55	2.60
11	3.45	4.05	3.40	2.75	2.55	2.50	2.60
12	3.50	4.10	3.40	2.70	2.75	2.50	2.60
13	3.50	3.70	3.40	2.70	2.80	2.50	2.60
14	3.50	4.10	3.40	2.60	2.80	2.50	2.60
15	3.50	4.15	3.25	2.60	2.80	2.50	2.60
16	3.50	4.15	3.20	2.60	2.80	2.50	2.60
17	3.50	4.15	3.20	2.60	2.70	2.60	2.60
18	3.65	3.95	3.15	2.70	2.70	2.60	2.60
19	3.80	3.80	3.00	2.70	2.70	2.60	2.60
20	4.00	3.65	3.00	2.60	2.65	2.65	2.60
21	3.95	3.60	3.00	2.60	2.60	3.00	2.55
22	3.80	3.60	2.95	2.60	2.65	3.15	2.50
23	3.90	3.50	2.90	2.60	2.85	2.95	2.50
24	3.95	3.50	2.90	2.55	3.25	2.90	2.50
25	3.80	3.60	2.90	2.55	3.30	2.90	2.50
26	3.60	3.70	2.90	2.60	3.30	2.85	2.50
27	3.65	4.00	2.90	2.65	3.15	2.80	2.55
28	3.75	4.05	2.90	2.65	3.00	2.75	2.60
29	4.10	4.20	2.90	2.60	3.00	2.75	2.60
30	4.40	4.05	2.90	2.60	3.00	2.70	2.60
31	.....	4.10	.....	2.50	3.00	.....	2.60

Rating table for Dolores River at Dolores, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.4	20	3.0	150	3.6	556	4.2	1,001
2.5	28	3.1	205	3.7	628	4.3	1,078
2.6	37	3.2	271	3.8	700	4.4	1,157
2.7	51	3.3	341	3.9	773	4.5	1,238
2.8	73	3.4	412	4.0	849	4.6	1,323
2.9	106	3.5	484	4.1	925		

Estimated monthly discharge of Dolores River at Dolores, Colo.

[Drainage area, 524 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	1,157	51	497	29,574	0.948	1.05
May	1,323	484	857	52,695	1.635	1.89
June	811	106	342	20,350	.653	.72
July	106	28	56	3,443	.107	.13
August	341	20	92	5,657	.176	.20
September	237	28	62	3,689	.118	.13
October	37	28	34	2,091	.065	.07

GUNNISON RIVER AT WHITEWATER, COLO.

This station was established by J. E. Field April 10, 1902, at a new wagon bridge constructed by the State of Colorado at a point about half a mile above the railroad station at Whitewater, on the Denver and Rio Grande Railroad. During 1895, 1897, and 1901 incomplete series of gage heights were obtained at this point, but the station was not regularly established until 1902. It was intended that this station should take the place of the one formerly maintained on the Gunnison at Grand Junction. The latter station was abandoned on account of inaccuracies that could not be overcome. They were mainly due to the fact that high stages of water in Grand River affected the gage rod in the Gunnison, and that the stream bed was partially filled with great bowlders, making accurate gagings impossible.

Discharge measurements of Gunnison River at Whitewater, Colo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 10	J. E. Field	4.60	[a]2,176
May 26	M. C. Hinderlider	6.10	3,322
July 31	do	3.20	384
August 30	do	4.60	1,230
September 20	G. H. Matthes	3.20	302
November 1	J. E. Field	3.80	622

[a] Sometime during the spring, between April 10 and May 26, a dam was placed across the river about 1¼ miles below the gaging station, which affected the gage heights at the bridge where gage is located. In the latter part of the summer part of the dam went out, thereby again changing the readings of gage rod. No definite conclusions could be arrived at as to the extent to which the river surface at gage rod was affected by the construction and later breaking of the dam. The gaging of April 10 was not used in constructing the rating table.

Daily gage height, in feet, of Gunnison River at Whitewater, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							
1	3.00	6.35	7.60	3.70	3.20	4.45	3.60
2	3.00	7.35	7.50	3.75	3.20	4.35	3.50
3	3.00	7.90	7.15	3.80	3.45	4.25	3.45
4	3.10	8.30	7.00	3.75	3.50	4.00	3.40
5	3.25	8.15	7.00	3.70	3.50	3.85	3.30
6	3.35	8.00	6.95	3.85	3.50	3.80	3.30
7	3.40	8.25	6.85	4.40	3.45	3.70	3.45
8	3.55	8.40	6.80	4.15	3.40	3.70	3.55
9	3.70	8.25	6.90	3.90	3.40	3.60	3.85
10	3.75	8.30	6.75	3.80	3.55	3.60	4.00
11	3.95	8.55	6.60	3.70	3.70	3.60	4.20
12	4.05	8.75	6.45	3.60	3.70	3.50	3.90
13	4.15	8.65	6.30	3.50	3.80	3.50	3.65
14	4.35	8.45	6.40	3.40	3.80	3.40	3.60
15	4.45	8.25	6.15	3.35	3.95	3.50	3.50
16	4.60	8.05	5.85	3.30	4.30	3.60	3.50
17	4.85	8.05	5.65	3.60	3.95	3.70	3.50
18	5.10	7.85	5.55	3.90	3.70	3.75	3.50
19	5.40	7.50	5.35	3.65	3.60	3.60	3.50
20	5.60	6.90	5.05	3.50	3.65	3.65	3.50
21	5.70	6.40	5.00	3.35	3.80	3.80	3.40
22	5.85	6.15	4.90	3.70	3.90	3.90	3.40
23	5.55	5.85	4.60	3.85	3.80	3.90	3.40
24	5.10	5.70	4.45	3.80	3.70	4.60	3.40
25	4.85	5.65	4.35	3.70	3.60	4.90	3.40
26	4.80	6.15	4.15	3.60	3.75	4.40	3.40
27	4.80	6.90	4.00	3.60	3.95	3.70	3.40
28	4.80	8.05	4.00	3.60	4.00	3.70	3.55
29	5.15	7.85	3.95	3.70	4.25	3.60	3.60
30	5.90	7.70	3.80	3.70	4.60	3.60	3.75
31	.....	7.35	.....	3.35	4.50	.....	3.80

Rating table for Gunnison River at Whitewater, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.0	260	4.6	1,169	6.2	3,528	7.8	8,237
3.2	341	4.8	1,359	6.4	3,982	8.0	9,007
3.4	427	5.0	1,571	6.6	4,477	8.2	9,825
3.6	521	5.2	1,815	6.8	5,012	8.4	10,690
3.8	623	5.4	2,091	7.0	5,587	8.6	11,587
4.0	734	5.6	2,399	7.2	6,195	8.8	12,500
4.2	860	5.8	2,739	7.4	6,838		
4.4	1,004	6.0	3,116	7.6	7,515		

Estimated monthly discharge of Gunnison River at Whitewater, Colo.

[Drainage area, 7,868 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	2,922	260	1,219	72,535	0.16	0.18
May	12,271	2,481	7,772	477,885	.99	1.14
June	7,515	623	3,284	195,411	.42	.47
July	1,004	383	570	35,048	.07	.08
August	1,169	341	610	37,507	.08	.09
September	1,461	427	667	39,689	.08	.09
October	860	383	504	30,990	.06	.07

GUNNISON RIVER AT IOLA, COLO.

The Iola station was established in March, 1900, for the purpose of determining the amount of water available for the irrigation project of Uncompahgre Valley. The rod is at a wagon bridge which crosses the river about a quarter of a mile above the Denver and Rio Grande Railroad station at Iola. It consists of a piece of 2-inch by 4-inch timber fastened to the downstream side of the second pier of the bridge from the south end, the zero of the rod being 7.43 feet below the bench mark—a spike in the base of an old post 40 feet south of the southern end of the bridge, on the west side of the road. The chief value of the station is with reference to determining the amount of water available for the proposed canal to the Uncompahgre Valley, although, owing to the fact that a number of streams enter the Gunnison below the station, the results obtained do not show the total

amount available. The channel at this place is wide, and the bed being of gravel and bowlders is not particularly susceptible to change. The banks, though not high, are not subject to overflow. The observer, A. Pomel, postmaster at Iola, telegraphs the gage height daily to the local forecast official of the United States Weather Bureau at Denver, who has it printed in the morning papers.

During 1902 the following discharge measurements were made by M. C. Hinderlider and A. L. Fellows:

May 30: Gage height, 3.60 feet; discharge, 1,925 second-feet.
July 19: Gage height, 1.90 feet; discharge, 271 second-feet.
September 1: Gage height, 2.10 feet; discharge, 400 second-feet.

Daily gage height, in feet, of Gunnison River at Iola, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	2.20	3.00	3.70	2.00	1.80	2.00	1.80	2.00
2	2.30	3.20	3.60	2.00	1.80	2.00	1.80	2.00
3	2.30	3.40	3.20	2.00	1.80	2.00	1.90	2.00
4	2.50	3.40	3.20	2.00	1.80	1.90	2.00	2.00
5	2.60	3.60	3.30	2.00	1.80	1.90	2.00	2.00
6	2.70	3.70	3.20	2.30	1.80	1.90	2.00	2.00
7	2.70	3.60	3.20	2.10	1.80	1.90	2.00	2.00
8	2.60	3.80	3.20	2.00	1.80	1.90	1.90	2.00
9	2.60	3.80	3.10	2.00	1.80	1.80	2.00	2.00
10	2.60	4.00	3.00	1.90	1.80	1.80	2.00	2.00
11	2.50	4.00	3.00	1.90	1.80	1.80	2.00	2.10
12	2.50	4.00	3.00	2.00	1.80	1.80	2.00	2.10
13	2.40	3.90	3.00	1.80	1.90	1.80	2.00	2.20
14	2.30	3.90	3.00	1.80	1.90	1.80	2.00	2.20
15	2.30	3.80	2.90	1.80	1.90	1.80	1.90	2.20
16	2.40	3.80	2.80	1.80	1.90	1.80	1.90	2.20
17	2.50	3.80	2.70	1.80	1.90	1.80	1.90	2.20
18	2.60	3.60	2.60	1.80	1.90	1.80	1 90	2.10
19	2.70	3.20	2.60	1.80	1.90	1.80	2.00	2.10
20	2.70	3.00	2.50	1.80	1.80	1.80	2.00	2.20
21	2.70	2.90	2.50	1.80	1.80	1.90	2.00	2.20
22	2.60	2.80	2.40	1.80	1.80	1.90	2.00	2.20
23	2.60	2.80	2.30	1.80	1.90	1.80	2.00	2.10
24	2.50	2.80	2.20	1.80	1.90	1.80	2.00	2.10
25	2.50	3.00	2.20	1.80	2.00	1.80	2.00	2.10
26	2.50	3.20	2.10	1.80	2.10	1.80	2.00	2.20
27	2.60	3.80	2.00	1.80	2.10	1.80	2.00	2.20
28	2.80	3.60	2.00	1.80	2.10	1.80	2.00	2.20
29	2.11	3.60	2.00	1.80	2.10	1.80	2.00	2.20
30	3.00	3.60	2.00	1.80	2.10	1.80	2.00	-------
31	-------	3.60	-------	1.80	2.10	-------	2. 0	-------

Rating table for Gunnison River at Iola, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.8	221	2.4	640	3.0	1,205	3.6	1,925
1.9	271	2.5	728	3.1	1,308	3.7	2,090
2.0	330	2.6	818	3.2	1,413	3.8	2,264
2.1	398	2.7	910	3.3	1,522	3.9	2,446
2.2	474	2.8	1,005	3.4	1,638	4.0	2,636
2.3	555	2.9	1,104	3.5	1,772		

Estimated monthly discharge of Gunnison River at Iola, Colo.

[Drainage area, 2,298 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	1,205	402	759	45,164	0.33	0.37
May	2,636	1,005	1,838	113,015	.80	.92
June	2,090	330	997	59,326	.43	.48
July	555	221	269	16,540	.12	.14
August	398	221	273	16,786	.12	.14
September	330	221	244	14,519	.11	.12
October	330	221	312	19,184	.14	.16
November	474	330	408	24,278	.18	.20

GRAND RIVER NEAR PALISADES, COLO.

This station was established April 9, 1902, by John E. Field, at the iron wagon bridge across Grand River where the river enters Grand Valley about 2 miles above Palisades. The channel at this point is deep and rocky, the mountains rising on either side rather abruptly. The station is above all irrigating ditches supplying water to the land of Grand Valley with the exception of one pumping plant, which takes about 20 second-feet of water from the river one-fourth of a mile above the station. The river at this point is deep and at high water very swift. The right bank is high and precipitous; the left bank for a short distance below the bridge is liable to overflow for a short distance out during very high water. The bed of the river is somewhat changeable, but for a river of this size fairly satisfactory results are obtained. The gage consists of a wire cable, to which a window weight is attached, swung from the middle of the bridge. The graduations are painted in feet and tenths on the hub rail on the

bridge. No bench mark has ever been established. The observations have been taken twice daily during the irrigating season since the station was established by S. L. Purdy, pumpman at the Mount Lincoln pumping plant.

Discharge measurements of Grand River near Palisades, Colo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 9	J. E. Field	12.30	2,564
May 27	M. C. Hinderlider	16.30	9,778
July 30	do	12.20	1,966
August 29	do	12.00	1,662
October 2	G. H. Matthes	12.15	1,415
October 15	do	12.20	1,465
October 26	do	12.20	1,361
November 3	do	12.10	1,346

Daily gage height, in feet, of Grand River near Palisades, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	11.60	14.15	17.75	13.75	12.25	12.00	12.10	(a)
2	11.60	15.00	17.55	13.75	11.98	12.00	12.20	
3	11.60	15.75	17.25	13.55	11.95	12.00	12.27	
4	11.60	16.30	17.10	13.42	11.92	11.95	12.25	
5	11.60	16.65	17.10	13.42	11.92	11.88	12.25	
6	11.70	16.90	17.10	13.38	11.90	11.80	12.20	
7	11.70	17.05	17.00	13.35	11.82	11.80	12.25	
8	12.30	17.30	16.95	13.25	11.80	11.75	12.18	
9	12.30	17.50	17.00	13.15	11.80	11.72	12.12	
10	12.40	17.75	16.95	12.98	11.75	11.72	12.10	
11	12.35	18.30	16.80	12.85	12.08	11.68	12.10	
12	12.35	18.45	16.65	12.70	11.80	11.60	12.10	
13	12.30	18.20	16.55	12.68	11.75	11.60	12.25	
14	12.35	18.30	16.45	12.70	11.75	11.60	12.30	
15	12.30	18.45	16.15	12.68	11.85	11.60	12.20	
16	12.20	18.55	15.95	12.60	11.98	11.60	12.25	
17	12.20	18.60	15.75	12.95	12.00	11.60	12.25	
18	12.25	18.25	15.45	12.68	11.48	11.60	12.25	
19	12.38	17.85	15.25	12.72	11.85	11.75	12.25	
20	12.65	17.10	14.95	13.25	11.78	11.70	12.20	
21	12.95	16.55	14.75	12.98	11.72	12.35	12.20	
22	13.27	16.00	14.55	12.75	11.70	12.15	12.20	
23	13.30	15.55	14.42	12.58	11.70	12.10	12.18	
24	12.95	15.30	14.38	12.45	11.65	12.10	12.20	
25	12.72	15.25	14.30	12.40	11.78	12.10	12.20	
26	12.72	15.75	14.08	12.32	11.85	12.10	12.18	
27	12.62	15.65	13.95	12.30	12.00	12.10	12.20	
28	12.72	17.45	13.80	12.28	11.60	12.10	12.18	
29	13.05	17.20	13.70	12.22	12.00	12.10	12.18	
30	13.55	17.30	13.65	12.18	12.10	12.10	12.10	
31		17.55		12.12	12.00		12.10	

(a) Station closed for winter.

Rating table for Grand River near Palisades, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
11.6	1,102	13.4	3,955	15.2	7,444	17.0	11,542
11.8	1,376	13.6	4,323	15.4	7,867	17.2	12,082
12.0	1,662	13.8	4,698	15.6	8,311	17.4	12,624
12.2	1,960	14.0	5,079	15.8	8,756	17.6	13,171
12.4	2,268	14.2	5,464	16.0	9,204	17.8	13,722
12.6	2,584	14.4	5,853	16.2	9,654	18.0	14,282
12.8	2,911	14.6	6,246	16.4	10,106	18.2	14,876
13.0	3,248	14.8	6,642	16.6	10,562	18.4	15,518
13.2	3,596	15.0	7,041	16.8	11,029	18.6	16,208

Estimated monthly discharge of Grand River near Palisades, Colo.

[Drainage area, 8,546 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	4,230	1,102	2,230	132,694	0.26	0.29
May	16,208	5,367	11,800	725,554	1.38	1.59
June	13,584	4,416	8,873	527,980	1.04	1.16
July	4,604	1,839	3,024	185,939	.35	.40
August	2,036	944	1,479	90,941	.17	.20
September	2,190	1,102	1,489	88,602	.17	.19
October	2,113	1,809	1,951	119,963	.23	.26

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

This station was first located May 12, 1899, at the request of the Denver and Rio Grande Railroad Company, at the railroad bridge a quarter of a mile west of the depot and just above the mouth of Roaring Fork. A wire gage was used. At the beginning of 1900, however, a new gage rod was located near the electric-light works of the Colorado Hotel. Measurements are made from the wagon bridge crossing the river between the town and the hotel. The channel is good, being composed of gravel and rock, and does not change much; the banks are high and not subject to overflow.

During 1902 the following discharge measurements were made by J. E. Field and M. C. Hinderlider.

April 11: Gage height, 3.87 feet; discharge, 1,328 second-feet.
July 28: Gage height, 3.90 feet; discharge, 1,414 second-feet.
August 28: Gage height, 3.60 feet; discharge, 1,079 second-feet.
November 3: Gage height, 3.30 feet; discharge, 842 second-feet.
December 13: Gage height, 3.30 feet; discharge, 775 second-feet.

Daily gage height, in feet, of Grand River at Glenwood Springs, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.[a]	Dec.
1902.									
1	3.10	3.10	3.25	3.15	5.40	7.75	5.00	.....	.....
2	3.15	3.00	3.20	3.20	5.95	7.65	4.80	.....	.....
3	3.15	2.90	3.20	3.25	6.45	7.40	4.75	.....	2.90
4	3.35	3.00	3.15	3.30	6.75	7.20	4.70	.....	2.90
5	3.25	3.05	3.15	3.40	6.90	7.35	4.60	.....	3.10
6	3.20	3.20	3.25	3.50	6.90	7.30	4.60	.....	3.20
7	3.20	3.20	3.20	3.60	6.70	7.30	4.60	.....	3.20
8	3.20	3.20	3.15	3.70	7.20	7.30	4.45	.....	3.10
9	3.20	3.20	3.25	3.90	7.40	7.40	4.30	.....	3.25
10	3.15	3.20	3.25	3.90	7.50	7.35	4.20	.....	3.25
11	3.10	3.20	3.25	3.85	7.80	7.30	4.20	.....	3.30
12	3.00	3.25	3.25	3.85	7.95	7.15	4.15	.....	3.30
13	3.05	3.30	3.25	3.90	7.80	7.00	4.10	.....	3.30
14	3.10	3.15	3.25	3.90	7.90	6.90	4.10	.....	3.30
15	3.00	3.15	3.15	3.80	8.10	6.65	4.00	.....	3.05
16	3.05	3.30	3.10	3.70	8.20	6.50	4.00	.....	2.85
17	3.20	3.25	3.20	3.70	8.15	6.30	4.00	.....	2.80
18	3.15	3.25	3.25	3.80	7.95	6.10	4.15	.....	2.58
19	3.10	3.30	3.30	3.95	7.75	5.95	4.55	.....	3.05
20	3.15	3.20	3.30	4.15	7.25	5.80	4.60	.....	3.05
21	3.10	3.20	3.35	4.30	6.80	5.60	4.35	.....	3.05
22	2.90	3.30	3.35	4.65	6.35	5.50	4.20	.....	3.05
23	3.20	3.30	3.30	4.45	6.10	5.35	4.10	.....	2.95
24	3.05	3.20	3.30	4.20	5.95	5.35	4.00	.....	3.05
25	3.15	3.30	3.30	4.10	5.95	5.20	3.90	.....	3.25
26	3.05	3.30	3.30	4.10	6.30	5.10	3.90	.....	3.30
27	3.00	3.30	3.30	4.10	7.10	5.10	3.80	.....	3.23
28	2.95	3.20	3.30	4.25	7.50	5.00	.....	.....	3.28
29	3.10	.....	3.25	4.55	7.35	4.90	.....	.....	(b)
30	3.10	.....	3.15	4.90	7.45	4.95	.....	.....	(b)
31	3.10	.....	3.15	.....	7.65	.....	.....	.....	(b)

[a] Automatic register placed on July 28. Never worked satisfactorily. Cause of break in record.

[b] Wire on gage broken.

Rating table for Grand River at Glenwood Springs, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet*
3.0	650	4.4	1,969	5.8	5,109	7.2	9,996
3.2	775	4.6	2,242	6.0	5,769	7.4	10,763
3.4	920	4.8	2,584	6.2	6,430	7.6	11,546
3.6	1,079	5.0	2,968	6.4	7,104	7.8	12,340
3.8	1,266	5.2	3,392	6.6	7,800	8.0	13,154
4.0	1,485	5.4	3,881	6.8	8,522	8.2	13,980
4.2	1,722	5.6	4,466	7.0	9,254		

Estimated monthly discharge of Grand River at Glenwood Springs, Colo.

[Drainage area, 5,838 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	882	600	721	44,332	0.123	0.14
February	845	600	775	43,041	.133	.14
March	882	710	802	49,313	.138	.16
April	2,772	742	1,419	84,436	.244	.27
May	13,980	3,881	9,825	604,120	1.683	1.94
June	12,140	2,772	7,316	435,332	1.253	1.39
July 1 to 27	----------	----------	1,864	99,824	.321	.37
December 3 to 28	----------	----------	723	37,285	.124	.12

WHITE RIVER AT MEEKER, COLO.

This station was established by A. L. Fellows, May 24, 1901, about one-half of a mile above the town of Meeker, at a point where a wagon bridge crosses the stream on the ranch of L. F. Van Cleave. The gage rod consists of a vertical 2 by 4 inch timber nailed to the left abutment of the bridge on the downstream side. The bridge is marked every 5 feet. The initial point for soundings is at the rod at the left or south end of the bridge. The banks are so high that they are not liable to overflow; the channel is of rock and gravel, and seems permanent in its nature. Measurements are made from the lower side of the wagon bridge. The observer is L. F. Van Cleave, who reads the rod twice each day.

The following discharge measurements were made during 1902 by A. J. McCune and J. E. Field:

July 6: Gage height, 4.00 feet; discharge, 472 second-feet.
Oct. 17: Gage height, 2.55 feet; discharge, 342 second-feet.

Daily gage height, in feet, of White River at Meeker, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							
1	3.55	4.70	5.40	3.85	3.30	3.60	3.60
2	3.55	4.85	5.35	3.95	3.35	3.55	3.60
3	3.50	5.20	5.15	3.90	3.35	3.55	3.50
4	3.60	5.25	5.20	3.80	3.35	3.50	3.50
5	3.60	5.25	5.25	3.95	3.35	3.50	3.50
6	3.60	5.30	5.10	4.05	3.35	3.50	3.50
7	3.70	5.50	5.10	3.95	3.35	3.50	3.50
8	3.80	5.65	5.00	3.90	3.35	3.50	3.50
9	3.75	5.75	4.95	3.85	3.30	3.50	3.50
10	3.70	5.70	4.90	3.80	3.30	3.40	3.50
11	3.65	5.80	4.80	3.80	3.30	3.40	3.50
12	3.70	5.70	4.95	3.75	3.40	3.50	3.70
13	3.70	5.65	4.65	3.75	3.40	3.45	3.65
14	3.60	5.70	4.65	3.70	3.45	3.45	3.55
15	3.55	5.70	4.55	3.65	3.40	3.50	3.55
16	3.60	5.70	4.45	3.60	3.40	3.50	3.50
17	3.70	5.70	4.30	3.70	3.40	3.45	3.50
18	3.75	5.60	4.25	3.80	3.40	3.45	3.50
19	3.95	5.25	4.20	3.70	3.40	3.50	3.50
20	4.05	5.10	4.10	3.65	3.40	3.50	3.50
21	4.15	4.85	4.10	3.60	3.40	3.70	3.50
22	4.00	4.75	3.95	3.60	3.40	3.70	3.50
23	3.95	4.70	3.95	3.55	3.40	3.60	3.55
24	3.85	4.60	3.90	3.50	3.45	3.60	3.50
25	3.80	4.60	3.80	3.50	3.50	3.60	3.50
26	3.80	4.90	3.80	3.50	3.50	3.60	3.50
27	3.80	5.15	3.75	3.50	3.50	3.60	3.50
28	4.00	5.30	3.75	3.50	3.50	3.60	3.50
29	4.20	5.35	3.90	3.40	3.50	3.60	3.50
30	4.45	5.25	3.90	3.40	3.50	3.60	3.50
31	------	5.60	------	3.30	3.50	------	3.50

Rating table for White River at Meeker, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.7	300	3.4	372	4.2	523	5.6	2,614
2.8	308	3.5	384	4.4	594	5.8	3,284
2.9	317	3.6	397	4.6	696	6.0	4,034
3.0	327	3.7	412	4.8	845	6.2	4,834
3.1	337	3.8	429	5.0	1,100	6.4	5,634
3.2	348	3.9	448	5.2	1,514		
3.3	360	4.0	469	5.4	2,024		

Estimated monthly discharge of White River at Meeker, Colo.

[Drainage area, 634 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	616	384	433	25,765	0.68	0.76
May	3,284	696	1,927	118,487	3.04	3.50
June	2,024	420	843	50,162	1.33	1.48
July	481	360	414	25,456	.65	.75
August	384	360	372	22,873	.59	.68
September	412	372	389	23,147	.61	.68
October	412	384	387	23,796	.61	.70

UINTA RIVER AT OURAY SCHOOL, NEAR LELAND, UTAH.

This station was established November 8, 1899, and is located at the highway bridge over the river near the Ouray School. It is about 5 miles below the station at Fort Duchesne. Dry Gulch Creek enters from the west, and except during flood stages carries practically only the waste water of Canal No. 1 and the Bench ditch, thereby accounting for the increase in flow between this point and the Fort Duchesne station. The rod is nailed to the east end of the south crib of the wagon bridge. Bench mark No. 1 is the head of a nail in the extreme northeast corner of the bridge floor, and is at an elevation of 4,745.97 feet above sea; bench mark No. 2 is a nail in the flagstaff of the school, with an elevation of 4,760 feet. The elevation of the zero of the rod is 4,737.36 feet. During low water measurements are made, by wading, at a section 200 feet below the bridge, and at high stages they are made from the bridge itself. The section is a good one, although the center pier of the bridge will interfere somewhat with the accuracy of the results when measurements are taken there.

Discharge measurements of Uinta River at Ouray School, near Leland, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 27	C. T. Prall	0.56	122
April 5	do	.36	89
April 10	do	.31	81
April 17	do	.24	72
April 24	do	.39	95
May 1	do	.35	90
May 8	do	.69	144
May 15	do	2.65	919
May 22	do	1.60	397
May 29	do	3.50	2,224
June 5	do	2.85	1,143
June 12	do	2.32	732
June 18	do	1.70	426
June 26	do	1.20	285
July 3	do	1.22	278
July 10	do	.67	150
July 24	H. S. Reed	.24	75
July 31	do	.03	47
August 7	do	— .16	35
August 14	do	.03	51
August 21	do	— .12	36
August 28	do	.05	48
September 4	do	.06	52
September 11	do	— .08	35
September 18	do	.07	50
September 25	do	.33	81
October 2	do	.30	78
October 9	do	.33	84
October 23	do	.33	81
October 30	do	.40	87
November 7	do	.33	83
November 13	do	.60	119
November 20	do	.54	109
November 26	do	.15	60
December 4	do	.33	57
December 10	do	.63	104
December 19	do	.65	89

Daily gage height, in feet, of Uinta River at Ouray School, near Leland, Utah, for 1902.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	(a)	(a)	0.46	0.31	3.45	1.28	0.01	0.19	0.30	0.40	0.48
2				.36	.32	3.05	1.39	— .04	.15	.30	.50	.40
3				.38	.31	2.60	1.20	— .08	.11	.30	.40	.35
4				.38	.35	2.50	1.18	— .09	.08	.30	.38	.20
5				.36	.32	2.55	1.10	— .06	.01	.31	.40	.53
6				.38	.45	2.60	1.10	— .12	— .01	.33	.35	.52
7				.35	.51	2.60	1.00	— .14	— .02	.34	.35	.55
8				.40	.70	2.68	.85	— .17	— .03	.35	.37	.53
9				.40	.88	2.68	.70	— .19	— .03	.35	.39	.58
10				.38	1.33	2.50	.68	— .21	— .04	.34	.40	.60
11				.32	1.90	2.54	.60	— .23	— .06	.35	.....	.62
12				.35	2.24	2.40	.59	.00	— .08	.35	.72	.55
13				.38	2.35	2.20	.55	.05	— .09	.37	.63	.53
14				.31	2.50	2.10	.45	.01	— .11	.38	.45	.58
15				.31	2.75	2.00	.39	.06	— .11	.38	.50	.50
16				.27	2.55	1.85	.38	.07	.00	.38	.38	.20
17				.28	2.90	1.74	.40	— .01	.05	.37	.35	.22
18				.26	2.53	1.68	.48	— .05	.06	.35	.43	.30
19				.29	2.30	1.53	.40	— .12	.07	.35	.32	.52
20				.30	1.96	1.48	.36	— .03	.07	.38	.53	.72
21				.45	1.80	1.48	.32	— .02	1.80	.38	.51	(a)
22				.68	1.59	1.40	.28	— .13	.58	.36	.52	.....
23				.41	1.48	1.32	.28	— .14	.40	.35	.52	.....
24				.45	1.30	1.28	.25	— .15	.36	.33	.50	.....
25				.40	1.44	1.24	.20	— .12	.32	.33	.45	.....
26				.38	1.85	1.20	.20	— .10	.30	.33	.40	.....
27				.38	2.95	1.12	.15	— .11	.30	.35	.40	.....
28				.35	3.53	1.18	.12	.01	.30	.33	.42	.....
29				.32	3.75	1.50	.11	.18	.31	.38	.40	.....
30				.29	3.78	1.35	.08	.18	.30	.38	.40	.....
31				.....	3.60	.....	.05	.17	.....	.38	.....	.....

[a] River frozen.

Rating table for Uinta River at Ouray School, near Leland, Utah, for January 1 to December 1, 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
—0.2	30	1.0	210	2.2	660	3.4	2,040
— .1	35	1.1	240	2.3	720	3.5	2,200
.0	40	1.2	270	2.4	780	3.6	2,362
.1	54	1.3	300	2.5	850	3.7	2,524
.2	68	1.4	330	2.6	930	3.8	2,686
.3	82	1.5	360	2.7	1,010	3.9	2,848
.4	96	1.6	390	2.8	1,110	4.0	3,010
.5	110	1.7	430	2.9	1,240	4.1	3,172
.6	130	1.8	470	3.0	1,400	4.2	3,334
.7	150	1.9	510	3.1	1,560	4.3	3,496
.8	170	2.0	550	3.2	1,720	4.4	3,658
.9	190	2.1	600	3.3	1,880	4.5	3,820

[a] The daily discharges for December were obtained from the measurements by interpolation.

Estimated monthly discharge of Uinta River at Ouray School, near Leland, Utah.

[Drainage area, 967 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January [a]			110	6,764	0.11	0.13
February [a]			110	6,109	.11	.11
March [a]			100	6,149	.10	.12
April	146	76	92	5,457	.09	.10
May	2,653	84	740	45,484	.77	.89
June	2,120	246	651	39,029	.67	.75
July	327	47	132	8,148	.14	.16
August	65	30	40	2,467	.04	.05
September	470	34	72	4,284	.07	.08
October	94	78	89	5,460	.09	.10
November	154	57	97	5,780	.10	.11
December [a]	104	57	83	5,129	.09	.10
The year	2,653	30	193	140,296	.20	2.70

[a] Jan. 1 to Apr. 1, and Dec. 21-31, river frozen; quantities estimated.

DUCHESNE RIVER AT PRICE ROAD BRIDGE, UTAH.

The station on Duchesne River was established October 26, 1899, and is located 3 miles below the mouth of Lake Creek at the highway bridge on the stage road from Price to Fort Duchesne. The permanent gage rod was placed November 16, 1899, and is nailed to the east side of the center pier. Bench mark No. 1 is a wire nail in a log close to the rod, and is opposite the 7-foot mark. Bench mark No. 2 is a wire nail on the west side of the crib, with an elevation of 5.48 feet above gage datum. The section at this point is very good, with a moderate velocity of water. There is one pier in the center of the stream which does not materially affect the accuracy of the results at low water, but presumably will to a certain extent during the flood season.

Discharge measurements of Duchesne River at Price Road Bridge, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 21	C. T. Prall	5.23	294
March 28	do	5.25	307
April 4	do	5.32	331
April 11	do	5.56	438
April 18	do	6.28	1,065
April 25	do	5.93	665
May 2	do	6.05	820
May 9	do	6.45	1,157
May 16	do	7.50	2,357
May 23	do	6.75	1,402
May 30	do	8.85	5,011
June 6	do	8.30	3,750
June 13	do	7.55	2,484
June 20	do	6.70	1,329
June 27	do	6.20	926
July 5	do	6.08	820
July 11	Prall and Reed	5.75	572
July 19	H. S. Reed	5.50	435
July 25	do	5.40	389
August 1	do	5.22	284
August 9	do	5.12	242
August 15	do	5.35	361
August 22	do	5.15	225
August 29	do	5.22	274
September 5	do	5.02	194
September 12	do	5.00	189
September 19	do	5.10	222
September 26	do	5.22	250
October 3	do	5.22	277
October 10	do	5.22	261
October 18	do	5.25	273
October 24	do	5.25	283
October 31	do	5.25	264
November 14	do	5.28	268
November 21	do	5.30	296
November 28	do	5.35	309

Daily gage height, in feet, of Duchesne River at Price Road Bridge, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	(a)	(a)	(a)	5.26	6.05	8.80	6.10	5.20	5.13	5.25	5.28	(a)
2				5.27	6.13	8.25	6.13	5.15	5.10	5.25	5.28	
3				5.29	6.18	7.90	6.13	5.18	5.10	5.25	5.28	
4				5.30	6.21	7.90	6.14	5.18	5.10	5.25	5.28	
5				5.33	6.22	8.05	6.09	5.15	5.10	5.25	5.28	
6				5.38	6.24	8.10	6.07	5.13	5.10	5.20	5.28	
7				5.39	6.25	8.15	6.03	5.13	5.08	5.20	5.28	
8				5.47	6.28	8.25	5.88	5.13	5.00	5.20	5.29	
9				5.53	6.48	8.43	5.80	5.10	5.00	5.20	5.28	
10				5.56	6.63	8.45	5.75	5.13	4.96	5.20	5.28	
11			5.19	5.58	6.80	7.85	5.75	5.15	4.99	5.20	5.30	
12			5.20	5.60	7.04	7.60	5.73	5.18	5.00	5.20	5.30	
13			5.23	5.63	7.35	7.45	5.70	5.20	5.02	5.20	5.30	
14			5.21	5.70	7.33	7.38	5.68	5.45	5.05	5.20	5.30	
15			5.25	5.78	7.48	7.35	5.65	5.33	5.05	5.20	5.30	
16			5.27	5.85	7.50	7.10	5.65	5.25	5.08	5.20	5.30	
17			5.27	5.93	7.60	6.90	5.64	5.18	5.10	5.25	5.30	
18			5.26	6.30	7.63	6.75	5.60	5.18	5.10	5.25	5.30	
19			5.27	6.46	7.40	6.65	5.50	5.18	5.10	5.25	5.30	
20			5.28	6.64	7.25	6.68	5.50	5.18	5.10	5.25	5.32	
21			5.21	6.50	7.00	6.57	5.50	5.18	5.38	5.25	5.32	
22			5.21	6.21	6.83	6.55	5.50	5.15	5.39	5.28	5.32	
23			5.22	5.95	6.70	6.53	5.46	5.15	5.33	5.29	5.32	
24			5.22	5.90	6.65	6.50	5.42	5.15	5.35	5.30	5.32	
25			5.23	5.93	6.55	6.40	5.40	5.15	5.28	5.30	5.32	
26			5.24	6.00	6.80	6.31	5.40	5.15	5.25	5.28	5.32	
27			5.25	6.04	7.50	6.20	5.35	5.15	5.25	5.28	5.32	
28			5.25	6.08	7.88	6.19	5.33	5.18	5.25	5.28	5.32	
29			5.26	5.99	8.53	6.18	5.28	5.20	5.25	5.28	5.32	
30			5.24	6.05	8.80	6.14	5.25	5.20	5.25	5.28	5.32	
31			5.27		9.20		5.23	5.17		5.28		

(a) River frozen.

Rating table for Duchesne River at Price Road Bridge, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.0	200	6.4	1,120	7.8	2,840	9.2	5,820
5.2	280	6.6	1,320	8.0	3,160	9.4	6,280
5.4	380	6.8	1,520	8.2	3,550	9.6	6,740
5.6	500	7.0	1,760	8.4	3,980	9.8	7,200
5.8	630	7.2	2,000	8.6	4,440	10.0	7,660
6.0	780	7.4	2,240	8.8	4,900		
6.2	940	7.6	2,520	9.0	5,360		

Estimated monthly discharge of Duchesne River at Price Road Bridge, Utah.

[Drainage area, 2,746 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January [a]	----------	----------	280	17,217	0.10	0.12
February [a]	----------	----------	280	15,550	.10	.11
March [a]	----------	----------	291	17,875	.11	.13
April	1,360	304	656	39,035	.24	.27
May	5,820	820	1,969	121,069	.72	.83
June	4,900	892	2,239	133,235	.82	.91
July	892	292	555	34,138	.20	.23
August	410	240	273	16,804	.10	.12
September	374	184	258	15,364	.09	.10
October	320	280	297	18,288	.11	.13
November	332	312	322	19,152	.12	.13
December [a]	----------	----------	300	18,447	.11	.13
The year	5,820	184	644	466,174	.24	3.21

[a] Jan. 1 to Mar. 10 and Dec. 1-31 river frozen; quantities estimated.

LAKE CREEK AT WAGON BRIDGE (NEAR MOUTH), UTAH.

The permanent gage rod at this place consists of a 1-inch by 4-inch by 8-foot board nailed vertically to the west abutment on the lower side of the wagon bridge near the mouth of the creek. Bench mark No. 1 is a nail in the abutment opposite the 4.50-foot mark on the rod. Bench mark No. 2 is directly over the gage rod, and is the head of a wire nail in the southwest corner of the bridge upright. Its elevation is 5,066.58 feet. The elevation of the zero of the rod is 5,055.99 feet above sea level, according to the hydrographic survey datum. The elevation of bench mark No. 2 is 5,129 feet, referred to the topographic survey datum. The elevation of a regulation iron post bench mark, 150 feet east of the bridge, is 5,127.55 feet, referred to the latter datum. The bed of the stream is composed of medium-sized cobblestones and forms a fair section. During flood stages measurements are made from the bridge, but at other periods they are made by wading at a point about 400 feet below.

Discharge measurements of Lake Creek at wagon bridge (near mouth), Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 21	C. T. Prall	1.86	93
March 28	do	1.92	103
April 4	do	1.92	105
April 11	do	1.90	103
April 18	do	1.90	103
April 25	do	2.00	121
May 2	do	2.04	133
May 9	do	2.33	226
May 16	do	3.20	651
May 23	do	2.70	358
May 30	do	5.85	2,367
June 6	do	4.93	1,735
June 13	do	4.10	1,144
June 20	do	3.10	649
June 27	do	2.70	454
July 5	do	2.55	357
July 11	Prall and Reed	2.30	222
July 19	H. S. Reed	2.25	173
July 25	do	2.05	141
August 1	do	1.95	106
August 9	do	1.92	98
August 15	do	2.06	141
August 22	do	1.89	89
August 29	do	1.93	110
September 5	do	1.80	79
September 12	do	1.80	76
September 19	do	1.85	86
September 26	do	1.95	105
October 3	do	1.92	103
October 10	do	1.90	94
October 24	do	1.92	99
October 31	do	1.90	96
November 14	do	1.90	98
November 21	do	1.93	97
November 28	do	2.50	127
November 28	do	2.50	162
December 5	do	2.00	106
December 13	do	1.82	76

Daily gage height, in feet, of Lake Creek at wagon bridge (near mouth), Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	(a)	(a)	(a)					1.95				
2					2.04							
3										1.92		
4				1.92								
5							2.55		1.80			2.00
6						4.93						
7												
8											1.89	
9					2.33			1.92				
10										1.90		
11				1.90			2.30					
12									1.80			
13						4.10						1.82
14											1.90	(a)
15								2.06				
16					3.20							
17												
18				1.90								
19							2.25		1.85			
20			(a)			3.10						
21			1.86								1.93	
22								1.89				
23					2.70							
24										1.92		
25				2.00			2.05					
26									1.95			
27						2.70						
28			1.92								2.50	
29								1.93				
30					5.85							
31										1.90		

a River frozen.

Estimated monthly discharge of Lake Creek at wagon bridge.

[Drainage area, 475 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January [a]	----------	----------	90	5,534	0.19	0.22
February [a]	----------	----------	90	4,998	.19	.20
March [a]	----------	----------	97	5,937	.20	.23
April	130	103	109	6,512	.23	.26
May	2,700	132	718	44,168	1.51	1.74
June	3,000	418	1,238	73,700	2.61	2.91
July	406	110	220	13,500	.46	.53
August	141	89	108	6,650	.23	.27
September	105	76	88	5,232	.18	.20
October	104	94	97	5,994	.20	.23
November	162	96	109	6,512	.23	.26
December [a]	----------	----------	90	5,534	.19	.22
The year	3,000	76	264	184,271	.54	7.27

[a] Jan. 1 to Mar. 15 and Dec. 18 to 31, river frozen; quantities estimated.

NOTE.—The daily discharges were obtained from the discharge measurements by interpolation.

UINTA RIVER AT FORT DUCHESNE, UTAH.

This river, on its emergence from its canyon, spreads out in numerous channels over its flood plain until it reaches a point a short distance above Fort Duchesne, where its waters are collected into one channel. Whiterocks River enters some distance above this point. A number of canals for the use of the Indians divert water between Fort Duchesne and the agency. On the west side are a number of small ditches, which in the aggregate take considerable water; but the amount is difficult to estimate. On the east side are two principal ditches, known as Canal No. 1 and Bench ditch. This station was established September 14, 1899, in connection with the investigation of the water supply for the Uinta Indian Reservation, and is located at the highway bridge at the fort. The permanent rod was established November 8, 1899, and is nailed to the southern end of the east crib of the new bridge. The bench mark is a nail is the southeast crib in the first header above the bottom and is at an elevation of 4,910.13 feet. The elevation of the zero of the rod is 4,907.20 feet.

Discharge measurements of Uinta River at Fort Duchesne, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 3	C. T. Prall	(a)	134
January 9	do		123
January 16	do		126
February 6	do		133
February 13	do		129
February 20	do		125
February 27	do		145
March 7	do	2.70	111
March 12	do	2.68	119
March 20	do	2.66	113
March 26	do	2.70	123
April 5	do	2.65	104
April 9	do	2.60	93
April 16	do	2.54	76
April 23	do	2.65	109
April 30	do	2.57	87
May 7	do	2.72	131
May 14	do	3.90	898
May 21	do	3.42	429
May 28	do	4.33	1,693
June 5	do	4.05	1,125
June 11	do	3.92	928
June 18	do	3.35	407
June 25	do	3.12	281
July 2	do	3.18	312
July 9	do	2.88	186
July 18	Prall and Reed	2.80	138
July 23	H. S. Reed	2.67	93
July 30	do	2.50	56
August 7	do	2.40	40
August 14	do	2.50	59
August 21	do	2.36	32
August 28	do	2.43	43
September 4	do	2.40	38
September 11	do	2.30	24
September 18	do	2.42	38
September 21	do	3.10	304
September 25	do	2.55	69
October 2	do	2.52	65

(a) Ice.

Discharge measurements of Uinta River at Fort Duchesne, Utah—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
October 8	H. S. Reed	2.55	67
October 22	do	2.55	70
October 30	do	2.58	66
November 5	do	2.61	77
November 12	do	2.80	151
November 19	do	2.70	114
November 26	do	2.62	65
December 3	do	2.60	56
December 9	do	2.81	105
December 19	do	2.90	83
December 26	do	.....	92

Daily gage height, in feet, of Uinta River at Fort Duchesne, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	(a)	(a)	2.60	2.75	2.60	4.30	3.14	2.45	2.47	2.52	2.58	2.60
2	.....	.....	2.60	2.65	2.62	4.05	3.17	2.43	2.45	2.52	2.58	2.60
3	.....	.....	2.53	2.64	2.65	3.90	3.09	2.41	2.42	2.52	2.55	2.60
4	.....	.....	2.48	2.63	2.68	3.95	3.05	2.40	2.41	2.52	2.59	2.53
5	.....	.....	2.53	2.63	2.72	3.98	3.03	2.40	2.39	2.53	2.60	2.60
6	.....	.....	2.60	2.63	2.75	3.95	3.00	2.40	2.37	2.53	2.60	2.70
7	.....	.....	2.85	2.63	2.75	3.93	2.98	2.40	2.35	2.53	2.60	2.75
8	.....	.....	2.85	2.63	2.85	3.93	2.93	2.40	2.35	2.54	2.62	2.80
9	.....	.....	2.83	2.62	2.99	4.03	2.87	2.40	2.35	2.55	2.62	2.80
10	.....	.....	2.80	2.60	3.26	3.85	2.85	2.38	2.35	2.55	2.62	2.80
11	.....	.....	2.74	2.58	3.48	3.74	2.83	2.37	2.35	2.55	2.73	2.80
12	.....	.....	2.68	2.58	3.74	3.73	2.81	2.50	2.37	2.58	2.78	2.80
13	.....	.....	2.70	2.58	3.68	3.70	2.80	2.50	2.38	2.58	2.67	2.62
14	.....	.....	2.68	2.58	3.85	3.68	2.77	2.50	2.38	2.58	2.68	2.57
15	.....	.....	2.66	2.56	3.94	3.58	2.74	2.48	2.38	2.58	2.68	2.53
16	.....	.....	2.68	2.54	4.00	3.48	2.72	2.45	2.40	2.57	2.64	2.48
17	.....	.....	2.68	2.53	4.08	3.42	2.78	2.43	2.40	2.56	2.65	2.48
18	.....	.....	2.68	2.54	3.80	3.38	2.79	2.40	2.40	2.56	2.68	2.66
19	.....	.....	2.65	2.55	3.60	3.29	2.73	2.40	2.43	2.56	2.70	2.80
20	.....	.....	2.65	2.60	3.53	3.25	2.70	2.38	2.45	2.56	2.70	2.80
21	.....	.....	2.65	2.70	3.39	3.24	2.70	2.38	2.98	2.56	2.70	(a)
22	.....	.....	2.65	2.80	3.31	3.20	2.68	2.35	2.58	2.56	2.70	.....
23	.....	.....	2.65	2.68	3.26	3.17	2.65	2.32	2.52	2.56	2.70	.....
24	.....	.....	2.68	2.66	3.19	3.11	2.63	2.36	2.52	2.56	2.70	.....
25	.....	.....	2.70	2.65	3.30	3.10	2.62	2.38	2.52	2.58	2.70	.....
26	.....	.....	2.70	2.60	3.50	3.10	2.62	2.38	2.52	2.58	2.62	.....
27	.....	.....	2.70	2.60	4.03	3.10	2.59	2.35	2.52	2.58	2.62	.....
28	.....	.....	2.72	2.60	4.48	3.10	2.57	2.43	2.52	2.60	2.62	.....
29	.....	.....	2.65	2.60	4.45	3.11	2.51	2.50	2.52	2.60	2.62	.....
30	.....	.....	2.65	2.58	4.43	3.12	2.50	2.50	2.52	2.60	2.62	.....
31	.....	.....	2.70	.....	4.44	.....	2.47	2.49	.....	2.60	.....	.....

[a] River frozen.

Rating table for Uinta River at Fort Duchesne, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.3	20	3.2	320	4.1	1,230	5.0	3,064
2.4	40	3.3	370	4.2	1,432	5.1	3,268
2.5	60	3.4	420	4.3	1,636	5.2	3,472
2.6	92	3.5	500	4.4	1,840	5.3	3,676
2.7	126	3.6	580	4.5	2,044	5.4	3,880
2.8	160	3.7	660	4.6	2,248	5.5	4,084
2.9	200	3.8	770	4.7	2,452		
3.0	240	3.9	890	4.8	2,656		
3.1	280	4.0	1,050	4.9	2,860		

Estimated monthly discharge of Uinta River at Fort Duchesne, Utah.

[Drainage area, 672 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.	
1902.							
January [a]	----------	----------	125	7,686	0.19	0.22	1.70
February [a]	----------	----------	130	7,220	.19	.20	.05
March	180	56	118	7,252	.18	.21	.14
April	160	70	98	5,857	.15	.17	.70
May	2,002	92	662	40,703	.99	1.14	.30
June	1,636	280	622	37,012	.93	1.04	.50
July	308	54	158	9,729	.24	.28	.05
August	60	24	43	2,676	.06	.07	.00
September	232	30	54	3,217	.08	.09	1.45
October	92	66	79	4,852	.12	.14	.00
November	153	60	102	6,052	.15	.17	.00
December [a]	----------	----------	85	5,205	.13	.15	.00
The year	2,002	24	190	137,461	.28	3.88	4.89

[a] January 1 to March 1 and December 21 to 31, river frozen; quantities estimated.

NOTE.—Daily discharges from November 26 to December 31 were obtained from the discharge measurements by interpolation.

UINTA RIVER NEAR WHITEROCKS, UTAH.

During the fall of 1899 an investigation of the water supply of the Uinta Indian Reservation was begun by Cyrus C. Babb, and in this connection a number of gaging stations were established. Uinta River emerges from its canyon about 10 miles northwest of the Indian agency at Whiterocks, and at this point a gaging station was established September 16, 1899. The gage rod is a 2 by 4 inch timber, 12 feet long, bolted to two trees on the left bank of the stream. The bench mark is a nail in an aspen tree 125 feet north of the rod, and its elevation is 8.93 feet above gage datum. During flood stages discharge measurements are made by means of a car and cable, but at ordinary stages they are made by wading. The bed of the stream is rocky and strewn with large bowlders, and the station is not altogether satisfactory, on account of the roughness of the channel. During high water the velocity undoubtedly will be great, owing to the rapid fall of the water. A few hundred yards above the station an important tributary comes in from the east. At the present location a second channel has to be measured, but it will never carry a large volume of water. Farther down the stream a number of larger channels are formed, so that it is difficult to obtain a satisfactory station.

Discharge measurements of Uinta River near Whiterocks, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 6	C. T. Prall	0.90	126
January 13	do	.85	144
February 10	do	.90	128
February 17	do	.65	124
February 24	do	.65	123
March 3	do	1.00	160
March 10	do	.75	123
March 17	do	.85	152
March 24	do	.75	126
March 31	do	.90	178
April 7	do	.80	144
April 14	do	.76	129
April 21	do	.92	179
April 28	do	.82	148
May 5	do	.92	179
May 12	do	1.70	538
May 19	do	1.60	507

Discharge measurements of Uinta River near Whiterocks, Utah—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
May 26	C. T. Prall	1.73	536
June 3	do	2.00	790
June 9	do	2.13	920
June 16	do	1.75	622
June 23	do	1.55	431
June 30	do	1.45	379
July 7	do	1.30	303
July 14	C. T. Prall and H. S. Reed	1.20	251
July 21	H. S. Reed	1.10	217
July 28	do	1.10	195
August 4	do	1.05	182
August 11	do	1.05	191
August 19	do	1.00	177
August 25	do	.97	167
September 1	do	1.00	171
September 8	do	.95	160
September 15	do	.93	160
September 22	do	1.00	177
September 29	do	.95	168
October 6	do	.93	161
October 20	do	.93	149
October 27	do	.90	142
November 3	do	.90	139
Do	do	.90	132
November 10	do	.90	137
November 17	do	.93	140
November 24	do	.90	147
December 1	do	1.07	124
December 17	do	1.28	92
December 23	do	.85	109
December 30	do	1.50	68

Daily gage height, in feet, of Uinta River near Whiterocks, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1									1.00			1.07
2												
3			1.00			2.00					0.90	
4								1.05				
5					0.92							
6	0.90									0.93		
7				0.80			1.30					
8									.95			
9						2.13						
10		0.90	.75								.90	
11								1.05				
12					1.70							
13	.85											
14				.76			1.20					
15									.93			
16						1.75						
17		.65	.85								.93	1.28
18												
19					1.60			1.00				
20										.93		
21				.92			1.10					
22									1.00			
23						1.55						.85
24		.65	.75								.90	
25								.97				
26					1.73							
27										.90		
28				.82			1.10					
29									.95			
30						1.45						1.50
31			.90									

Estimated monthly discharge of Uinta River near Whiterocks, Utah. [a]

[Drainage area, 218 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	144	123	136	8,360	0.62	0.71
February	143	123	127	7,083	.58	.60
March	178	123	144	8,837	.66	.76
April	185	129	154	9,164	.71	.79
May	1,200	160	555	34,114	2.55	2.94
June	1,000	379	665	39,579	3.05	3.40
July	430	190	262	16,132	1.20	1.38
August	200	167	181	11,144	.83	.96
September	177	160	167	9,923	.77	.86
October	166	140	152	9,364	.70	.81
November	147	125	139	8,269	.64	.71
December	----------	----------	125	7,686	.57	.66
The year	1,200	123	235	169,655	1.07	14.58

[a] Daily discharges were obtained from the discharge measurements by interpolation.

WHITEROCKS RIVER NEAR WHITEROCKS, UTAH.

A gaging station was established in the canyon of this river about 10 miles above the United States Indian agency at Whiterocks on September 15, 1899, by Cyrus C. Babb, in connection with the investigation of a water supply for the Uinta Indian Reservation. The gage rod consists of a 2 by 4 inch by 12 foot timber bolted to the triple trunk of a tree on the left bank of the stream. The bench mark is a nail in a burnt tree 50 feet east of the rod, and is at an elevation of 10.12 feet above gage datum. During flood stages discharge measurements are made from a car and cable 200 feet above the gage rod. At ordinary stages they are made by wading. The bed of this river is rocky, is strewn with large bowlders, and although permanent in character is not altogether satisfactory because of the fact that it is impossible to obtain accurate soundings.

Discharge measurements of Whiterocks River near Whiterocks, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 7	C. T. Prall	0.80	52
January 14	do	.90	48
February 11	do	.70	39
February 18	do	.75	40
February 25	do	.70	47
March 4	do	1.10	44
March 11	do	.70	47
March 18	do	.70	47
April 1	do	.78	56
April 8	do	.78	54
April 15	do	.72	46
April 22	do	.86	66
April 29	do	.88	66
May 6	do	1.12	101
May 13	do	2.10	429
May 20	do	1.75	293
May 27	do	2.75	851
June 4	do	2.20	490
June 10	do	2.00	425
June 17	do	1.70	276
June 24	do	1.40	169
July 1	do	1.40	166
July 8	do	1.23	133
July 15	Prall and Reed	1.05	91
July 22	H. S. Reed	1.03	77
July 29	do	1.00	78
August 5	do	.97	68
August 12	do	1.00	70
August 18	do	.95	64
August 26	do	.90	63
September 2	do	.93	61
September 9	do	.87	49
September 16	do	.90	51
September 23	do	1.00	67
September 30	do	.90	59
October 7	do	.87	56
October 21	do	.85	51
October 28	do	.83	47
November 4	do	.80	46

Discharge measurements of Whiterocks River near Whiterocks, Utah—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
November 11	H. S. Reed	0.95	63
November 18	do	.90	48
November 25	do	.78	38
December 2	do	2.15	41
December 18	do	1.92	52
December 24	do	.85	40
December 31	do	.85	39

Daily gage height, in feet, of Whiterocks River near Whiterocks, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1				0.78			1.40					
2									0.93			2.15
3												
4			1.10			2.20					0.80	
5								0.97				
6					1.12							
7	0.80									0.87		
8				.78			1.23					
9									.87			
10						2.00						
11		0.70	.70								.95	
12								1.00				
13					2.10							
14	.90											
15				.72			1.05					
16									.90			
17						1.70						
18		.75	.70					.95			.90	1.92
19												
20					1.75							
21										.85		
22				.86			1.03					
23									1.00			
24						1.40						.85
25		.70									.78	
26								.90				
27					2.75							
28										.83		
29				.88			1.00					
30									.90			
31												.85

Estimated monthly discharge of Whiterocks River near Whiterocks, Utah.[a]

[Drainage area, 114 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	54	41	48	2,924	0.42	0.48
February	47	39	41	2,297	.36	.37
March	55	44	48	2,955	.42	.48
April	71	46	57	3,416	.50	.56
May	1 100	76	471	28,947	4.13	4.77
June	900	166	348	20,704	3.05	3.40
July	200	77	109	6,684	.96	1.11
August	76	62	67	4,094	.59	.68
September	67	49	57	3,410	.50	.56
October	59	47	53	3,255	.46	.53
November	63	38	48	2,830	.42	.47
December	52	39	44	2,705	.39	.45
The year	1,100	38	116	84,221	1.02	13.86

[a] Daily discharges were obtained from the discharge measurements by interpolation.

ASHLEY CREEK NEAR VERNAL, UTAH.

This stream drains an area directly east of the Uinta Basin. About 7½ miles above the town of Vernal the river appears from its canyon, and within the next few miles a series of canals divert its low-water flow, which is applied to the adjacent lands—Vernal Valley—which are extensively irrigated. A gaging station was established in the canyon of this stream on March 15, 1900, by C. T. Prall. It is located at the ranch of the observer, E. Marett. The gage is a vertical rod, painted white, fastened to the west side of the single pier of the wagon bridge.

The bench mark at this station was originally at the 4-foot mark, being a 20-penny nail driven into the pier at that point, but owing to the settling of the upper stringers of the pier the upper fastenings to the gage rod pulled out and the bench mark has dropped one-tenth of a foot, so that in the fall of 1902 it was opposite the 3.90-foot mark.

The gage readings have not been disturbed as the bottom upon which the lower stringers rests, to which the rod is fastened, is of a very permanent character.

The channel is straight for a distance above and below the bridge and the bed is rocky. At high stages two other channels discharge a portion of the water and these also have to be measured.

The three principal canals diverting water from Ashley Creek below the gaging station are, in order downstream, Upper Ashley canal, Rock Point canal, and Central Ashley canal.

Discharge measurements of Ashley Creek near Vernal, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 14	C. T. Prall	0.60	46.0
July 16	H. S. Reed	1.00	104.0
November 6	do	.60	43.0
December 12	do	.60	40.0

Daily gage height, in feet, of Ashley Creek near Vernal, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	0.65	0.60	0.60	0.55	1.95	2.80	1.23	0.75	0.70	0.70	0.65	0.60
2	.60	.60	.60	.55	2.55	2.45	1.25	.70	.70	.70	.60	.60
3	.60	.60	.60	.55	2.45	2.35	1.20	.70	.70	.70	.60	.60
4	.60	.60	.60	.55	2.30	2.30	1.20	.70	.70	.70	.60	.60
5	.60	.60	.60	.55	2.20	2.30	1.20	.70	.70	.70	.60	.60
6	.60	.60	.60	.58	2.30	2.20	1.15	.70	.70	.70	.60	.60
7	.60	.60	.60	.60	2.10	2.10	1.15	.70	.65	.70	.60	.60
8	.60	.60	.60	.63	2.30	2.05	1.10	.70	.65	.70	.60	.60
9	.60	.60	.60	.65	2.50	2.03	1.10	.70	.65	.70	.60	.60
10	.60	.60	.60	.65	2.50	1.95	1.10	.70	.65	.70	.60	.60
11	.60	.60	.60	.65	2.60	1.95	1.05	.70	.60	.70	.70	.60
12	.60	.60	.60	.63	2.55	1.90	1.05	.73	.60	.70	.70	.60
13	.60	.60	.60	.60	2.60	1.83	1.00	.75	.60	.70	.65	.60
14	.60	.60	.60	.60	3.05	1.73	1.00	.75	.60	.65	.60	.60
15	.60	.60	.60	.60	2.90	1.68	1.00	.70	.60	.65	.60	.60
16	.60	.60	.55	.60	2.95	1.65	1.00	.70	.60	.65	.60	.60
17	.60	.60	.55	.63	2.85	1.60	1.00	.70	.60	.65	.60	.60
18	.60	.60	.55	.75	2.40	1.55	1.00	.70	.60	.65	.60	.60
19	.60	.60	.55	1.25	2.20	1.50	1.00	.70	.60	.65	.60	.60
20	.60	.60	.55	1.30	2.10	1.45	.95	.70	.70	.65	.60	.60
21	.60	.60	.55	1.10	2.00	1.45	.95	.70	.80	.65	.60	.60
22	.60	.60	.55	.98	1.90	1.38	.90	.70	.75	.65	.60	.60
23	.60	.60	.55	.85	1.80	1.33	.90	.70	.70	.65	.60	.60
24	.60	.60	.55	.80	1.80	1.30	.85	.70	.70	.65	.60	.60
25	.60	.60	.55	.80	1.80	1.30	.85	.70	.70	.65	.60	.60
26	.60	.60	.55	.73	2.25	1.25	.80	.70	.70	.65	.60	.60
27	.60	.60	.55	.83	3.15	1.20	.80	.70	.70	.65	.60	.60
28	.60	.60	.55	.95	3.50	1.20	.80	.70	.70	.65	.60	.60
29	.60	------	.55	1.40	3.25	1.30	.80	.70	.70	.65	.60	.60
30	.60	------	.55	1.80	2.95	1.30	.80	.70	.70	.65	.60	.60
31	.60	------	.55	------	3.00	------	.75	.70	------	.65	------	.60

Rating table for Ashley Creek near Vernal, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	37	1.4	202	2.3	474	3.2	774
.6	45	1.5	230	2.4	506	3.3	810
.7	55	1.6	258	2.5	538	3.4	846
.8	69	1.7	286	2.6	570	3.5	882
.9	85	1.8	315	2.7	602	3.6	918
1.0	106	1.9	346	2.8	636	3.7	954
1.1	128	2.0	378	2.9	670	3.8	990
1.2	152	2.1	410	3.0	704		
1.3	176	2.2	442	3.1	738		

Estimated monthly discharge of Ashley Creek near Vernal, Utah.

[Drainage area, 250 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.		Rainfall, in inches, at Vernal 7¼ miles south.
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.	
1902.							
January	50	45	45	2,777	0.18	0.21	0.21
February	45	45	45	2,498	.18	.19	.51
March	45	40	42	2,608	.17	.20	.86
April	315	40	78	4,665	.31	.35	.72
May	882	315	533	32,765	2.13	2.46	.42
June	636	152	306	18,226	1.22	1.36	.51
July	164	62	108	6,627	.43	.50	.12
August	62	55	56	3,429	.22	.25	.46
September	69	45	52	3,096	.21	.23	.99
October	55	50	52	3,103	.21	.24	.05
November	55	45	46	2,737	.18	.20	1.12
December	45	45	45	2,767	.18	.21	.97
The year	882	40	117	85,298	.47	6.40	6.94

YAMPA RIVER AT CRAIG, COLO.

This station was established by A. L. Fellows May 25, 1901, at the wagon bridge about 1 mile southwest from Craig, Colo., this point being selected as the most suitable station on Yampa River. The gage consists of a vertical 2 by 4 inch timber fastened to the south abutment of the bridge on the downstream side, the rod being marked in feet and tenths vertically. The wagon bridge is marked every 6 feet. The channel is deep at this point, and at low stages the current is sluggish, but measurements give good results, as the channel changes but little. The observer is H. Jones, of Craig, who reads the rod daily.

The following discharge measurements were made during 1902 by A. J. McCune and J. E. Field:

July 7: Gage height, 3.50 feet; discharge, 987 second-feet.
October 15: Gage height, 2.30 feet; discharge, 243 second-feet.

Daily gage height, in feet, of Yampa River at Craig, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.
1902.						
1	2.60	6.10	7.90	3.60	2.10	1.90
2	2.80	6.80	7.10	3.50	2.00	1.90
3	2.80	7.30	6.80	3.30	2.00	1.90
4	2.90	7.50	7.00	3.40	2.00	1.90
5	2.90	7.70	7.10	3.20	1.90	(a)
6	3.00	7.50	6.90	3.30	1.90	.....
7	3.00	7.30	6.90	3.30	1.90	.....
8	3.20	7.00	6.90	3.20	1.90	.....
9	3.30	7.50	7.00	3.10	1.90	.....
10	3.50	7.65	6.70	3.00	1.90	.....
11	3.60	7.85	6.50	2.90	1.90	.....
12	3.60	7.80	6.40	2.80	1.90	.....
13	3.60	7.50	6.20	2.70	1.90	.....
14	3.70	7.60	5.90	2.70	1.90	.....
15	3.80	7.70	5.60	2.60	1.90	.....
16	3.70	7.80	5.30	2.50	1.90	.....
17	4.00	8.00	5.10	2.40	1.90	.....
18	4.40	7.50	4.90	2.40	1.90	.....
19	4.90	7.00	4.70	2.40	1.90	.....
20	5.30	6.60	4.50	2.50	1.90	.....
21	5.40	6.00	4.30	2.60	1.90	.....
22	5.10	5.70	4.10	2.50	1.90	.....
23	5.00	5.40	3.90	2.50	1.90	.....
24	4.80	5.20	3.90	2.40	1.80	.....
25	4.70	5.40	3.70	2.40	1.80	.....
26	4.80	5.30	3.60	2.30	1.80	.....
27	4.90	7.00	3.40	2.30	1.90	.....
28	5.00	7.40	3.30	2.30	1.90	.....
29	5.20	7.10	3.60	2.30	2.00	.....
30	5.70	7.50	3.60	2.20	2.00	.....
31	.....	7.20	.....	2.20	1.90	.....

(a) No observer.

Rating table for Yampa River at Craig, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
1.8	90	3.4	906	5.0	2,985	6.6	5,891
2.0	136	3.6	1,081	5.2	3,320	6.8	6,285
2.2	198	3.8	1,285	5.4	3,664	7.0	6,683
2.4	276	4.0	1,520	5.6	4,016	7.2	7,086
2.6	370	4.2	1,780	5.8	4,376	7.4	7,494
2.8	480	4.4	2,058	6.0	4,744	7.6	7,904
3.0	606	4.6	2,352	6.2	5,120	7.8	8,316
3.2	748	4.8	2,662	6.4	5,502	8.0	8,728

Estimated monthly discharge of Yampa River at Craig, Colo.

[Drainage area, 1,730 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	4,195	370	1,797	106,929	1.04	1.16
May	8,728	3,320	6,722	413,320	3.89	4.48
June	8,522	825	3,969	236,172	2.29	2.55
July	1,081	198	479	29,452	.28	.32
August	165	90	115	7,071	.07	.08

GREEN RIVER AT GREENRIVER, WYO.

The gaging station at Greenriver, Wyo., is at the crossing of the Union Pacific Railroad. It was established May 2, 1895, at the pump house of the Union Pacific Railroad Company. The rod is fastened to a pile near the east end of the bridge. The bench mark consists of a cross on the third step from the bottom on the south end of the east abutment, and is 12.48 feet above gage datum. As the section under the railroad bridge is poor, discharge measurements are made from the iron highway bridge about one-half mile below. The station was temporarily discontinued during the latter part of 1900 and for part of 1901.

During 1902 the following discharge measurements were made by A. J. Parshall:

March 31: Gage height, 0.48 feet; discharge, 307 second-feet.
April 9: Gage height, 0.85 feet; discharge, 696 second-feet
April 18: Gage height, 0.98 feet; discharge, 797 second-feet.
May 3: Gage height, 1.15 feet; discharge, 958 second-feet.
May 28: Gage height, 2.20 feet; discharge, 2,244 second-feet.

Daily gage height, in feet, of Green River, at Greenriver, Wyo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	0.50	1.15	4.12	3.05	1.75	1.10	0.55	0.45
2	.50	1.15	4.22	3.00	1.70	1.05	.55	.....
3	.50	1.20	4.27	2.95	1.67	1.05	.55	.....
4	.45	1.15	3.90	2.95	1.60	1.05	.55	.....
5	.45	1.10	3.55	2.97	1.55	1.00	.50	.....
6	.53	1.05	3.47	2.97	1.58	1.00	.50	.....
7	.65	1.00	3.55	2.88	1.50	.97	.50	.....
8	.80	1.00	3.67	2.77	1.45	.95	.50	.....
9	.95	1.00	3.77	2.68	1.40	.95	.50	.....
10	1.00	1.03	3.95	2.57	1.35	.90	.50	.....
11	1.00	1.13	4.20	2.48	1.35	.90	.50	.....
12	.95	1.38	4.50	2.32	1.30	.80	.50	.....
13	.90	1.55	4.75	2.23	1.30	.80	.50	.....
14	.90	1.78	4.67	2.12	1.25	.73	.50	.....
15	.95	1.88	4.57	2.10	1.30	.72	.50	.....
16	1.00	2.08	4.48	2.03	1.30	.75	.50	.....
17	.95	2.35	4.25	2.00	1.30	.70	.50	.....
18	.95	2.60	3.95	2.05	1.25	.68	.50	.....
19	1.10	2.77	3.67	2.12	1.25	.65	.50	.....
20	1.25	2.75	3.47	2.15	1.23	.60	.50	.....
21	1.40	2.70	3.33	2.15	1.20	.95	.50	.....
22	1.40	2.55	3.12	2.10	1.20	1.00	.50	.....
23	1.45	2.42	3.07	2.05	1.20	.95	.50	.....
24	1.50	2.33	3.00	2.00	1.80	.75	.50	.....
25	1.48	2.15	3.03	1.95	2.00	.65	.50	.....
26	1.48	2.05	3.13	1.90	2.20	.60	.50	.....
27	1.28	2.08	3.17	1.85	2.20	.60	.45	.....
28	1.20	2.25	3.25	1.85	2.20	.60	.45	.....
29	1.20	2.85	3.25	1.80	1.65	.57	.45	.....
30	1.20	3.60	3.12	1.80	1.10	.55	.45	.....
31	.....	3.98	.....	1.80	1.10	.....	.45	.....

Rating table for Green River at Greenriver, Wyo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	30	1.2	1,055	2.3	2,430	3.4	5,822
.2	90	1.3	1,165	2.4	2,630	3.5	6,188
.3	160	1.4	1,275	2.5	2,860	3.6	6,554
.4	240	1.5	1,385	2.6	3,130	3.7	6,920
.5	330	1.6	1,495	2.7	3,410	3.8	7,286
.6	430	1.7	1,605	2.8	3,700	3.9	7,652
.7	530	1.8	1,720	2.9	4,030	4.0	8,018
.8	635	1.9	1,845	3.0	4,375	4.5	9,848
.9	740	2.0	1,975	3.1	4,725	5.0	11,678
1.0	845	2.1	2,110	3.2	5,090		
1.1	950	2.2	2,260	3.3	5,456		

Estimated monthly discharge of Green River at Greenriver, Wyo.

[Drainage area, 7,450 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	1,385	285	844	50,153	0.11	0.12
May	7,925	845	2,262	138,845	.30	.35
June	10,763	4,375	7,104	419,990	.95	1.06
July	4,550	1,720	2,673	164,043	.36	.42
August	2,260	950	1,387	85,130	.19	.22
September	950	380	656	38,937	.09	.10
October	380	285	329	20,206	.04	.05

Miscellaneous measurements in the Colorado River drainage basin.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
1902.				*Sec. feet.*
November 19	W. D. Smith	Gila River	Near mouth	25
November 25	do	do	do	836
December 18	do	do	do	2,109
December 24	do	do	do	238
November 14	S. G. Bennett	Imperial Canal	International boundary	374
December 14	W. D. Smith	do	do	494
October 13	J. E. Field	Yampa	Steamboat Springs, Colo.	112
October 16	do	Williams Fork	Hamilton, Colo	47
October 11	do	Grand	Near Piney Creek	488
October 13	do	Elk River	Trull, Colo.	147
October 14	do	Yampa	Hayden, Colo	235
July 7	A. J. McCune	Williams Fork		136
July 10	do	Snake	Near Dixon	253
October 11	J. E. Field	Rock Creek	Near McCoy's ranch	11
July 13	W. P. Edwards	Lathos Creek	At mouth	15
July 13	do	Taylor River	Clarke's ranch	259
July 13	do	Spring Creek	Near Gunnison, Colo.	19
July 14	do	Cebolla	Between Spencer and Dubois	67
July 15	do	Lake Fork	Carr's ranch	171
July 15	do	Pine Creek	Near Gate View	13
July 15	do	Little Blue Creek	At mouth	9
July 15	do	do	Above junction	18
July 15	do	Little Cimarron Creek.	At mouth	16
July 15	do	Cimarron River	At Cimarron, Colo	119
March 21	A. L. Fellows	Mancos River	Mancos	18
July 12	do	do	do	5
July 17	do	Uncompahgre	Fort Crawford, Colo	63

INTERIOR BASIN.

Under this head is comprised the large extent of arid country which includes nearly the whole of Nevada, the northern and western parts of Utah, and small portions of California and Idaho. Having no outlet to the sea, the entire drainage of this vast basin is lost mainly through evaporation from the numerous lakes and sinks in which the waters of the rivers collect.

The largest of the lakes is Great Salt Lake, which receives the waters of that portion of the basin lying in northern Utah and Idaho. Southwestern Utah drains into Sevier Lake. Other important lakes are Humboldt, Pyramid, Winnemucca, Carson, and Walker, all in western Nevada. These lakes receive the basin drainage from Nevada and California. The principal rivers in this section are as follows:

Bear River has its source on the northern slope of the Uinta Mountains in the northeastern part of Utah, and after a circuitous course, in which it leaves Utah and enters Wyoming, reenters Utah, appears again in Wyoming, then in Idaho, and reenters Utah, it finally discharges its waters into Great Salt Lake. Considerable irrigation is practiced on certain portions of the river. Logan River empties into Bear River in Cache Valley, Utah. Blacksmith Fork is a tributary of Bear River from the western slope of the Wasatch Range.

Weber River rises in the high country east of the Wasatch Mountains. Passing through that range, it appears in the plains region in the vicinity of Ogden, where, after receiving the waters of Ogden River, it discharges into Great Salt Lake. There are a number of good reservoir sites on its upper tributaries, some of which have been utilized within the last year.

Provo River rises on the western slope of the Uinta Mountains and after receiving a number of tributaries enters what is known as Heber Valley, where considerable irrigation is practiced. After crossing this valley it passes through the Wasatch Mountains in a picturesque canyon, and finally enters Utah Valley, where its summer flow is completely diverted for irrigation purposes. Its flood waters discharge into Utah Lake.

Sevier River drains a large area in the southwestern part of Utah. It flows northerly until it enters Juab County, then makes a short bend and flows southwest into Sevier Lake. San Pitch River joins Sevier River near Gunnison, Utah.

Humboldt River rises in the extreme northeastern part of Nevada and flows in a general westerly and southerly direction, finally entering Humboldt Lake, whence its waters find their way into the Humboldt and Carson Sink. The general direction of the mountain ranges of this basin is north and south, crossed at nearly right

angles by the main Humboldt River. The tributaries flow in the general direction of the mountain ranges, and drain either to the north or to the south. During low stages the water of the river is almost wholly diverted. For the future development of the country recourse must be had to the construction of storage reservoirs. Of its tributaries, the North Fork enters it west of Peko, Nev., and the South Fork enters it about 10 miles below Elko, Nev.

Pine Creek is a tributary from the south and joins it near Palisade, Nev. Marys River is one of the headwater tributaries of the Humboldt.

Walker River is formed by two branches which have their sources across the Nevada-California boundary, in California. It flows north and then takes a sharp bend to the southeast, emptying into Walker Lake.

Carson River has its source on the slopes of the Sierra Nevada in eastern California, and flows northward into the State of Nevada. The East and West forks unite near Genoa, Nev., in Carson Valley. At Empire, 3 miles east of Carson, after having traversed the Upper Carson Valley, it turns to the northeast and enters a deep canyon, through which it flows for several miles, emerging into a second smaller valley a short distance above the town of Dayton. After leaving this valley it passes through two other shorter canyons and through one rather large valley before entering Lower Carson Valley, or Carson Sink Valley, as it is also known, and discharging its waters into the Carson Sink.

The Truckee has its source on the slopes of the Sierra Nevada in eastern California and flows northward, entering Lake Tahoe, which is at an elevation of 6,225 feet and the largest body of fresh water in the United States at this considerable altitude. The area of the lake is 193 square miles. Its outlet is at Tahoe, Cal., from which point Truckee River has a general northward and eastward course, receiving several important tributaries which contribute to its flow. It drains into Pyramid and Winnemucca lakes, which have no outlets. Donner and Prosser creeks are tributaries of Truckee River. Independence Creek discharges into the Little Truckee, a main branch of Truckee River, entering it at Boca, Cal. They drain areas of 31, 56, and 8.5 square miles, respectively, lying to the northwest of Lake Tahoe, in California.

Susan River has its source in the Sierra Nevada in northeastern California, and flowing eastward discharges into Honey Lake—one of the land-locked lakes of the Great Basin—of which it is the principal feeder. A considerable area of land is irrigated from the waters of the river below the gaging station, and during the last ten or twelve years several projects have been started for irrigating other extensive areas by the storage of its waters both above and below the town of Susanville.

The following is a list of stations in the Interior drainage basin:

Bear River near Collinston, Utah.
Bear River at Battlecreek, near Preston, Idaho.
Blacksmith Fork at Hyrum, Utah.
Logan River near Logan, Utah.
Weber River near Uinta, Utah.
Provo River near Provo, Utah.
Sevier River near Gunnison, Utah.
San Pitch River near Gunnison, Utah.
Humboldt River near Oreana, Nev.
Humboldt River near Golconda, Nev.
Humboldt River at Palisade, Nev.
Pine Creek at Palisade, Nev.
Humboldt River (South Fork) at Mason's ranch, near Elko, Nev.
Humboldt River near Elko, Nev.
Humboldt River (North Fork) near Elburz station, near Halleck, Nev.
Marys River at Bradley's Home ranch, near Deeth, Nev.
Walker River near Wabuska, Nev.
Walker River (East Fork) at Ross ranch, near Yerington, Nev.
Walker River (West Fork) at upper end of Antelope Valley, near Coleville, Cal.
Carson River near Empire, Nev.
Carson River (East Fork) at Rodenbah's ranch, near Gardnerville, Nev.
Carson River (West Fork) at Woodfords, Cal.
Truckee River at Tahoe, Cal.
Truckee River at Vista, near Reno, Nev.
Truckee River near Mystic, at Nevada-California State line.
Independence Creek below Independence Lake, near Overton, Cal.
Prosser Creek below Prosser Creek Ice Company's dam, near Boca, Cal.
Donner Creek near Donner Ice Company's dam, near Truckee, Cal.
Susan River near Susanville, Cal.

BEAR RIVER NEAR COLLINSTON, UTAH.

The gaging station at Collinston was established July 1, 1889, and is located about 4 miles from the railroad station at Collinston, 2 miles east of the town of Fielding, Utah, and below the headworks of the Bear River canal. The gage consists of a vertical iron rod graduated to tenths of a foot. The bench mark is a nail in an oak post 20 feet west of the gage and 20 feet north of the cable, and is at an elevation of 7.35 feet above gage datum. The equipment consists of a cable, a tagged wire, and a boat. The observer is generally the ditch rider of the Bear River Canal Company, who has a house near the station. The banks of the stream are high and the channel is gravelly, with bowlders, the water flowing with moderate velocity. At this point it has a slope of 0.55 foot in 600 feet.

During 1902 the following discharge measurements were made by G. L. Swendsen:

July 16: Gage height, 0.40 foot; discharge, 324 second-feet.
July 20: Gage height, 0.30 foot; discharge, 205 second-feet.
August 13: Gage height, 0.40 foot; discharge, 68 second-feet.
August 26: Gage height, 0.45 foot; discharge, 60 second-feet.
December 30: Gage height, 0.51 foot; discharge, 402 second-feet.

Daily gage height, in feet, of Bear River near Collinston, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.70	1.65	1.85	1.65	2.90	3.50	0.40	−0.10	−0.65	0.80	0.80	0.35
2	1.75	1.60	1.75	1.65	2.90	3.60	.30	− .10	− .55	.80	.80	.35
3	1.80	1.60	1.75	1.70	2.90	3.60	.30	− .10	− .20	.80	.80	.40
4	1.80	1.65	1.75	1.75	2.90	3.45	.40	− .10	− .10	.80	.80	.40
5	1.80	1.60	1.65	1.80	2.80	3.30	.40	− .15	− .15	.80	.80	.45
6	1.80	1.55	1.65	1.90	2.70	3.15	.35	− .20	− .20	.80	.80	.50
7	1.80	1.55	1.65	1.90	2.60	3.00	.35	− .25	− .30	.80	.80	.50
8	1.85	1.60	1.65	2.40	2.60	3.00	.35	− .30	− .20	.80	.80	.55
9	1.85	1.75	1.70	3.00	2.70	3.00	.40	− .35	− .30	.40	.80	.60
10	1.80	1.80	1.80	2.90	2.80	3.10	.40	− .35	− .20	1.00	.90	.60
11	1.80	1.85	1.80	2.75	2.90	3.10	.40	− .40	− .20	.30	1.10	.60
12	1.80	1.85	1.75	2.75	3.00	3.10	.40	− .40	− .10	.90	1.20	.80
13	1.75	1.90	1.75	2.75	3.10	3.10	.35	− .40	− .10	.90	1.30	.70
14	1.70	1.90	1.70	2.75	3.15	3.00	.35	− .40	− .10	.90	1.40	.60
15	1.70	1.70	1.70	2.75	3.15	3.00	.40	− .40	− .10	.90	1.50	.50
16	1.70	1.70	1.65	2.70	3.20	2.90	.45	− .45	− 10	.90	.50	.40
17	1.70	1.70	1.65	2.65	3.25	2.80	.45	− .45	.00	.90	.50	.30
18	1.60	1.80	1.70	2.65	3.30	2.60	.40	− .45	.10	.90	.50	.30
19	1.65	1.80	1.70	2.70	3.30	2.50	.30	− .45	.10	.90	.45	.35
20	1.65	1.70	1.80	2.80	3.30	2.35	.30	− .45	.20	.90	.40	.40
21	1.65	1.70	1.75	3.00	3.30	2.20	.25	− .45	.30	.90	.50	.40
22	1.65	1.65	1.80	3.20	3.20	2.10	.20	− .45	.30	.80	.50	.40
23	1.66	1.65	1.80	3.20	3.20	2.00	.15	− .45	.30	.80	.50	.40
24	1.60	1.65	1.75	3.10	3.10	1.90	.10	− .50	.30	.90	.50	.40
25	1.40	1.65	1.70	3.30	3.10	1.80	.20	− .50	.30	.90	.40	.45
26	1.40	1.70	1.70	3.30	3.10	1.70	.20	− .50	.30	.90	.40	.45
27	1.40	2.00	1.70	3.20	3.20	1.60	.10	− .50	.40	.80	.30	.40
28	1.40	1.95	1.70	3.10	3.25	1.40	.10	− .55	.50	.80	.30	.40
29	1.45	------	1.70	3.00	3.30	.50	.10	− .55	.60	.80	.35	.40
30	1.50	------	1.70	2.90	3.35	.50	.00	− .60	.70	.80	.35	.40
31	1.65	------	1.65	------	3.45	------	−.10	− .60	--------	.80	------	.40

Rating table for Bear River near Collinston, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
−0.1	280	0.7	370	2.0	1,470	3.6	3,340
.0	280	.8	410	2.2	1,670	3.8	3,600
.1	280	.9	460	2.4	1,880	4.0	3,860
.2	285	1.0	520	2.6	2,100	4.2	4,140
.3	290	1.2	690	2.8	2,330	4.4	4,420
.4	300	1.4	870	3.0	2,570	4.6	4,700
.5	310	1.6	1,070	3.2	2,820	4.8	5,000
.6	340	1.8	1,270	3.4	3,080	5.0	5,300

Estimated monthly discharge of Bear River near Collinston, Utah.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	1,320	870	1,139	70,034	0.19	0.22
February	1,470	1,020	1,191	66,145	.20	.22
March	1,320	1,120	1,191	73,232	.20	.23
April	2,950	1,120	2,176	129,481	.36	.40
May	3,145	2,100	2,656	163,311	.44	.51
June	3,340	310	2,138	127,220	.36	.40
July	305	280	292	17,954	.05	.06
August	280	280	280	17,217	.05	.06
September	370	280	289	17,197	.05	.06
October	520	290	427	26,255	.07	.08
November	970	290	420	24,992	.07	.08
December	410	290	312	19,184	.05	.06
The year	3,340	280	1,043	752,222	.17	2.38

BEAR RIVER AT BATTLECREEK, IDAHO.

This station, established October 11, 1889, is about 10 miles north of the Utah-Idaho boundary line. The station is of considerable importance from the fact that its location is near the Utah-Idaho line, and the measurements there will indicate the volume of water that passes from Idaho into Utah. During 1901 a large canal was completed, appropriating the waters of the Bear about 8 miles below Soda Springs in sufficient quantity to irrigate about 35,000 acres of very fine land in that locality. The original gage consisted of a vertical board nailed to a pile. This was carried away June 30, 1899, but was replaced on August 4 by a wire and weight, readings being made on a horizontal scale. The bench mark for the old gage was a nail in the southeast corner of a house near the gage, about 1.5 feet from the ground and 10.95 feet above gage datum. There are two bench marks to which the present gage is referred. The first is a nail in the bridge floor beam close to the gage, and the second is three nails in the east side of the north post which supports the station cable. Both of these bench marks are 11.118 feet above the gage datum. The station is equipped with a cable and car.

Discharge measurements of Bear River at Battlecreek, Idaho.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 13	George L. Swendsen	1.60	407
February 1	do	1.80	606
March 15	do	1.72	610
April 20	do	3.00	1,803
May 30	do	3.15	1,961
June 12	do	3.40	2,231
June 18	do	2.40	924
July 21	do	1.25	355
August 11	do	1.19	290
September 29	do	1.32	385
October 6	do	1.58	412
November 3	do	1.62	455
December 24	do	1.70	524

Daily gage height, in feet, of Bear River at Battlecreek, Idaho.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.60	1.60	1.70	1.70	2.75	3.10	2.30	1.20	1.80	1.45	1.70	1.60
2	1.60	1.60	1.70	1.70	2.75	3.10	2.25	1.15	1.80	1.48	1.65	1.60
3	1.60	1.60	1.70	1.70	2.75	3.10	1.95	1.25	1.80	1.50	1.65	1.60
4	1.00	1.60	1.70	1.75	2.70	3.10	1.88	1.15	1.80	1.55	1.65	1.60
5	(a)	1.60	1.70	1.85	2.65	3.10	1.85	1.20	1.80	1.55	1.65	1.60
6	(a)	1.60	1.70	2.15	2.58	3.10	1.85	1.25	1.80	1.60	1.65	1.60
7	(a)	1.60	1.70	2.70	2.50	3.10	1.85	1.30	1.80	1.60	1.65	1.60
8	(a)	1.60	1.70	3.20	2.60	3.10	1.85	1.35	1.70	1.60	1.65	1.60
9	(a)	(a)	1.70	3.00	2.63	3.10	1.83	1.40	1.60	1.60	1.65	1.60
10	(a)	(a)	1.70	2.90	2.65	3.10	1.80	1.45	1.50	1.60	1.65	1.60
11	(a)	(a)	1.70	2.90	2.70	3.15	1.68	1.50	1.40	1.60	1.65	1.60
12	1.60	(a)	1.70	3.00	2.75	3.15	1.65	1.55	1.30	1.60	1.70	1.60
13	1.60	(a)	1.70	3.50	2.75	3.15	1.65	1.60	1.20	1.60	1.70	1.60
14	1.60	(a)	1.70	3.50	2.75	3.15	1.65	1.65	1.10	1.60	1.70	1.60
15	1.60	(a)	1.70	2.88	2.75	3.10	1.65	1.70	1.10	1.60	1.70	1.60
16	1.60	1.65	1.70	2.80	2.80	3.50	1.58	1.80	1.10	1.60	1.70	1.60
17	1.60	1.65	1.70	2.80	2.85	3.25	1.50	1.80	1.10	1.60	1.70	1.60
18	1.60	1.70	1.70	2.83	3.05	2.95	1.48	1.90	1.15	1.60	1.65	1.60
19	1.60	1.65	1.70	2.90	2.95	2.88	1.43	1.90	1.20	1.60	1.60	1.60
20	1.60	1.65	1.70	2.85	2.90	2.78	1.40	1.90	1.27	1.60	1.60	1.60
21	1.60	1.65	1.70	2.90	3.00	2.73	1.40	1.90	1.30	1.60	1.60	1.60
22	1.60	1.65	1.70	2.80	3.00	2.68	1.40	1.90	1.30	1.60	1.60	1.60
23	1.60	1.65	1.70	2.95	3.00	2 63	1.40	1.90	1.30	1.60	1.60	1.60
24	1.60	1.65	1.70	2.90	3.20	2.58	1.37	1.90	1.30	1.60	1.60	1.60
25	1.60	1.65	1.70	3.20	3.15	2.53	1.35	1.90	1.30	1.60	1.60	1.60
26	1.60	1.65	1.70	3.10	3.10	2.43	1.35	1.90	1.30	1.68	1.60	1.60
27	1.60	1.65	1.70	3.00	3.10	2.33	1.35	1.90	1.32	1.70	1.60	1.60
28	1.60	1.65	1.70	2.95	3.10	2.13	1.35	1.90	1.35	1.70	1.60	.....
29	1.60	.....	1.70	2.90	3.10	2.08	1.33	1.90	1.32	1.70	1.60	.....
30	1.60	.....	1.70	2.85	3.10	2.13	1.30	1.95	1.40	1.70	1.60	.....
31	1.60	.....	1.70	.....	3.10	.....	1.27	1.80	.....	1.70	.....	.....

(a) Gage lost.

Rating table for Bear River at Battlecreek, Idaho, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.1	302	1.8	570	2.5	1,130	3.2	1,928
1.2	324	1.9	632	2.6	1,230	3.3	2,060
1.3	350	2.0	700	2.7	1,334	3.4	2,196
1.4	382	2.1	776	2.8	1,442	3.5	2,336
1.5	420	2.2	856	2.9	1,556		
1.6	464	2.3	942	3.0	1,676		
1.7	514	2.4	1,034	3.1	1,800		

Estimated monthly discharge of Bear River at Battlecreek, Idaho.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	464	464	464	28,530	0.10	0.12
February	514	464	480	26,658	.11	.11
March	514	514	514	31,605	.11	.13
April	2,336	514	1,438	85,567	.32	.36
May	1,928	1,130	1,493	91,801	.33	.38
June	2,336	776	1,570	93,421	.35	.39
July	942	337	493	30,313	.11	.13
August	666	313	508	31,236	.11	.13
September	570	302	406	24,159	.09	.10
October	514	399	467	28,715	.10	.12
November	514	464	485	28,859	.11	.12
December	464	464	464	28,530	.10	.12
The year	2,336	302	732	529,394	.16	2.21

BLACKSMITH FORK AT HYRUM, UTAH.

Six irrigation canals and one large power canal are supplied by this river, and during the irrigation season the entire supply is utilized. The present gaging station was established July 19, 1900, by George L. Swendsen. It is near the tollgate at the mouth of the canyon. Daily readings are made on a vertical gage. The bench mark, a line of red paint on the top of a short cedar post near the north post of the tollgate, is 8.29 feet above gage datum.

Discharge measurements of Blacksmith Fork at Hyrum, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 27	George L. Swendsen	2.80	112
February 24	do	2.90	114
March 17	do	2.92	113
April 29	do	3.05	129
May 19	do	3.28	176
June 23	do	3.05	130
July 7	do	2.99	130
August 4	do	2.90	115
September 16	do	2.78	103
October 13	do	2.85	119
November 24	do	2.80	108
December 21	do	2.78	102

Daily gage height, in feet, of Blacksmith Fork at Hyrum, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	-----	2.80	2.90	3.05	3.00	3.30	2.80	2.90	2.80	2.85	2.90	2.90
2	-----	2.80	2.90	3.05	3.00	3.30	2.80	2.90	2.80	2.85	2.90	2.90
3	-----	2.92	2.90	3.05	3.00	3.30	2.80	2.90	2.80	2.85	2.85	2.90
4	-----	2.92	2.90	3.05	3.00	3.30	2.80	2.90	2.80	2.90	2.85	2.90
5	2.92	2.92	2.90	3.05	3.00	3.30	2.80	2.85	2.80	2.90	2.85	2.90
6	2.92	2.92	2.90	3.05	3.05	3.30	2.80	2.85	2.80	2.90	2.85	2.90
7	2.80	2.80	2.90	3.05	3.05	3.30	2.80	2.80	2.80	2.90	2.85	2.90
8	2.80	2.80	2.90	3.05	3.05	3.30	2.80	2.80	2.80	2.90	2.90	2.90
9	2.80	2.80	2.90	3.05	3.05	3.30	2.80	2.80	2.80	2.95	2.90	2.90
10	2.80	2.80	2.90	3.05	3.05	3.30	2.80	2.80	2.80	2.95	2.90	2.90
11	2.80	2.80	2.90	3.05	3.05	3.30	2.80	2.80	2.80	2.95	2.90	2.90
12	2.80	2.80	2.90	3.05	3.05	2.90	2.80	2.80	2.80	2.95	2.90	2.90
13	2.80	2.90	2.90	3.05	3.05	2.90	2.80	2.80	2.80	2.95	2.90	2.90
14	2.80	2.90	2.90	3.05	3.00	2.90	2.80	2.80	2.80	2.95	2.90	2.90
15	2.80	2.90	2.90	3.05	3.00	3.20	2.80	2.80	2.80	2.90	2.95	2.90
16	2.80	2.90	2.90	3.05	3.00	3.20	2.80	2.80	2.80	2.95	2.95	2.90
17	2.80	2.90	2.90	2.90	2.90	3.10	2.80	2.80	2.85	2.90	2.95	2.90
18	2.80	2.90	2.80	2.90	2.90	3.10	2.80	2.80	2.85	2.90	2.95	2.90
19	2.80	2.90	2.90	2.90	2.90	3.10	2.80	2.80	2.85	2.90	2.90	2.90
20	2.80	2.90	2.90	2.90	2.90	3.00	2.80	2.80	2.85	2.90	2.90	2.90
21	2.90	2.90	2.90	2.90	2.90	3.00	2.80	2.80	2.85	2.90	2.90	2.90
22	2.80	2.90	2.90	2.90	2.90	3.00	2.80	2.80	2.85	2.91	2.90	2.90
23	2.80	2.90	2.80	2.90	2.90	3.00	2.80	2.80	2.85	2.90	2.90	2.90
24	2.80	2.90	2.90	2.90	3.00	2.90	2.80	2.80	2.85	2.90	2.90	2.90
25	2.80	2.90	2.90	3.00	3.00	2.90	2.80	2.80	2.85	2.95	2.85	2.90
26	2.80	2.90	2.90	3.00	3.00	2.90	2.80	2.80	2.85	2.95	2.85	2.90
27	2.80	2.90	2.90	3.00	3.00	2.80	2.90	2.80	2.85	2.95	2.85	2.90
28	2.80	2.90	2.90	3.00	3.00	2.80	2.90	2.80	2.85	2.95	2.85	2.90
29	2.80	-----	2.90	3.00	3.00	2.80	2.90	2.80	2.85	2.90	2.85	2.90
30	2.80	-----	2.90	3.00	3.00	2.80	2.90	2.80	2.85	2.90	2.90	2.90
31	2.80	-----	2.90	-----	3.00	-----	2.90	2.80	-----	2.90	-----	2.90

Rating table for Blacksmith Fork at Hyrum, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	100	2.95	116	3.30	192	3.65	374
2.65	102	3.00	120	3.35	216	3.70	401
2.70	104	3.05	124	3.40	241	3.75	429
2.75	106	3.10	128	3.45	267	3.80	457
2.80	108	3.15	135	3.50	293	3.85	485
2.85	110	3.20	147	3.55	320	3.90	514
2.90	112	3.25	169	3.60	347		

Estimated monthly discharge of Blacksmith Fork at Hyrum, Utah.

[Drainage area, 286 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	112	108	109	6,702	0.38	0.44
February	112	108	111	6,165	.39	.42
March	112	108	112	6,887	.39	.45
April	124	112	120	7,140	.42	.47
May	124	112	119	7,317	.42	.48
June	192	108	146	8,688	.51	.57
July	112	108	109	6,702	.38	.44
August	112	108	109	6,702	.38	.44
September	110	108	109	6,486	.38	.42
October	116	110	113	6,948	.40	.46
November	116	110	112	6,664	.39	.44
December	112	112	112	6,887	.39	.45
The year	192	108	115	83,288	.40	5.48

LOGAN RIVER NEAR LOGAN, UTAH.

The station on Logan River was established June 1, 1896, and is located in the river canyon about 2 miles east of Logan, Utah. One gage is a vertical iron post, set firmly in the middle of the river's bed and graduated to feet and tenths. A second gage rod is a wooden post driven into the ground near the north bank of the river. The bench mark for both rods is a stone 35 feet northeast of the end of the cable on the north side of the river, and is at an elevation of 14.01 feet above gage datum. It is marked by a cross chiseled on the rock and

by the letters "B. M." in red paint. The equipment consists of a cable and car. Owing to a washout regular daily gage records were not taken during 1902.

Discharge measurements of Logan River near Logan, Utah.

Date.	Hydrographer.	Gage height.	Dicharge.
1902.		*Feet.*	*Second-feet.*
January 27	G. L. Swendsen	1.45	103
February 22	do	1.60	124
March 3	do	1.60	107
April 17	do	1.70	153
April 26	do	1.80	163
May 17	do	3.50	588
June 13	do	4.37	1,056
June 27	do	3.60	598
July 5	do	2.90	284
August 12	do	2.82	198
September 16	do	2.80	191
October 13	do	2.72	178
November 24	do	2.65	171
December 23	do	2.67	165

WEBER RIVER NEAR UINTA, UTAH.

The gaging station on Weber River, established in October, 1899, is located in the canyon 5 miles east of Uinta, on the Union Pacific Railroad, immediately above the narrows known as Devils Gate. The gage is vertical, and is supported from above by a projecting timber placed out of reach of high water. The bench mark consists of a spike driven into the first telegraph pole in the canyon above the gage, and is at an elevation of 17.44 feet above gage datum. The equipment consists of a cable, car, and tagged wire.

Discharge measurements of Weber River near Uinta, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 20	G. L. Swendsen	1.48	113
February 10	do	1.30	121
April 12	do	1.52	166
May 12	do	1.75	339
September 22	do	1.22	79
October 20	do	1.40	162
December 28	do	1.35	112

PROVO RIVER NEAR PROVO, UTAH.

The gaging station on Provo River, established July 27, 1889, is located in the canyon, about 6 miles from Provo and above the head of most of the irrigation canals of Utah Valley. The diversion works of the company which develop power at the mouth of Provo Canyon for electric transmission to the mines west of Provo, are located about 5 miles above the station. The gage is inclined and fastened to stakes set in the ground. The bench mark is a stone firmly bedded in the bank near the wagon road, about 100 feet southwest of the gage. It is marked "B. M." in black paint, and is 6.95 feet above gage datum. The channel is straight for some distance above and below the station. The bed of the river is gravel and not liable to change. The equipment consists of a cable, car, and tagged wire.

Discharge measurements of Provo River near Provo, Utah.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 26	G. L. Swendsen	4.00	204
March 10	do	4.35	230
April 14	do	4.50	395
May 5	do	4.60	414
July 26	do	4.10	202
September 20	do	4.00	172
November 17	do	3.95	165
December 27	do	4.00	178

SEVIER RIVER NEAR GUNNISON, UTAH.

The station, established by Caleb Tanner on June 29, 1900, is at the bridge which crosses the stream 4 miles west of the town of Gunnison. The gage, which is vertical, is nailed to one of the bridge piles. The bench mark consists of a post at the southeast corner of the bridge, marked, in pencil, "U. S. G. S. gage B. M.," and its elevation is 13.23 feet above gage datum. During 1902 the following measurements were made by Caleb Tanner:

May 18: Gage height, 0.88 foot; discharge, 41 second-feet.
August 15: Gage height, 0.62 foot; discharge, 19 second-feet.

Daily gage height, in feet, of Sevier River, near Gunnison, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.00	(a)	1.50	1.32	0.42	0.50	0.80	0.52	0.60	0.55	0.40	0.95
2	2.05	1.82	1.50	1.32	.42	.55	.80	.52	.60	.50	.35	.95
3	2.10	1.82	1.52	1.30	.42	.50	.60	.52	.62	.50	.35	1.05
4	2.10	2.00	1.45	1.30	.42	.50	.60	.57	.60	.50	.35	1.05
5	2.10	2.02	1.40	1.30	.42	.50	.60	.57	.60	.47	.35	1.00
6	2.10	2.27	1.40	1.32	.45	.42	.67	.67	.60	.47	.35	1.00
7	2.05	2.30	1.40	1.32	.55	.42	.60	.67	.60	.45	.35	1.50
8	2.10	2.42	1.40	1.32	.55	.42	.60	.62	.62	.45	.35	1.70
9	2.10	2.42	1.10	1.32	.55	.42	.50	.62	.62	.45	.35	1.70
10	2.15	2.37	1.10	1.35	.60	.40	.50	.62	.62	.45	.35	1.55
11	2.10	2.37	1.10	1.35	.70	.40	.50	.62	.62	.45	.35	1.60
12	2.10	2.45	1.10	1.35	.80	.40	.50	.62	.62	.45	.35	1.60
13	2.10	2.40	1.02	1.25	.80	.40	.50	.62	.62	.45	.35	1.55
14	2.10	2.40	1.02	1.20	.97	.40	.50	.62	.62	.50	.35	1.60
15	2.10	2.37	1.02	1.20	.97	.42	.50	.60	.62	.50	.35	1.65
16	2.05	2.00	1.05	1.15	1.10	.50	.50	.60	.62	.50	.37	1.55
17	2.05	2.00	1.20	1.15	1.00	.65	.52	.60	.60	.50	.35	1.60
18	2.02	1.97	1.15	1.12	.90	.65	.52	.60	.60	.50	.35	1.60
19	2.00	1.90	1.12	1.15	.80	.70	.60	.60	.60	.50	.35	1.70
20	2.00	1.85	1.25	1.22	.70	.70	.57	.60	.60	.50	.35	1.70
21	2.00	1.82	1.22	1.20	.65	.70	.57	.60	.60	.47	.50	1.65
22	2.02	1.77	1.22	1.20	.55	.67	.55	.60	.60	.47	.50	1.65
23	1.92	1.70	1.22	1.15	.50	.62	.52	.60	.60	.47	.50	1.70
24	1.92	1.62	1.12	1.10	.50	.62	.52	.60	.60	.45	.90	1.70
25	1.92	1.62	1.22	1.15	.47	.62	.50	.60	.57	.45	.90	1.65
26	(a)	1.60	1.25	1.05	.50	.60	.50	.60	.57	.45	.75	(a)
27	(a)	1.60	1.25	.70	.50	.60	.50	.60	.60	.45	.80	(a)
28	(a)	1.55	1.55	.47	.42	.60	.50	.60	.60	.45	.85	(a)
29	(a)	.....	1.55	.42	.52	.80	.50	.60	.57	.45	.97	(a)
30	(a)	.....	1.52	.42	.50	.80	.50	.60	.57	.45	.97	(a)
31	(a)	.....	1.45	.....	.50	.....	.52	.....	.....	.45	.....	(a)

a Frozen.

Rating table for Sevier River near Gunnison, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.4	6	1.1	59	1.8	129	2.5	199
.5	11	1.2	69	1.9	139	2.6	209
.6	17	1.3	79	2.0	149	2.7	219
.7	25	1.4	89	2.1	159	2.8	229
.8	33	1.5	99	2.2	169	2.9	239
.9	41	1.6	109	2.3	179		
1.0	49	1.7	119	2.4	189		

Estimated monthly discharge at Sevier River near Gunnison, Utah.

[Drainage area, 3,986 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	164	139	151	9,285	0.038	0.044
February	194	104	149	8,275	.037	.038
March	104	51	76	4,673	.019	.022
April	84	7	65	3,868	.017	.019
May	59	7	20	1,230	.005	.006
June	33	6	15	893	.004	.004
July	33	11	14	861	.004	.005
August	23	12	17	1,045	.004	.005
September	19	15	17	1,012	.004	.004
October	14	8	9	553	.002	.002
November	46	5	14	833	.004	.004
December	119	45	100	6,149	.025	.029
The year	194	5	54	38,677	.014	.182

Investigations in relation to the amount of seepage in the Sevier River Basin between Panguitch and the Sevier Bridge between Scipio and Juab.

WATER ENTERING THE DIFFERENT VALLEYS.

Date.	Locality.	Source.	Quantity.
1902.			*Second-feet.*
August 9	Panguitch Valley	Sevier River	46.2
August 10–11	Junction Valley	do	27.0
		East Fork of Sevier River	16.2
		City Creek	4.0
	Total		47.2
August 11	Between Junction and Marysvale.	Sevier River	10.7
		Tenmile Creek	1.0
		Cottonwood Creek	3.5
		Cottonwood Wash Spring	2.0
	Total		17.2

Investigations in relation to the amount of seepage in the Sevier River Basin between Panguitch and the Sevier Bridge between Scipio and Juab—Cont'd.

WATER ENTERING THE DIFFERENT VALLEYS—Continued.

Date.	Locality.	Source.	Quantity.
1902.			*Second-feet.*
August 11–13	Marysvale Valley	Sevier River	38.0
		Bullion Creek	12.5
		Beaver Creek	2.5
	Total		53.0
August 13–14	Sevier Valley to Rocky Ford.	Sevier River	47.5
		Clear Creek	7.3
		Monroe Creek	3.9
		Thompsons Creek	.2
		Redbutte and Cottonwood creeks.	.3
		Water Canyon Creek	.3
		Spring Creek	5.3
		Cove Creek	9.5
		Cedar Ridge Creek	.5
	Total		74.8
August14–15	Rocky Ford to Redmond Ford.	Sevier River	1.5
		Rocky Ford canal	35.0
		Lost Creek	.7
		Salina Creek	7.8
	Total		45.0
August 15–16	Redmond Ford to Westview Bridge.	Sevier River.	15.5
		Westview canal	4.2
		Willow Creek	.5
		Sanpitch River	15.2
	Total		35.4
Do	Westview Bridge to McArty's Ford.	Sevier River	18.7
		Dover canal	10.7
		Warm Creek	2.7
	Total		32.1
August 16	McArty's Ford to Sevier Bridge.	Sevier River	22.0

Investigations in relation to the amount of seepage in the Sevier River Basin between Panguitch and the Sevier Bridge between Scipio and Juab—Cont'd.

AMOUNT OF WATER DIVERTED FOR IRRIGATION IN THE DIFFERENT VALLEYS.

Date.	Locality.	Canal or ditch.	Quantity.
1902.			*Second-feet.*
August 9	Panguitch Valley	East Panguitch Irrigation Co. canal.	11.9
		Long Canal Co. canal	16.6
		East Bench Co. canal	3.8
		Panguitch Creek	13.6
		Little Creek	.3
		McEwan ditch	6.0
		Houston ditch	5.0
		Tibb's ditch	.3
		Orton's ditch	1.9
		Peterson ditch	2.2
		Walley ditch	4.3
		Vaetor ditch	Dry.
		Kessler ditch	2.1
		Johnson ditch	Dry.
	Total		68.0
August 10–11	Junction Valley	Miscellaneous canals	38.7
		Junction Canal Co. upper ditch	5.0
		Junction Canal Co. middle ditch	4.4
		Junction Canal Co. lower ditch	4.5
		Private ditch	1.2
	Total		53.8
August 11	Between Junction and Marysvale.	Not given	6.5
August 11–13	Marysvale Valley	do	15.0
August 13–14	Sevier Valley to Rocky Ford.	Clear Creek irrigation canal	1.38
		Joseph City irrigation canal	3.85
		Wells irrigation canal	2.38
		Isaacson irrigation canal	3.03
		Monroe irrigation canal	7.25
		Elsinore irrigation canal	2.75
		Brooklin irrigation canal	5.50
		Richfield irrigation canal	17.50
		Anabella irrigation canal	11.18
		Candor irrigation canal	.50
		Vermilion irrigation canal	9.04
	Total		64.36

Investigations in relation to the amount of seepage in the Sevier River Basin between Panguitch and the Sevier Bridge between Scipio and Juab—Cont'd.

AMOUNT OF WATER DIVERTED FOR IRRIGATION IN THE DIFFERENT VALLEYS—Continued.

Date.	Locality.	Canal or ditch.	Quantity.
1902.			*Second-feet.*
August 14–15	Rocky Ford to Redmond Ford.	Not given	43.5
August 15–16	Redmond Ford to Westview Bridge.	Robbins canal	8.14
		Westview canal	4.20
		Other canals	15.70
	Total		28.04
Do	Westview Bridge to McArty's Ford.	Not given	13.4
August 16	McArty's Ford to Sevier Bridge.		None.

AMOUNT OF WATER LEAVING THE DIFFERENT VALLEYS.

Date.	Locality.	Name of river or canal.	Quantity second-feet.
1902.			
August 10	Panguitch Valley	Sevier River	30.7
August 11	Junction Valley	do	10.7
Do	Between Junction and Marysvale.	do	38.0
August 13	Marysvale Valley	do	47.5
August 14	Sevier Valley to Rocky Ford.	do	1.5
		Rocky Ford and Willow Bend canal.	35.0
	Total		36.5
August 15	Rocky Ford to Redmond Ford.	Sevier River	15.5
		West View canal	4.2
	Total		19.7
Do	Redmond Ford to Westview Bridge.	Sevier River	18.7
		Dover canal	10.7
	Total		29.4
Do	Westview Bridge to McArty's Ford.	Sevier River	22.0
August 16	McArty's Ford to Sevier Bridge.	do	18.5
Do	Panguitch to Sevier Bridge.	do	18.5

Investigations in relation to the amount of seepage in the Sevier River Basin between Panguitch and the Sevier Bridge between Scipio and Juab—Cont'd.

RÉSUMÉ.

Date.	Locality.	Quantity of water.				Seepage.
		Entering valley.	Used for irrigation.	Leaving valley.	Leaving valley and used for irrigation.	
1902.		*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
August 8–10	Panguitch Valley	46.2	68.0	30.7	98.7	52.5
August 10–11	Junction Valley	47.2	53.8	10.7	64.5	17.3
August 11	Between Junction and Marysvale.	17.2	6.5	38.0	44.5	27.3
August 11–13	Marysvale Valley	53.0	15.0	47.5	62.5	9.5
August 13–14	Sevier Valley to Rocky Ford.	74.8	64.36	36.5	100.86	26.06
August 14–15	Rocky Ford to Redmond Ford.	45.0	43.5	19.7	63.2	18.2
August 15–16	Redmond Ford to Westview Bridge.	35.4	28.04	29.4	57.44	22.04
Do	Westview Bridge to McArty's Ford.	32.1	13.4	22.0	35.40	3.3
August 16	McArty's Ford to Sevier Bridge.	22.0	0.0	18.5	18.5	—3.5
August 8–16	Panguitch to Sevier Bridge.	142.1	292.6	18.5	311.1	169.0

SAN PITCH RIVER NEAR GUNNISON, UTAH.

The station, established by Caleb Tanner on June 30, 1900, is 4 miles northeast of the town of Gunnison, at the ranch of the observer, J. P. Jensen. The gage consists of a vertical post driven firmly into the bed of the stream and strongly braced. The bench mark is the top of a cedar post 1 foot in diameter, set firmly in the ground, 40 feet west of the gage rod. Its elevation is 5.96 feet above gage datum. During 1902 the following measurements were made by Caleb Tanner:

May 17: Gage height, 2.28 feet; discharge, 81 second-feet.
August 16: Gage height, 1.79 feet; discharge, 15 second-feet.

Daily gage height, in feet, of San Pitch River near Gunnison, Utah.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.74	1.74	1.74	1.80	2.40	2.30	2.00	1.70	1.75	1.75	1.77	1.70
2	1.74	1.74	1.74	1.80	2.50	2.30	2.08	1.70	1.75	1.75	1.77	1.70
3	1.74	1.74	1.76	1.80	2.60	2.20	2.00	1.70	1.75	1.75	1.70	1.80
4	1.74	1.74	1.76	1.80	2.50	2.20	2.00	1.70	1.75	1.75	1.70	1.80
5	1.74	1.74	1.76	1.80	2.70	2.20	2.00	1.70	1.75	1.75	1.70	1.80
6	1.74	1.76	1.76	1.76	2.70	2.20	2.00	1.80	1.75	1.75	1.70	1.75
7	1.76	1.76	1.76	1.70	2.70	2.20	2.00	1.80	1.75	1.75	1.70	1.75
8	1.76	1.76	1.76	1.90	2.65	2.20	2.00	1.80	1.75	1.75	1.70	1.70
9	1.76	1.76	1.76	1.87	2.60	2.10	2.00	1.80	1.75	1.75	1.70	1.70
10	1.76	1.76	1.76	1.85	2.65	2.10	2.00	1.80	1.75	1.75	1.70	1.70
11	1.76	1.76	1.76	1.80	2.70	2.20	2.00	1.80	1.75	1.75	1.70	1.70
12	1.76	1.76	1.76	1.90	2.75	2.20	2.00	1.75	1.75	1.75	1.70	1.70
13	1.76	1.76	1.76	1.90	2.70	2.10	2.00	1.80	1.75	1.75	1.70	1.70
14	1.76	1.76	1.76	1.90	2.80	2.10	2.00	1.80	1.75	1.75	1.70	1.70
15	1.76	1.76	1.76	1.90	2.40	2.10	2.00	1.80	1.75	1.75	1.70	1.65
16	1.76	1.76	1.76	1.90	2.40	2.15	2.00	1.80	1.75	1.75	1.70	1.65
17	1.76	1.76	1.76	1.97	2.30	2.15	2.00	1.70	1.75	1.75	1.70	1.65
18	1.76	1.76	1.76	2.00	2.30	2.15	2.10	1.70	1.75	1.75	1.70	1.65
19	1.76	1.76	1.76	2.20	2.30	2.10	2.10	1.70	1.75	1.75	1.70	1.70
20	1.76	1.76	1.76	2.10	2.20	2.10	2.10	1.80	1.75	1.75	1.70	1.70
21	1.76	1.76	1.76	2.20	2.20	2.00	2.00	1.80	1.85	1.75	1.70	1.70
22	1.76	1.74	1.76	2.10	2.10	2.20	2.00	1.80	1.85	1,75	1.70	1.70
23	1.76	1.74	1.76	2.00	2.10	2.10	2.00	1.80	1.80	1.75	1.70	1.70
24	1.76	1.74	1.76	2.20	2.20	2.12	1.90	1.80	1.75	1.75	1.70	1.70
25	1.76	1.74	1.76	2.20	2.20	2.00	1.90	1.80	1.75	1.75	1.70	1.70
26	1.76	1.74	1.76	2.30	2.30	2.00	1.80	1.80	1.75	1.77	1.70	1.70
27	1.76	1.74	1.76	2.30	2.30	2.00	1.76	1.80	1.75	1.77	1.70	1.70
28	1.76	1 74	1.76	2.30	2.40	2.10	1.70	1.80	1.75	1.77	1.70	1.70
29	1.76	.....	1.76	2.30	2.30	2.10	1.70	1.80	1.75	1.77	1.70	1.70
30	1.76	.....	1.76	2.40	2.30	2.10	1.70	1.80	1.75	1.77	1.70	1.70
31	1.76	.....	1.76	.....	2.30	.....	1.70	1.75	.....	1.77	.....	1.70

Rating table for San Pitch River near Gunnison, Utah, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	10	1.92	27	2.14	57	2.36	89
1.72	11	1.94	30	2.16	59	2.38	92
1.74	12	1.96	32	2.18	62	2.40	95
1.76	13	1.98	34	2.20	65	2.42	98
1.78	14	2.00	37	2.22	68	2.44	101
1.80	15	2.02	40	2.24	71	2.46	104
1.82	17	2.04	43	2.26	74	2.48	107
1.84	19	2.06	45	2.28	77	2.50	110
1.86	21	2.08	48	2.30	80		
1.88	23	2.10	51	2.32	83		
1.90	25	2.12	54	2.34	86		

Estimated monthly discharge of San Pitch River near Gunnison, Utah.

[Drainage area, 836 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	13	12	13	799	0.02	0.02
February	13	12	13	722	.02	.02
March	13	12	13	799	.02	.02
April	95	10	40	2,380	.05	.06
May	155	51	101	6,210	.12	.14
June	80	37	54	3,213	.06	.07
July	51	10	33	2,029	.04	.05
August	15	10	14	861	.02	.02
September	21	13	14	833	.02	.02
October	15	13	13	799	.02	.02
November	15	10	10	595	.01	.01
December	15	7	10	615	.01	.01
The year	155	7	27	19,855	.03	.46

HUMBOLDT RIVER NEAR OREANA, NEV.

On the lower reaches of this river measurements have been made for a number of years near Oreana, and the results show the amount of water available for storage at the possible reservoir sites in the vicinity of Humboldt station, and also for the six canal systems now in operation below Oreana. The station established by L. H. Taylor, January 27, 1896, was located at the old Oreana highway bridge, about 12 miles northeast of Lovelocks, Nev. The bridge abutment to which the gage was fastened was undermined and fell May 26, 1897. A temporary gage was used until September 8, 1897, when a new inclined one was placed on the left bank of the river about a mile and a half above the sight of the old gage and opposite the C. P. Railroad section house.

This gage was washed out and a new vertical gage, in two parts, was placed November 29, 1902, by E. C. Murphy. The gage was spiked to piles at the site of the old dam, the zero of the old and new gages coinciding. The bench mark is four nails driven into piles to which the upper part of the gage is fastened. Its elevation is 5 feet above the zero of gage. The channel here is straight for about 500 feet above the gage and for about 150 feet below. The station is provided with a cable and car. The river banks are high and not liable to overflow. The bed of the stream is sandy and shifting. The observer is G. A. Sapp.

During 1902 the following discharge measurements were made by E. C. Murphy and D. W. Hays:

July 23: Gage height, 1.75 feet; discharge, 251 second-feet.
October 17: Gage height, 0.17 foot; discharge, 22 second-feet.

Daily gage height, in feet, of Humboldt River near Oreana, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1902.												
1	0.70	0.80	0.90	1.10	1.00	1.00	2.20	1.30	0.20	0.50	0.40	0.50
2	.70	.90	.80	1.10	1.00	1.30	2.00	1.20	.10	.50	.40	.40
3	.70	.90	.80	1.20	1.00	1.50	1.90	1.30	.10	.60	.40	.40
4	.80	1.00	.90	1.20	.90	1.70	1.90	1.30	.10	.60	.40	.50
5	.80	1.00	1.00	1.20	.70	1.80	2.10	1.20	.20	.60	.30	.60
6	.80	1.20	1.00	1.20	.60	1.60	2.20	1.20	.30	.60	.30	.40
7	.90	1.30	.90	1.20	.40	1.60	2.40	1.10	.30	.40	.30	(a)
8	.90	1.30	1.00	1.20	.40	1.50	2.60	1.10	.30	.30	.30	(a)
9	1.00	1.60	1.00	1.10	.50	1.40	2.70	1.00	.40	.30	(a)	(a)
10	1.00	1.40	.90	1.10	.60	1.10	2.50	.90	.40	.30	(a)	(a)
11	1.10	1.40	1.00	1.00	.60	.80	2.30	1.00	.60	.20	(a)	(a)
12	1.10	1.20	1.00	1.00	.50	.60	2.20	1.00	.60	.30	(a)	(a)
13	1.30	1.20	1.00	1.00	.60	.60	2.20	.90	.60	.30	(a)	(a)
14	1.20	1.00	1.00	1.00	.70	.50	2.10	.80	.60	.40	(a)	.20
15	1.00	.90	1.00	1.20	.70	.50	2.10	.80	.60	.40	(a)	.20
16	1.00	.90	1.00	1.20	.70	.50	2.00	.70	.40	.30	.20	.20
17	.90	.80	1.00	1.20	.60	.60	2.00	.70	.40	.30	.20	.10
18	.90	.80	1.00	1.30	.60	.80	1.90	.70	.40	.20	.30	.10
19	.90	.80	1.10	1.30	.50	.80	1.80	.80	.50	.20	.30	.20
20	1.00	.70	1.10	1.30	.50	1.00	1.70	.70	.50	.20	.20	.20
21	1.00	.70	1.10	1.20	.30	1.30	1.90	.70	.50	.30	.20	.20
22	1.20	.60	1.10	1.10	.30	1.30	1.80	.60	.30	.30	.20	.20
23	1.20	.70	1.10	1.10	.10	1.50	1.80	.60	.30	.20	.20	.10
24	1.30	.70	1.10	1.00	.10	1.60	1.80	.60	.40	.10	.20	.10
25	1.40	.70	1.20	1.00	.20	1.70	1.70	.60	.40	.10	.30	.20
26	1.40	.80	1.20	1.00	.30	1.60	1.70	.50	.30	.10	.30	.30
27	1.10	.90	1.20	1.00	.50	1.60	1.60	.50	.30	.20	.50	.30
28	1.00	.90	1.10	1.00	.60	1.70	1.40	.50	.40	.30	.50	.30
29	1.00	.....	1.10	1.00	.70	1.70	1.40	.40	.40	.30	.50	.30
30	.90	.....	1.10	.90	.90	2.00	1.40	.40	.50	.40	.50	.30
31	.80	.....	1.10	.....	1.00	.....	1.30	.40	.....	.40	.....	.20

Rating table for Humboldt River near Oreana, Nev.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	19	0.8	69	1.5	168	2.2	333
.2	24	.9	80	1.6	187	2.3	364
.3	29	1.0	92	1.7	207	2.4	397
.4	35	1.1	105	1.8	229	2.5	432
.5	42	1.2	119	1.9	252	2.6	470
.6	50	1.3	134	2.0	277	2.7	511
.7	59	1.4	150	2.1	304	.....	.....

[a] Only two gagings were made at this station during 1902 and this table is but approximate, being constructed from these and the discharge curve for the year 1901.

Estimated monthly discharge of Humboldt River near Oreana, Nev.

[Drainage area, 13,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	150	59	94	5,780	0.007	0.008
February	187	50	91	5,054	.007	.007
March	119	69	96	5,903	.007	.008
April	134	80	107	6,367	.008	.009
May	92	19	52	3,197	.004	.005
June	277	42	137	8,152	.010	.011
July	511	134	276	16,970	.020	.023
August	134	35	75	4,612	.005	.006
September	50	19	35	2,083	.003	.003
October	50	19	32	1,968	.002	.002
November	42	24	30	1,785	.002	.002
December	50	19	28	1,722	.002	.002
The year	511	19	88	63,593	.006	.086

HUMBOLDT RIVER NEAR GOLCONDA, NEV.

The gaging station at Golconda is located near the great northern bend of Humboldt River and below the central valley. It is about 12 miles above the mouth of Little Humboldt River. The station was established by L. H. Taylor October 24, 1894, and has been maintained continuously since that time. It is located 1¼ miles north of the town. The new inclined gage, installed November 28, 1902, by E. C. Murphy, is fastened to the left bank by 4 by 4 inch stakes. The zeros of the old and new gages are at the same elevation. The bench mark is a 4 by 4 inch timber driven 4 feet north of the cable post on the left bank, at an elevation of 10.75 feet above the zero of the gage. Measurements are made from a cable and suspended car. The banks are moderately high, but liable to overflow at extreme high water. The bed of the stream is of gravel and sand and is somewhat shifting.

During 1902 the following discharge measurements were made by E. C. Murphy and D. W. Hays:

July 24: Gage height, 2.40 feet; discharge, 218 second-feet.
October 16: Gage height, —0.16 foot; discharge, 1.2 second-feet.

Daily gage height, in feet, of Humboldt River near Golconda, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.10	1.10	1.70	2.20	2.80	3.15	4.30	1.60	0.60	0.40	−0.10	+0.10
2	1.05	1.10	1.70	2.30	2.75	3.15	4.20	1.50	.50	.30	− .10	.00
3	1.00	1.15	1.70	2.20	2.70	3.20	4.25	1.40	.40	.20	− .15	.00
4	1.00	1.15	1.80	2.25	2.70	3.25	4.20	1.35	.35	.20	− .15	.00
5	1.05	1.20	1.90	2.30	2.75	3.30	4.15	1.30	.40	.15	− .20	− .10
6	1.00	1.20	2.00	2.30	2.75	3.30	4.10	1.35	.40	.10	− .15	− .10
7	1.05	1.15	2.00	2.30	2.80	3.35	4.00	1.40	.50	.05	− .10	− .10
8	1.10	1.10	1.90	2.35	2.90	3.35	3.90	1.50	.40	.00	− .10	.00
9	1.20	1.10	2.00	2.35	2.90	3.40	3.80	1.40	.30	− .05	− .10	.00
10	1.30	1.10	2.00	2.30	3.00	3.40	3.70	1.30	.20	− .10	− .15	.10
11	1.40	1.15	2.10	2.35	3.10	3.45	3.60	1.20	.10	− .20	− .10	.10
12	1.50	1.20	2.05	2.40	3.15	3.50	3.50	1.25	.20	− .10	− .10	.15
13	1.60	1.20	2.00	2.50	3.20	3.55	3.30	1.20	.30	− .10	− .10	.15
14	1.60	1.30	2.10	2.60	3.20	3.60	3.20	1.10	.25	.00	− .10	.15
15	1.60	1.40	1.90	2.70	3.15	4.00	3.10	1.00	.10	− .10	.00	.10
16	1.50	1.50	1.90	2.70	3.15	4.10	2.95	.90	.00	− .20	.00	.10
17	1.50	1.50	1.90	2.60	3.10	4.15	2.75	.80	.00	− .10	.10	.00
18	1.40	1.60	1.90	2.65	3.20	4.20	2.70	.70	.00	− .20	.10	.10
19	1.40	1.60	2.00	2.70	3.20	4.25	2.70	.60	.00	− .20	.15	.10
20	1.30	1.65	2.00	2.50	3.15	4.25	2.60	.50	.90	− .20	.15	.10
21	1.30	1.60	2.10	2.60	3.15	4.30	2.65	.40	.90	− .15	.10	.10
22	1.40	1.60	2.10	2.60	3.20	4.30	2.50	.30	.80	− .15	.10	.20
23	1.30	1.50	2.10	2.70	3.20	4.35	2.50	.10	.70	− .10	.10	.30
24	1.20	1.60	2.10	2.70	3.15	4.30	2.40	.20	.60	− .10	.10	.30
25	1.10	1.65	2.00	2.60	3.20	4.35	2.40	.25	.65	.00	.15	.40
26	1.10	1.60	2.15	2.60	3.15	4.30	2.30	.30	.70	.10	− .10	.40
27	1.15	1.65	2.00	2.70	3.20	4.30	2.20	.35	.75	.15	− .15	.50
28	1.10	1.70	2.10	2.75	3.20	4.35	2.10	.40	.60	.20	− .20	.60
29	1.10	.....	2.15	2.75	3.20	4.30	1.90	.50	.50	.15	− .10	.60
30	1.00	.....	2.10	2.80	3.15	4.30	1.80	.55	.40	.10	− .10	.70
31	1.00	.....	2.15	.....	3.15	.....	1.70	.60	.....	.00	.....	.80

Rating table for Humboldt River near Golconda, Nev., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.2	0.8	2.2	139	4.6	584	7.0	1,400
.0	3.0	2.4	162	4.8	635	7.2	1,495
.2	8.0	2.6	188	5.0	688	7.4	1,594
.4	14.0	2.8	217	5.2	743	7.6	1,700
.6	22.0	3.0	248	5.4	802	7.8	1,815
.8	30.0	3.2	283	5.6	865	8.0	1,943
1.0	40.0	3.4	320	5.8	931	8.2	2,088
1.2	52.0	3.6	359	6.0	1,000	8.4	2,256
1.4	66.0	3.8	400	6.2	1,073	8.6	2,451
1.6	82.0	4.0	443	6.4	1,149	8.8	2,675
1.8	99.0	4.2	488	6.6	1,228	9.0	2,935
2.0	118.0	4.4	535	6.8	1,311	9.2	3,235

Estimated monthly discharge of Humboldt River near Golconda, Nev.

[Drainage area, 10,780 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth, in inches.
1902.						
January	82	40	56	3,443	0.0052	0.0060
February	90	46	65	3,610	.0060	.0062
March	134	90	117	7,194	.0109	.0126
April	217	139	177	10,532	.0164	.0183
May	283	202	258	15,864	.0239	.0276
June	523	273	413	24,575	.0383	.0427
July	511	90	282	17,339	.0262	.0302
August	82	5	38	2,337	.0035	.0040
September	35	3	16	952	.0015	.0017
October	14	1	4	246	.0004	.0005
November	6	1	3	179	.0003	.0003
December	30	2	8	492	.0007	.0008
The year	523	1	120	86,763	.0111	.1509

HUMBOLDT RIVER AT PALISADE, NEV.

This station was established November 27, 1902, by E. C. Murphy. It is located at Palisade, Nev. The gage is a plain staff graduated to feet and tenths, located about an eighth of a mile downstream from the cable from which the measurements are made. The gage is read daily by J. O. Brooks. The channel is straight for 200 feet above and 300 feet below the station. The banks are both high. The bed of the stream is permanent. The bench mark is a spike and three nails driven in the timber to which the gage is fastened. Its elevation is 7 feet above the zero of the gage.

Daily gage height, in feet, of Humboldt River at Palisade, Nev.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1902.			1902.			1902.			1902.		
1	.....	1.35	9	.....	1.55	17	.....	1.50	25	.....	1.55
2	.....	1.35	10	.....	1.55	18	.....	1.50	26	.....	1.55
3	.....	1.30	11	.....	1.55	19	.....	1.45	27	1.35	1.60
4	.....	1.50	12	.....	1.60	20	.....	1.40	28	1.40	1.55
5	.....	1.50	13	.....	1.55	21	.....	1.40	29	1.45	1.50
6	.....	1.55	14	.....	1.50	22	.....	1.45	30	1.35	1.45
7	.....	1.55	15	.....	1.45	23	.....	1.50	31	.....	1.55
8	.....	1.55	16	.....	1.40	24	.....	1.55			

PINE CREEK AT PALISADE, NEV.

This station was established November 27, 1902, by E. C. Murphy. It is located at the railway bridge 1 mile southwest of Palisade, Nev. The gage is a plain staff graduated to feet and tenths, spiked to the right abutment of the railroad bridge. It is read daily by J. O. Brooks. The channel both above and below the station is straight. The banks are high and liable to overflow only at very high water. The bed of the stream is permanent and is composed of gravel and sand. The bench mark is a spike and three nails driven into the timber to which the gage is fastened. Its elevation is 7 feet above the zero of the gage.

A measurement was made October 14, 1902, by E. C. Murphy, which showed a discharge of 7.2 second-feet.

Daily gage height, in feet, of Pine Creek at Palisade, Nev.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1902.			1902.			1902.			1902.		
1	.....	1.40	9	.....	1.40	17	.....	1.70	25	.....	1.35
2	.....	1.35	10	.....	1.45	18	.....	1.70	26	.....	1.40
3	.....	1.80	11	.....	1.40	19	.....	1.80	27	.....	1.35
4	.....	1.35	12	.....	1.45	20	.....	1.75	28	1.80	1.85
5	.....	1.40	13	.....	1.40	21	.....	1.50	29	1.45	1.70
6	.....	1.45	14	.....	1.50	22	.....	1.75	30	1.45	1.45
7	.....	1.45	15	.....	1.60	23	.....	1.35	31	.....	1.80
8	.....	1.40	16	.....	1.65	24	.....	1.30			

HUMBOLDT RIVER (SOUTH FORK) AT MASON'S RANCH NEAR ELKO, NEV.

The station, established August 29, 1896, by L. H. Taylor, is located 10 miles southwest of the town of Elko and about 6 miles above the junction of the South Fork with the main stream. The gage is inclined and spiked to posts driven firmly into the right bank. A new inclined gage was placed by E. C. Murphy November 22, 1902. It is at the site of the old one, the 4-foot marks of old and new gages coinciding. The bench mark is a 4 by 4-inch timber driven 4 feet south of the gage. It is 6.29 feet above gage datum. The measurements are made from a cable and suspended car at a point 1 mile above the gage, the latter being placed near the farm of the observer, for his convenience. At the point of measurement the banks are high, and the channel is straight for some distance above and below the station. The bed of the stream is of rock and gravel and quite stable. There is a good site for a reservoir a short distance above the station.

In 1902 the following discharge measurement was made by E. C. Murphy:

October 12: Gage height, 0.50 feet; discharge, 12 second-feet.

Daily gage height, in feet, of Humboldt River (South Fork) at Mason's ranch near Elko, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	0.75	0.75	0.95	1.30	2.60	2.95	3.10	1.30	0.65	0.30	1.00	1.20
2	.75	.80	.95	1.30	2.60	3.00	2.90	1.30	.65	.30	1.00	1.20
3	.75	.80	.95	1.40	2.60	3.00	2.90	1.10	.65	.35	1.00	1.20
4	.75	.90	.95	1.40	2.70	3.50	2.80	1.10	.65	.35	1.00	1.20
5	.70	.90	.95	1.40	2.70	3.50	2.75	1.10	.65	.35	1.10	1.20
6	.70	.95	.95	1.90	2.80	4.10	2.50	1.00	.60	.35	1.10	1.20
7	.70	.95	.95	1.95	2.80	4.40	2.50	1.00	.50	.40	1.10	1.30
8	.70	.95	.95	1.95	2.70	4.50	2.35	1.00	.45	.40	1.10	1.30
9	.70	.90	1.10	2.00	2.90	5.00	2.35	1.00	.30	.40	1.10	1.30
10	.70	.90	1.10	2.00	2.90	5.10	2.20	1.00	.30	.40	1.10	1.30
11	.70	.90	1.10	2.00	3.00	5.20	2.20	1.00	.30	.40	1.10	1.30
12	.70	.90	1.10	2.10	3.00	5.40	2.20	1.00	.30	.50	1.20	1.30
13	.70	.90	1.10	2.20	3.10	5.70	2.30	.90	.35	.50	1.20	1.30
14	.70	.90	1.10	2.20	3.10	5.70	2.25	.90	.25	.55	1.20	1.30
15	.70	.90	1.10	2.35	3.10	5.10	2.25	.90	.25	.55	1.20	1.30
16	.70	.90	1.10	2.35	3.20	5.00	2.10	.90	.20	.60	1.20	1.30
17	.70	.90	1.10	2.35	3.30	4.60	2.10	.80	.20	.65	1.20	1.30
18	.70	.90	1.15	2.50	3.10	4.50	2.00	.80	.15	.65	1.20	1.30
19	.70	.90	1.15	2.60	3.10	4.50	2.00	.80	.10	.70	1.20	1.30
20	.70	.90	1.15	2.80	2.80	4.50	1.90	.70	.10	.70	1.20	1.30
21	.70	.90	1.20	2.80	2.75	4.50	1.90	.70	.20	.70	1.20	1.30
22	.70	.90	1.20	2.80	2.75	4.50	1.80	.70	.20	.70	1.20	1.30
23	.70	.95	1.20	2.80	2.60	4.40	1.75	.70	.20	.75	1.10	1.30
24	.70	.95	1.20	2.75	2.60	4.40	1.75	.70	.25	.75	1.10	1.30
25	.70	.95	1.20	2.75	2.70	4.10	1.75	.70	.25	.80	1.10	1.30
26	.75	.95	1.20	2.75	2.80	3.90	1.75	.70	.25	.90	1.20	1.90
27	.75	.95	1.25	2.70	3.00	3.90	1.50	.70	.25	.90	1.20	1.30
28	.75	.95	1.25	2.70	3.40	3.90	1.50	.70	.25	1.00	1.20	1.30
29	.75	------	1.25	2.70	3.60	3.40	1.40	.70	.25	1.00	1.20	1.30
30	.75	------	1.30	2.60	3.90	3.20	1.40	.70	.30	1.00	1.20	1.30
31	.75	------	1.30	------	3.90	------	1.40	.65	------	1.00	------	1.30

Rating table for Humboldt River (South Fork), at Mason's ranch, Nevada, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
0.4	7	2.0	276	3.6	740	5.2	1,230
.6	24	2.2	327	3.8	801	5.4	1,292
.8	47	2.4	382	4.0	862	5.6	1,354
1.0	74	2.6	439	4.2	922	5.8	1,416
1.2	105	2.8	499	4.4	983	6.0	1,478
1.4	141	3.0	559	4.6	1,045		
1.6	182	3.2	619	4.8	1,106		
1.8	227	3.4	679	5.0	1,168		

Estimated monthly discharge of Humboldt River (South Fork) at Mason's ranch, near Elko, Nev.

[Drainage area, 1,150 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	41	35	37	2,275	0.032	0.037
February	67	41	61	3,388	.053	.055
March	122	67	92	5,657	.080	.092
April	499	122	349	20,767	.304	.339
May	831	439	550	33,818	.478	.551
June	1,385	544	959	57,064	.834	.934
July	589	141	313	19,246	.272	.314
August	122	30	59	3,628	.051	.059
September	30	0	7	417	.006	.007
October	74	2	29	1,783	.025	.029
November	105	74	96	5,712	.083	.093
December	122	105	119	7,317	.103	.119
The year	1,385	0	223	161,072	.193	2.629

HUMBOLDT RIVER NEAR ELKO, NEV.

The station at Elko, established June 17, 1895, by L. H. Taylor is located at the highway bridge 1 mile southwest of the town. The gage is inclined, fastened to iron bolts driven into the solid rock, and is placed on the left bank immediately below the bridge. The bench mark is on the southwest corner of the cofferdam surrounding the stone pier of the bridge, 80 feet north of the gage, and is at an elevation of 7.50 feet above gage datum. The right bank is quite low; the left is high and rocky. The bed of the stream is of gravel and sand, with a slight tendency to change during flood stages.

The following discharge measurement was made in 1902 by E. C. Murphy.

October 11: Gage height, 1.80 feet; discharge, 1.1 second-feet.

Daily gage height, in feet, of Humboldt River near Elko, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.										
1	1.85	2.50	3.00	2.86	4.30	3.70	3.50	2.20	1.70	1.70
2	1.85	2.50	3.00	2.87	4.25	3.78	3.53	2.15	1.70	1.70
3	1.85	2.50	2.90	2.88	4.10	4.00	3.45	2.15	1.70	1.70
4	1.85	2.50	2.85	2.90	4.10	4.30	3.40	2.15	1.70	1.70
5	1.87	2.40	2.85	2.90	4.00	4.50	3.35	2.15	1.70	1.70
6	1.87	2.40	2.80	2.90	3.90	4.75	3.45	2.15	1.70	1.70
7	1.87	2.50	2.75	2.95	3.80	4.95	3.65	2.00	1.70	1.70
8	1.87	2.40	2.75	3.00	3.75	4.90	3.55	2.00	1.70	1.70
9	1.87	2.50	2.75	3.20	3.75	4.95	3.45	1.90	1.70	1.70
10	1.87	2.50	2.75	3.25	3.60	5.00	3.30	1.90	1.70	1.70
11	1.87	2.40	2.76	3.35	3.60	5.20	3.20	1.90	1.70	1.70
12	2.50	2.40	2.77	3.40	3.65	5.25	3.20	2.00	1.70	1.70
13	2.50	2.50	2.78	3.40	3.75	5.35	3.15	1.90	1.70	1.70
14	2.50	2.50	2.79	3.35	3.80	5.50	3.00	1.90	1.70	(a)
15	2.50	2.60	2.80	3.30	3.85	5.70	2.95	1.90	1.70	.....
16	2.50	2.50	2.80	3.25	3.90	5.65	2.90	1.90	1.70	.....
17	2.50	2.50	2.80	3.28	3.95	5.65	2.85	1.80	1.70	.....
18	2.50	2.50	2.75	3.10	4.00	5.60	2.75	1.80	1.70	.....
19	2.50	2.50	2.80	3.10	4.10	5.65	2.73	1.80	1.70	.....
20	2.50	2.50	2.85	3.20	4.20	5.70	2.75	1.80	1.70	.....
21	2.60	2.60	2.90	3.35	4.25	5.75	2.70	1.75	1.70	.....
22	2.50	2.60	2.90	3.40	4.30	5.60	2.65	1.75	1.70	.....
23	2.40	2.50	2.80	3.50	4.40	5.00	2.60	1.70	1.70	.....
24	2.50	2.60	2.85	4.00	4.30	4.65	2.50	1.70	1.70	.....
25	2.50	2.70	2.90	4.10	4.30	4.20	2.45	1.70	1.70	.....
26	2.50	2.80	3.00	4.40	4.30	4.00	2.43	1.70	1.70	.....
27	2.50	2.90	2.95	4.80	4.25	3.90	2.40	1.70	1.70	.....
28	2.40	3.00	2.90	4.70	4.25	3.75	2.35	1.70	1.70	.....
29	2.40	.....	2.87	4.65	3.60	3.65	2.35	1.70	1.70	.....
30	2.30	.....	2.85	4.60	3.60	3.55	2.30	1.70	1.70	.....
31	2.40	.....	2.85	.....	3.60	.....	2.25	1.70	.....	.....

(a) Discontinued on account of dam backing water up.

Rating table for Humboldt River near Elko, Nev., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.6	0.5	3.0	190	4.8	743	6.6	1,550
1.7	1.0	3.2	240	5.0	822	6.8	1,655
1.8	7.0	3.4	292	5.2	903	7.0	1,763
1.9	14.0	3.6	346	5.4	988	7.2	1,873
2.0	22.0	3.8	402	5.6	1,076	7.4	1,986
2.2	43.0	4.0	461	5.8	1,166	7.6	2,101
2.4	70.0	4.2	525	6.0	1,257	7.8	2,218
2.6	104.0	4.4	594	6.2	1,352	8.0	2,339
2.8	144.0	4.6	667	6.4	1,449		

Estimated monthly discharge of Humboldt River near Elko, Nev.

[Drainage area, 2,840 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	104	10	57	3,505	0.0197	0.023
February	190	70	96	5,332	.0338	.035
March	190	134	153	9,408	.0539	.062
April	743	155	322	19,160	.1134	.126
May	594	346	460	28,284	.1620	.187
June	1,143	332	767	45,640	.2701	.301
July	360	50	187	11,498	.0658	.076
August	43	1	14	861	.0049	.006
September	1	1	1	60	.0004	.0004
October 1 to 14	1	1	1	28	.0004	.0002

HUMBOLDT RIVER (NORTH FORK) NEAR HALLECK, NEV.

This station was established October 10, 1902, by E. C. Murphy. It is located about 2 miles west of the Southern Pacific Railroad station at Elburz. The nearest post-office is Halleck, Nev. The gage is an inclined 4 by 4 inch timber graduated to read direct to feet and tenths. It is read daily by the observer, Joe Dolce. The measurements are taken from a car and cable. The channel is straight both above and below the station. The current is swift. Both banks are high. The left bank overflows at very high water. The bed of the stream is permanent and composed of gravel and silt. The bench mark is a 4 by 4 inch timber driven into the ground about 20 feet upstream from the cable. Its elevation is 6.99 feet above the zero of the gage.

Daily gage height, in feet, of the Humboldt River (North Fork) near Halleck, Nev.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1	.....	2.20	2.40	12	2.00	2.30	2.50	23	2.10	2.20	2.60
2	.....	2.10	2.50	13	2.00	2.20	2.60	24	2.20	2.20	2.60
3	.....	2.10	2.50	14	2.00	2.20	2.50	25	2.20	2.10	2.50
4	.....	2.20	2.40	15	2.00	2.30	2.60	26	2.20	2.10	2.60
5	.....	2.30	2.50	16	2.00	2.20	2.60	27	2.20	2.30	2.60
6	.....	2.20	2.40	17	2.00	2.30	2.55	28	2.10	2.40	2.60
7	.....	2.20	2.50	18	2.10	2.30	2.60	29	2.20	2.40	2.70
8	.....	2.30	2.60	19	2.10	2.30	2.50	30	2.10	2.40	2.70
9	.....	2.20	2.50	20	2.10	2.30	2.50	31	2.10	.....	2.70
10	1.90	2.20	2.60	21	2.10	2.30	2.40				
11	1.90	2.30	2.60	22	2.20	2.30	2.50				

MARYS RIVER AT BRADLEY'S HOME RANCH, NEAR DEETH, NEV.

This station is located on Bradley's ranch at the wagon bridge about 20 miles upstream from the mouth or from Deeth, Nev. The gage is a vertical staff graduated to feet and tenths, and is spiked to the pier of the bridge. It is read twice daily by George Murry. The channel is straight both above and below the station. The banks are high and the bed of the stream is composed of silt and clay. The bench mark is a 4 by 4 inch timber set on the left bank 35 feet from the gage. Its elevation is 9.28 feet above the zero of the gage.

A measurement October 10, 1902, by E. C. Murphy showed no discharge.

Daily gage height, in feet, of Marys River near Deeth, Nev.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1902.			1902.			1902.			1902.		
1		2.30	9		2.40	17		2.45	25	2.40	2.40
2		2.35	10		2.40	18		2.40	26	2.50	2.45
3		2.45	11		2.40	19		2.55	27	2.30	2.40
4		2.40	12		2.40	20		2.45	28	2.25	2.40
5		2.30	13		2.40	21		2.45	29	2.35	2.50
6		2.40	14		2.40	22		2.50	30	2.40	2.40
7		2.40	15		2.30	23		2.45	31		2.40
8		2.40	16		2.45	24	2.45	2.30			

WALKER RIVER NEAR WABUSKA, NEV.

This station was established July 22, 1902, by L. H. Taylor. It was equipped December 12, 1902, by E. C. Murphy. It is located about 2 miles east of Wabuska, Nev. The gage is a vertical staff graduated to feet and tenths and located about 50 feet upstream from the cable, from which measurements are made. The gage is read twice daily by W. H. Mitchell. The channel is straight both above and below the station. The banks are high. The bed of the stream is sandy and shifting. The bench mark is four nails driven in the northwest corner of the pump platform 35 feet east of the gage. The elevation of the bench mark is 6.94 feet above the zero of the gage.

During 1902 the following discharge measurements were made by E. C. Murphy and L. H. Taylor:

July 22: Gage height, 1.00 foot; discharge, 47 second-feet.
October 7: Gage height, 0.48 foot; discharge, 0.71 second-foot.

Daily gage height, in feet, of Walker River near Wabuska, Nev.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						
1		0.60	0.20	0.20	0.60	1.30
2		.55	.20	.20	.60	1.30
3		.50	.20	.20	.60	1.30
4		.50	.20	.25	.55	1.35
5		.45	.20	.25	.55	1.40
6		.40	.20	.25	.55	1.40
7		.40	.20	.30	.60	1.50
8		.40	.20	.30	.65	1.70
9		.40	.20	.30	.65	1.70
10		.40	.20	.30	.70	1.70
11		.40	.15	.30	.70	1.75
12		.40	.15	.30	.80	1.75
13		.40	.15	.30	.90	1.75
14		.40	.15	.30	1.00	1.80
15		.40	.15	.30	1.00	1.90
16		.40	.15	.30	1.00	1.90
17		.35	.15	.30	1.00	1.85
18		.35	.15	.30	1.05	1.85
19		.30	.15	.30	1.15	1.80
20		.30	.20	.30	1.30	1.80
21		.30	.20	.30	1.40	1.75
22	1.00	.30	.20	.30	1.40	1.75
23	.85	.30	.20	.30	1.40	1.75
24	.80	.30	.15	.30	1.40	1.70
25	.75	.30	.15	.30	1.40	1.70
26	.70	.25	.15	.35	1.40	1.65
27	.60	.25	.20	.35	1.40	1.65
28	.60	.25	.20	.35	1.40	1.60
29	.60	.25	.20	.40	1.35	1.55
30	.60	.25	.20	.45	1.30	1.45
31	.60	.25	.....	.60	.....	1.40

WALKER RIVER (EAST FORK) AT ROSS RANCH, NEAR YERINGTON, NEV.

This station was established October 6, 1902, by E. C. Murphy. It is located about 10 miles southeast of Yerington, Nev., at Ross ranch. The gage is a 4 by 4 vertical timber graduated to feet and tenths. It is read daily by I. A. Strosnider, the ranch owner, who lives about 200 yards away. Measurements are made from a cable. The channel is straight both above and below the station. The banks are low and liable to overflow at high water. The bed of the stream is sand and clay and is liable to shift. The bench mark is three nails driven in the stump of a tree 6 inches in diameter and 15 feet east of the gage. Its elevation is 5.85 feet above the zero of the gage.

The following discharge measurement was made in 1902 by E. C. Murphy:

October 6: Gage height, 1.20 feet; discharge, 55 second-feet.

Daily gage height, in feet, of Walker River (East Fork) at Ross ranch, near Yerington, Nev.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1	.....	1.70	1.85	12	1.50	1.80	1.80	23	1.60	1.80	1.80
2	.....	1.70	1.90	13	1.50	1.80	1.80	24	1.60	1.80	1.80
3	.....	1.70	1.90	14	1.50	1.80	1.80	25	1.70	1.80	1.80
4	.....	1.70	2.00	15	1.60	1.80	1.80	26	1.70	1.80	1.80
5	.....	1.70	2.00	16	1.60	1.80	1.80	27	1.70	1.80	1.80
6	1.30	1.80	2.10	17	1.60	1.80	1.80	28	1.70	1.80	1.80
7	1.50	1.80	2.10	18	1.60	1.80	1.80	29	1.70	1.80	1.80
8	1.40	1.80	2.10	19	1.60	1.80	1.80	30	1.70	1.80	1.80
9	1.50	1.80	2.10	20	1.60	1.80	1.80	31	1.70	.....	1.80
10	1.50	1.80	2.10	21	1.60	1.80	1.80				
11	1.50	1.80	1.80	22	1.60	1.80	1.80				

WALKER RIVER (WEST FORK) AT UPPER END OF ANTELOPE VALLEY, NEAR COLEVILLE, CAL.

This station was established October 5, 1902, by E. C. Murphy. It is located about 4 miles southwest of Coleville, Cal. The gage is a plain staff graduated to feet and tenths. It is located about one-half mile upstream from the cable from which the measurements are made. The observer is John Trumble. The channel is straight both above and below the station. Both banks are high. The bed of the stream is stony and permanent. The bench mark is a spike driven into the tree to which the gage is fastened. Its elevation is 6 feet above the zero of the gage.

During 1902 the following discharge measurements were made by L. H. Taylor and D. W. Hays:

July 25: Discharge, 331 second-feet.
September 23: Discharge, 32 second-feet.
October 4: Discharge, 70 second-feet.

Daily gage height, in feet, of Walker River (West Fork) near Coleville, Cal.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1	.....	1.30	1.30	12	1.00	1.50	1.10	23	1.00	1.30	1.20
2	.....	1.20	1.20	13	1.00	1.20	1.00	24	1.20	1.20	1.00
3	.....	1.20	1.20	14	1.00	1.20	1.30	25	1.20	1.20	1.30
4	.....	1.20	1.30	15	1.00	1.20	1.20	26	1.20	1.30	1.30
5	1.10	1.20	1.40	16	1.00	1.30	1.30	27	1.20	1.30	1.10
6	1.10	1.20	1.30	17	1.00	1.20	1.10	28	1.30	1.10	1.00
7	1.10	1.20	1.30	18	1.00	1.30	1.00	29	1.30	1.30	1.10
8	1.10	1.20	1.30	19	1.00	1.20	1.00	30	1.30	1.30	1.20
9	1.00	1.20	1.30	20	1.00	1.30	1.00	31	1.30	.....	1.20
10	1.00	1.50	1.30	21	1.00	1.40	1.20				
11	1.00	1.50	1.20	22	1.00	1.40	1.20				

CARSON RIVER NEAR EMPIRE, NEV.

On October 21, 1900, a gaging station was established about 2 miles below the town of Empire. The old gage, a temporary one, was vertical, driven into the stream bed, and spiked to a timber set firmly in the left bank. The bench mark was on a stone wall 10 feet from the gage and at an elevation of 7.5 feet above gage datum. The channel is straight, the banks are rather high at the old station, and the bed is composed of cobbles and gravel and is not likely to shift. On February 18, 1901, erosion of a bar in the channel above the gage caused a division of the stream bed into two channels. On March 13, 1901, a permanent gage was placed farther downstream where the banks are more stable. The gage consists of a wooden rod driven vertically into the stream bed and spiked to a cottonwood tree on the left bank. The bench mark is on the top of a large bowlder 10 feet north of the gage, its elevation being 8.38 feet above the datum of the gage.

Discharge measurements of Carson River near Empire, Nev.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 8	C. V. Taylor	3.10	925
April 22	D. W. Hays	2.80	755
May 12	C. V. Taylor	3.70	1,391
July 3	D. W. Hays	2.15	413
July 30	do	.35	23
August 30	L. L. Richards	.45	32

Daily gage height, in feet, of Carson River near Empire, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.60	1.60	2.10	1.90	2.50	3.80	2.30	0.30	0.30	0.20	1.60	1.40
2	1.60	1.60	2.00	1.90	2.50	3.60	2.30	.40	.30	.20	1.50	1.50
3	1.60	1.60	2.20	1.90	2.50	3.30	2.20	.40	.30	.20	1.50	1.50
4	1.70	1.60	2.40	2.00	2.40	3.10	2.10	.40	.20	.20	1.40	1.50
5	1.70	1.60	2.40	2.00	2.50	3.10	2.00	.30	.30	.20	1.30	1.50
6	1.70	1.60	2.70	2.00	2.70	3.10	1.90	.30	.20	.20	1.20	1.50
7	1.70	1.60	2.70	2.30	2.90	3.20	1.80	.20	.20	.20	1.10	1.50
8	1.70	1.60	2.70	2.90	3.10	3.30	1.60	.20	.20	.20	1.00	1.50
9	1.60	1.60	2.80	3.00	3.50	3.50	1.50	.20	.20	.20	1.00	1.60
10	1.60	1.60	2.40	2.70	3.70	3.70	1.40	.10	.20	.20	1.00	1.60
11	1.60	1.60	2.00	2.60	3.70	3.70	1.40	.10	.20	.20	1.00	1.60
12	1.60	1.60	1.90	2.40	3.70	3.80	1.40	.10	.20	.30	1.10	1.50
13	1.50	1.80	1.90	2.40	3.70	3.80	1.50	.20	.20	.30	1.10	1.50
14	1.50	1.70	1.90	2.50	3.70	3.60	1.40	.30	.20	.40	1.20	1.50
15	1.50	1.70	1.90	2.60	3.40	3.50	1.20	.30	.10	.40	1.20	1.50
16	1.60	1.70	1.90	2.70	3.30	3.40	1.10	.30	.10	.50	1.20	1.50
17	1.60	1.70	1.90	2.80	3.30	3.20	1.10	.30	.20	.50	1.20	1.50
18	1.60	1.70	2.00	3.00	3.10	3.10	1.00	.30	.10	.60	1.20	1.50
19	1.60	1.70	2.00	3.10	3.30	3.00	1.00	.30	.20	.60	1.40	1.50
20	1.60	1.70	1.90	3.30	3.10	3.00	.90	.30	.20	.60	1.40	1.50
21	1.50	1.70	1.90	3.30	2.90	3.00	.70	.30	.20	.60	1.40	1.50
22	1.50	1.70	1.90	2.80	2.70	3.00	.60	.30	.10	.70	1.40	1.50
23	1.50	1.70	1.90	2.60	2.70	2.90	.50	.30	.10	.70	1.40	1.50
24	1.50	1.70	1.90	2.50	2.70	2.70	.40	.30	.20	.80	1.40	1.50
25	1.50	1.70	1.80	2.50	2.90	2.60	.40	.30	.20	.90	1.40	1.50
26	1.30	1.70	1.80	2.40	3.20	2.60	.40	.30	.20	1.00	1.40	1.50
27	1.30	2.50	1.80	2.30	3.50	2.60	.40	.20	.20	1.10	1.40	1.50
28	1.20	2.30	1.80	2.30	3.70	2.40	.40	.20	.20	1.20	1.40	1.50
29	1.30	.....	1.80	2.30	3.90	2.30	.40	.30	.20	1.40	1.40	1.50
30	1.40	.....	1.80	2.30	4.00	2.30	.30	.30	.20	1.40	1.40	1.50
31	1.50	.....	1.80	.....	3.90	.....	.30	.30	.....	1.50	.....	1.40

Rating table for Carson River near Empire, Nev., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	10	1.1	116	2.1	416	3.1	938
.2	15	1.2	137	2.2	457	3.2	1,008
.3	20	1.3	160	2.3	500	3.3	1,082
.4	25	1.4	185	2.4	545	3.4	1,160
.5	32	1.5	212	2.5	592	3.5	1,242
.6	41	1.6	241	2.6	642	3.6	1,328
.7	52	1.7	272	2.7	695	3.7	1,418
.8	65	1.8	305	2.8	751	3.8	1,512
.9	80	1.9	340	2.9	810	3.9	1,610
1.0	97	2.0	377	3.0	872	4.0	1,712

Estimated monthly discharge of Carson River near Empire, Nev.

[Drainage area, 988 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	272	137	225	13,835	0.228	0.26
February	592	241	279	15,495	.282	.29
March	751	305	411	25,271	.416	.48
April	1,082	340	618	36,774	.626	.70
May	1,712	545	1,041	64,009	1.054	1.22
June	1,512	500	1,002	59,623	1.014	1.13
July	500	20	170	10,453	.172	.20
August	25	10	19	1,168	.019	.02
September	20	10	15	893	.015	.02
October	212	15	54	3,320	.055	.06
November	241	97	160	9,521	.162	.18
December	241	185	213	13,097	.216	.25
The year	1,712	10	351	253,459	.355	4.81

CARSON RIVER (EAST FORK) AT RODENBAH'S RANCH, NEAR GARDNERVILLE, NEV.

The gaging station was established by L. H. Taylor on October 17, 1900, at the place where measurements were made in the years 1890, 1891, and 1892. The old gage was an inclined timber securely fastened to posts set in the right bank of the stream. The old bench mark was on a basalt rock in the edge of the stream, 20 feet from the gage and at an elevation of 6.3 feet above gage datum. The channel at the old station is straight and the banks are high. The stream bed is of cobbles and gravel, and is quite stable.

On August 2, 1901, a loose-rock dam was raised a short distance below the gaging station, which affected the velocity at the latter point. The dam was partly washed out by a freshet on December 4, 1901. A new gage was established on March 10, 1901, a short distance downstream from the original one, which had been destroyed. It consists of a vertical timber driven into the stream bed at the right bank and spiked to a cottonwood tree. A bench mark was also established on a large granite bowlder 20 feet south of the gage under the cable from which the measurements are made. Its elevation is 8.10 feet above the datum of the gage. On October 3, 1902, a new inclined gage was installed by E. C. Murphy at a point on the left bank of the river 600 feet above the cable. This gage has not been read, as the

one placed on March 10, 1901, is still in use. The bench mark is on a rock 2 feet east of the gage. It is 9.945 feet above gage datum.

Discharge measurements of Carson River (East Fork) near Gardnerville, Nev.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 21	D. W. Hays	4.50	514
May 13	C. V. Taylor	5.12	1,138
July 2	D. W. Hays	4.25	486
July 19	do	3.80	192
July 29	do	3.70	139
August 5	C. V. Taylor	3.50	100
September 9	L. L. Richards	3.00	60
October 3	E. C. Murphy	3.20	66

Daily gage height, in feet, of Carson River (East Fork) near Gardnerville, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.30	3.10	3.10	3.80	4.40	4.90	3.80	3.50	3.35	3.05	2.95	3.40
2	3.30	3.10	3.20	3.80	4.40	5.00	4.00	3.60	3.30	2.95	3.00	3.35
3	3.30	3.20	3.10	3.80	4.50	5.20	3.90	3.40	3.10	3.15	2.90	3.30
4	3.30	3.20	3.20	3.80	4.50	5.30	3.90	3.25	3.10	3.10	2.90	3.40
5	3.30	3.20	3.10	3.90	4.60	5.40	3.90	3.40	3.05	3.05	3.00	3.30
6	3.40	3.20	3.10	3.90	4.80	5.50	4.00	3.50	3.00	2.95	3.00	3.30
7	3.30	3.10	3.20	4.90	5.00	5.70	3.80	3.40	3.10	3.10	2.90	3.35
8	3.40	3.20	3.20	4.80	5.20	6.00	3.70	3.60	3.15	3.05	2.90	3.30
9	3.40	3.40	3.40	4.70	5.50	5.40	3.80	3.70	3.05	3.00	3.55	3.30
10	3.30	3.30	3.40	4.40	5.80	5.30	3.90	3.95	3.20	3.10	4.00	3.35
11	3.60	3.20	3.40	4.30	5.20	5.30	3.80	3.75	3.10	3.10	3.75	3.25
12	3.50	3.30	3.40	4.40	5.40	5.40	3.90	3.80	3.05	3.00	3.70	3.30
13	3.50	3.30	3.40	4.40	5.50	5.50	3.80	3.90	3.00	3.10	3.55	3.25
14	3.50	3.30	3.40	4.50	5.50	5.40	3.80	3.85	3.20	2.95	3.50	2.90
15	3.40	3.50	3.50	4.60	5.40	5.50	3.70	3.70	3.15	2.90	3.45	2.90
16	3.50	3.70	3.60	4.60	5.40	5.00	3.80	3.70	3.15	2.95	3.40	2.80
17	3.50	3.60	3.60	4.80	5.50	4.60	3.90	3.75	3.20	3.00	3.25	2.80
18	3.50	3.50	3.60	4.90	4.90	4.70	3.80	3.65	3.00	2.90	3.35	2.80
19	3.40	3.50	3.60	4.70	5.00	4.80	3.80	3.70	2.90	2.90	3.40	2.85
20	3.50	3.50	3.60	4.70	5.20	4.50	3.80	3.70	2.90	2.95	3.35	2.80
21	3.40	3.40	3.70	4.50	5.20	4.60	3.70	3.80	2.85	3.00	3.30	2.75
22	3.50	3.40	3.70	4.30	5.30	4.70	3.70	3.80	2.80	3.20	3.30	2.70
23	3.50	3.30	3.70	4.50	5.60	4.30	3.80	3.65	2.80	3.05	3.40	2.65
24	3.40	3.30	3.60	4.30	5.30	4.20	3.70	3.65	2.75	3.05	3.35	2.60
25	3.10	3.30	3.50	4.60	5.50	4.20	3.60	3.50	2.80	2.95	3.40	2.60
26	2.90	3.30	3.50	4.50	5.40	4.10	3.70	3.50	2.85	2.90	3.40	2.50
27	3.00	3.20	3.60	4.50	5.30	4.00	3.60	3.45	2.90	2.90	3.25	2.60
28	3.10	3.10	3.60	4.30	6.00	4.00	3.50	3.50	3.05	2.85	3.35	2.50
29	3.20	.....	3.70	4.40	5.50	3.90	3.70	3.45	3.00	2.90	3.35	2.50
30	3.20	.....	3.80	4.30	5.40	3.80	3.60	3.45	3.00	3.00	3.40	2.50
31	3.20	.....	3.80	.....	5.20	.....	3.60	3.40	.....	2.95	.....	2.45

Rating table for Carson River (East Fork) near Gardnerville, Nev., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.5	30	3.4	85	4.3	519	5.2	1,200
2.6	34	3.5	98	4.4	598	5.3	1,275
2.7	38	3.6	115	4.5	675	5.4	1,350
2.8	42	3.7	140	4.6	750	5.5	1,425
2.9	46	3.8	180	4.7	825	5.6	1,500
3.0	51	3.9	233	4.8	900	5.7	1,575
3.1	57	4.0	297	4.9	975	5.8	1,650
3.2	65	4.1	368	5.0	1,050	5.9	1,725
3.3	74	4.2	441	5.1	1,125	6.0	1,800

Estimated monthly discharge of Carson River (East Fork) at Rodenbah ranch, near Gardnerville, Nev.

[Drainage area, 381 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth, in inches.
1902.						
January	115	46	81	4,980	0.213	0.25
February	140	57	78	4,332	.205	.21
March	180	57	101	6,210	.265	.31
April	975	180	601	35,762	1.577	1.76
May	1,800	598	1,205	74,093	3.163	3.64
June	1,800	180	955	56,826	2.507	2.80
July	297	98	178	10,945	.467	.54
August	265	70	131	8,055	.344	.40
September	80	40	54	3,213	.142	.16
October	65	44	51	3,136	.134	.15
November	297	46	86	5,117	.226	.25
December	85	28	54	3,320	.142	.16
The year	1,800	28	298	215,989	.782	10.63

CARSON RIVER (WEST FORK) AT WOODFORDS, CAL.

The gaging station, established by L. H. Taylor on October 18, 1900, is about three-fourths of a mile above the post-office at Woodfords. The gage is a vertical timber graduated to feet and tenths. It is read daily by Bernice Merrill, Woodfords, Cal. The channel at the station

is straight, the banks are high and rocky, and the bed is of rock and gravel and not likely to shift. Measurements are made from a car suspended on a steel cable across the stream.

Discharge measurements of Carson River (West Fork) at Woodfords, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
April 22	D. W. Hays	3.65	182
May 13	C. V. Taylor	4.70	422
July 3	D. W. Hays	3.40	158
July 30	do	2.50	47
August 6	C. V. Taylor	2.45	53
September 9	L. L. Richards	2.21	40

Daily gage height, in feet, of Carson River (West Fork) at Woodfords, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.00	3.70	4.40	3.10	3.90	4.60	4.20	2.50	2.30	2.20	2.40	2.50
2	2.90	3.90	4.60	3.20	3.90	4.50	3.90	2.40	2.30	2.20	2.40	2.50
3	2.90	3.80	4.20	3.40	3.80	4.50	3.80	2.40	2.20	2.20	2.40	2.50
4	2.90	3.90	3.90	3.40	3.70	4.40	3.80	2.40	2.20	2.20	2.40	2.50
5	2.90	4.00	3.60	3.50	3.70	4.40	3.80	2.40	2.20	2.20	2.30	2.50
6	2.80	4.00	3.60	3.80	3.70	4.40	3.60	2.40	2.20	2.20	2.30	2.50
7	2.90	4.00	3.50	3.90	3.60	4.40	3.60	2.40	2.20	2.20	2.40	2.50
8	3.00	3.50	3.50	3.90	3.60	4.60	3.50	2.40	2.20	2.20	2.30	2.50
9	3.00	3.90	3.60	3.80	3.70	4.50	3.40	2.60	2.20	2.20	2.40	2.50
10	3.00	3.90	3.60	3.80	3.80	4.50	3.40	2.40	2.20	2.20	2.40	2.50
11	2.90	3.80	3.60	3.90	4.00	4.40	3.40	2.30	2.20	2.20	2.50	2.50
12	2.90	3.80	3.40	3.90	4.00	4.40	3.20	2.30	2.20	2.20	2.50	2.70
13	2.80	3.90	3.50	3.90	4.00	4.40	3.20	2.30	2.30	2.30	2.50	2.60
14	2.90	3.80	3.60	3.90	4.10	4.40	3.00	2,40	2.30	2.20	2.60	2.50
15	2.90	3.80	3.40	3.80	4.20	4.00	3.00	2.40	2.30	2.30	2.50	2.50
16	2.90	3.90	3.30	3.80	4.40	4.20	2.90	2.30	2.30	2.30	2.40	2.60
17	3.00	4.00	3.20	3.60	3.80	4.10	2.90	2.50	2.30	2.20	2.40	2.60
18	2.90	3.90	3.00	3.50	3.80	4.10	2.90	2.30	2.30	2.20	2.40	2.60
19	2.90	3.80	2.80	3.40	3.80	4.10	2.80	2.30	2.30	2.30	2.40	2.60
20	3.00	3.90	2.70	3.30	3.90	4.10	2.90	2.30	2.30	2.30	2.40	2.60
21	3.20	3.80	2.70	3.30	4.20	4.10	2.90	2.30	2.20	2.30	2.50	2.70
22	3.10	3.90	2.80	3.30	4.30	4.20	2.80	2.30	2.20	2.30	2.50	2.70
23	3.20	3.90	2.60	3.40	4.40	4.20	2.90	2.30	2.20	2.30	2.50	2.80
24	3.20	4.00	2.60	3.40	4.60	4.30	2.90	2.40	2.20	2.30	2.50	2.80
25	3.30	4.20	2.60	3.30	4.60	4.20	2.80	2.50	2.20	2.40	2,50	2.80
26	3.20	4.20	2.60	3.40	4.80	4.10	2.70	2.40	2.20	2.30	2.60	2.80
27	3.40	4.30	2.60	3.30	4.80	4.10	2.70	2.30	2.20	2.20	2.60	2.80
28	3.50	4.30	2.60	3.50	4.80	4.20	2.60	2.30	2.20	2.30	2.50	2.80
29	3.60	.....	2.60	3.50	4.70	4.30	2.60	2.30	2.20	2.40	2.50	2.60
30	3.60	.....	2.60	3.60	4.70	4.30	2.60	2.30	2.20	2.40	2.50	2.60
31	3.70	.....	2.80	.....	4.70	.....	2.60	2.30	.....	2.40	.....	2.50

Rating table for Carson River (West Fork) at Woodfords, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.4	2	2.4	42	3.4	147	4.4	342
1.6	6	2.6	57	3.6	178	4.6	393
1.8	12	2.8	75	3.8	213	4.8	448
2.0	20	3.0	96	4.0	252	5.0	508
2.2	30	3.2	120	4.2	295		

Estimated monthly discharge of Carson River (West Fork) at Woodfords, Cal.

[Drainage area, 70 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	195	75	107	6,579	1.53	1.76
February	318	162	238	13,218	3.40	3.54
March	393	57	138	8,485	1.97	2.27
April	232	108	175	10,413	2.50	2.79
May	448	178	287	17,647	4.10	4.73
June	393	252	319.	18,982	4.56	5.09
July	295	57	121	7,440	1.73	1.99
August	57	36	40	2,460	.57	.66
September	36	30	32	1,904	.46	.51
October	42	30	34	2,091	.49	.56
November	57	36	46	2,737	.66	.74
December	75	49	58	3,566	.83	.96
The year	448	30	133	95,522	1.90	25.60

TRUCKEE RIVER AT TAHOE, CAL.

Truckee River, the natural outlet of Lake Tahoe, leaves the lake at the city of Tahoe. About 500 feet from the lake there is a timber dam across the river, which has been maintained for more than twenty years, for the purpose of controlling the discharge from the lake. June 17, 1900, a gage was placed in the stream for the purpose of recording the height of the water in the river. The gage is a vertical timber driven into the stream bed at the left bank about 300 feet below the dam, and is spiked to the root of a tree growing on the bank. The bench mark is cut in the side of the tree and is 4 feet above gage datum. The measurements are made from a cable

and suspended car about one-fourth mile below the gage, which was placed as near the city of Tahoe as possible for the convenience of the observer. At the point of measurement the right bank is low and is subject to overflow at very high stages of the stream. The left bank is rather high. The channel is nearly straight for a short distance below the station, and the bed of the river, which is of gravel and coarse sand, is smooth and stable. The purpose of the station is to ascertain the actual overflow from Lake Tahoe with a view to determining its real value as a storage reservoir.

The following measurement was made in 1902 by E. C. Murphy:

October 22: Gage height, 1.67 feet; discharge, 320 second-feet.

Daily gage height, in feet, of Truckee River at Tahoe, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	0.80	0.95	0.40	0.40	0.35	0.80	0.80	1.90	2.00	1.75	1.80	1.93
2	.80	.35	.35	.40	.35	.80	.80	1.90	2.00	1.75	1.80	1.90
3	.90	.35	.35	.40	.35	.80	.80	1.90	2.00	1.75	1.87	1.90
4	.90	.35	.35	.40	.35	.80	.80	1.90	2.00	1.75	1.87	1.90
5	.90	.35	.35	.40	.90	.80	.80	1.90	2.00	1.75	1.87	1.90
6	.90	.35	.35	.40	.90	.80	.80	1.90	2.00	1.70	1.87	1.90
7	.90	.35	.35	.40	.90	.80	.95	1.90	1.80	1.70	1.87	1.80
8	.90	.35	.35	.35	.90	.80	.95	1.90	1.80	1.75	1.87	1.80
9	.90	.90	.35	.35	.90	.80	.95	1.90	1.80	1.80	1.70	1.80
10	.90	.90	.35	.35	.90	.80	.95	1.90	1.80	1.80	1.70	1.75
11	.90	.90	.35	.35	.85	.80	.95	1.90	1.80	1.80	1.70	1 75
12	.90	.00	.35	.35	.85	.80	.95	1.90	1.80	1.80	1.70	1.75
13	.90	.00	.35	.35	.80	.80	.95	1.90	1.80	1.80	1.70	1.75
14	.90	.95	.35	.35	.80	.80	1.20	2.10	1.80	1.80	1.70	1.75
15	.90	.95	.35	.35	.80	.70	1.20	2.10	1.80	1.75	1.70	1.75
16	1.00	.95	.35	.35	.80	.70	1.20	2.10	1.80	1.75	1.70	1.75
17	1.00	.95	.35	.35	.80	.70	1.20	2.10	1.80	1.75	1.70	1.70
18	1.00	.90	.35	.35	.80	.70	1.20	2.10	1.80	1.75	1.70	1.70
19	1.00	.90	.35	.35	.80	.70	1.20	2.10	1.80	1.75	1.92	1.70
20	1.00	.40	.35	.35	.80	.70	1.20	2.10	1.80	1.75	1.92	1.70
21	1.00	.40	.35	.35	.80	.75	1.20	2.10	1.75	1.70	1.92	1.70
22	1.00	.40	.35	.35	.80	.80	1.20	2.10	1.80	1.70	1.92	1.70
23	1.00	.40	.35	.35	.80	.80	1.90	2.10	1.80	1.70	1.92	1.70
24	1.00	.40	.35	.35	.80	.80	1.90	2.10	1.80	1.70	1.92	1.70
25	.95	.40	.35	.35	.80	.80	1.90	2.00	1.80	1.70	1.92	1.70
26	.95	.40	.35	.35	.80	.80	1.90	2.00	1.75	1.70	1.92	1.70
27	.95	.40	.30	.35	.80	.80	1.90	2.00	1.75	1.70	1.92	1.70
28	.95	.40	.80	.35	.80	.80	1.60	2.00	1.75	1.80	1.92	1.65
29	1.05	.....	.80	.35	.80	.80	1.90	2.00	1.75	1.80	1.92	1.65
30	.95	.....	.80	.35	.80	.80	1.90	2.00	1.75	1.80	1.93	1.65
31	1.05	.....	.40	.....	.80	.....	1.90	2.00	.....	1.80	.....	1.65

Rating table for Truckee River at Tahoe, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	25	0.7	85	1.4	225	2.1	445
.1	30	.8	100	1.5	251	2.2	486
.2	36	.9	117	1.6	279	2.3	531
.3	43	1.0	136	1.7	308	2.4	580
.4	51	1.1	156	1.8	339		
.5	61	1.2	178	1.9	372		
.6	72	1.3	201	2.0	407		

Estimated monthly discharge of Truckee River at Tahoe, Cal.

[Drainage area, 519 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	146	100	125	7,686	0.24	0.28
February	126	25	73	4,054	.14	.15
March	100	43	52	3,197	.10	.12
April	51	47	48	2,856	.10	.11
May	117	47	97	5,964	.19	.22
June	100	40	95	5,653	.18	.20
July	372	100	204	12,543	.39	.45
August	445	372	406	24,964	.78	.90
September	407	324	350	20,826	.67	.75
October	339	308	324	19,922	.62	.71
November	407	308	346	20,588	.67	.75
December	407	293	326	20,045	.63	.73
The year	445	25	204	148,298	.39	5.37

TRUCKEE RIVER AT VISTA, NEV.

The station at Vista, Nev., was established August 18, 1899, by L. H. Taylor, and is located 7 miles east of Reno. On November 12, 1902, a new gage was installed by E. C. Murphy. It consists of a vertical 4 by 4 inch timber spiked to a willow tree. It is on the left bank of the river, 150 feet above the new railroad bridge. The zeros of the old and new gages coincide. The bench mark consists of two spikes driven into the root of the willow tree to which the gage is attached.

The elevation of the bench mark is 6.98 feet above the zero of the gage. The cable was moved to a point about a quarter of a mile below the old station. The left bank is low and subject to overflow at extreme high water. The bed is rocky and not subject to change.

The following discharge measurements were made during 1902 by C. V. Taylor:

April 9: Gage height, 5.04 feet; discharge, 1,678 second-feet.
May 9: Gage height, 5.70 feet; discharge, 2,319 second-feet.

Daily gage height, in feet, of Truckee River at Vista, Nev.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.60	2.60	3.40	4.00	4.20	4.60	2.60	2.60	2.80	2.65	3.10	(a)
2	2.55	2.70	3.30	4.00	4.00	4.30	2.70	2.50	2.90	2.60	3.10	.....
3	2.50	2.70	3.20	4.45	3.80	4.00	2.60	2.40	3.00	2.70	3.10	.....
4	2.65	2.65	3.20	4.00	3.90	4.00	2.60	2.40	3.10	2.65	3.20	.....
5	2.75	2.65	3.20	4.80	3.90	4.00	2.70	2.40	2.80	2.60	3.10	.....
6	2.75	2.65	3.30	7.00	4.50	4.00	2.60	2.30	2.90	2.60	3.10	.....
7	2.80	2.60	3.30	7.00	5.20	4.20	2.60	2.20	3.10	2.60	3.00	.....
8	2.80	2.60	3.50	5.60	5.70	4.50	2.50	2.20	2.80	2.70	3.00	.....
9	2.75	2.65	3.10	5.00	5.70	4.70	2.50	2.10	2.90	2.70	3.30	.....
10	2.75	2.60	3.05	5.00	5.40	4.80	2.50	2.10	2.70	2.70	3.40	.....
11	2.70	2.60	2.95	5.40	5.60	4.90	2.40	2 10	2.60	2.70	3.50	.....
12	2.60	2.65	3.00	5.00	5.70	4.50	2.40	2.20	2.60	2.80	3.60	.....
13	2.60	2.70	2.90	5.72	5.50	4.40	2.20	2.10	2.70	2.70	3.60	.....
14	2.60	2.90	2.85	5.75	5.30	4.40	2.20	2.40	2.80	2.80	3.70	.....
15	2.60	4.00	2.90	5.71	5.00	4.00	2.30	2.60	2.70	2.80	4.00	.....
16	2.60	4.00	2.80	5.77	4.70	3.90	(a)	2.80	2.60	2.80	3.90	.....
17	2.60	3.60	2.80	5.77	4.80	3.80	.....	2.50	2.70	2.70	3.80	.....
18	2.65	3.20	2.85	5.76	4.70	3.70	.....	2.60	2.60	2.90	3.80	.....
19	2.70	3.25	2.90	5.79	4.60	3.70	.....	2.50	2.60	2.90	3.70	.....
20	2.60	3.25	2.90	5.77	4.20	3.60	.....	2.60	2.70	3.10	3.60	.....
21	2.60	3.20	2.85	5.77	4.10	3.70	.....	2.60	2.70	2.90	3.60	.....
22	2.60	3.15	2.80	4.78	4.00	3.40	.....	2.60	2.70	3.00	3.40	.....
23	2.60	3.00	2.80	4.79	3.90	3.40	.....	2.60	2.70	3.00	3.40	.....
24	2.55	3.30	2.85	4.75	4.00	3.40	.....	2.60	2.70	3.10	3.40	.....
25	2.65	3.50	2.80	4.72	4.50	3.40	.....	2.50	2.70	3.10	3.40	.....
26	2.60	3.50	2.90	4.71	4.80	3.40	.....	2.50	2.70	2.90	3.30	.....
27	2.70	3.60	2.90	4.10	5.20	3.30	2.30	2.60	2.70	3.10	3.30	.....
28	2.60	3.55	2.90	4.10	5.60	3.20	2.60	2.70	2.70	3.00	3.30	.....
29	2.60	.....	3.00	4.20	5.40	2.80	2.60	2.70	2.70	3.00	3.20	.....
30	2.60	.....	3.40	4.30	5.20	2.60	2.70	2.80	2.60	3.10	(a)	.....
31	2.60	.....	3.70	.....	5.00	.....	2.60	2.80	.....	3.00	.....	.....

a No record July 16 to 26 and November 30 to December 31.

Rating table for Truckee River at Vista, Nev., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	110	3.4	773	4.8	1,601	6.2	2,780
2.2	185	3.6	882	5.0	1,733	6.4	3,079
2.4	274	3.8	995	5.2	1,871	6.6	3,438
2.6	370	4.0	1,110	5.4	2,015	6.8	3,857
2.8	467	4.2	1,227	5.6	2,168	7.0	4,336
3.0	566	4.4	1,348	5.8	2,338		
3.2	668	4.6	1,473	6.0	2,537		

Estimated monthly discharge of Truckee River at Vista, Nev.

[Drainage area, 1,519 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	467	322	389	23,919	0.256	0.30
February	1,110	370	598	33,211	.393	.41
March	938	467	589	36,216	.388	.45
April	4,336	1,110	1,922	114,367	1.265	1.42
May	2,250	995	1,610	98,995	1.060	1.22
June	1,666	370	1,056	62,836	.695	.78
July	418	185	292	17,954	.192	.22
August	467	146	311	19,123	.205	.24
September	617	370	443	26,360	.292	.33
October	617	370	485	29,821	.319	.37
November 1 to 29	1,110	566	782	44,981	.515	.56

TRUCKEE RIVER AT NEVADA-CALIFORNIA STATE LINE, NEAR MYSTIC, CAL.

The gaging station on this river was established by L. H. Taylor September 7, 1899, at the State line, 17 miles west of Reno, Nev. The old gage was vertical, driven into the bed of the river, and wired to a granite bowlder. A new gage was established by E. C. Murphy November 11, 1902. It is a 4 by 4 inch timber in two parts and is located on the right bank 400 feet below the old gage. The lower section of the gage is inclined; the upper part is vertical. The zeros of the old and new gages coincide. The bench mark consists of two spikes driven into the root of the cottonwood tree to which the ver-

tical portion of the gage is attached. The elevation of the bench mark is 5.99 feet above the zero of the gage.

The following discharge measurements were made during 1902 by C. V. Taylor:

April 10: Gage height, 3.60 feet; discharge, 1,492 second-feet.
May 10: Gage height, 4.50 feet; discharge, 2,384 second-feet.

Daily gage height, in feet, of Truckee River at Nevada-California State line near Mystic, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.50	1.40	2.10	2.20	3.40	3.70	2.40	2.10	2.20	1.90	1.90	1.90
2	1.90	1.60	2.10	2.10	3.30	3.70	2.20	2.10	2.20	2.00	1.80	2.00
3	1.80	1.60	1.90	2.20	3.20	3.50	2.20	2.10	2.20	1.90	1.90	2.00
4	1.60	1.60	2.00	2.20	3.20	3.50	3.00	2.10	2.20	1.90	1.80	2.10
5	1.50	1.70	2.10	2.50	3.30	3.40	2.10	2.00	2.20	1.90	1.90	2.10
6	1.60	1.60	2.40	3.20	3.90	3.50	2.10	2.00	2.10	1.80	1.90	2.10
7	1.50	1.70	1.90	5.00	4.40	3.90	2.10	2.00	2.20	1.90	1.80	2.20
8	1.50	1.80	1.90	4.00	4.80	3.90	2.10	2.00	2.10	2.10	1.90	2.10
9	1.60	1.80	1.80	4.10	4.80	4.00	1.70	2.00	2.00	1.90	1.90	2.20
10	1.50	2.10	1.50	3.70	4.70	4.10	2.00	1.80	2.00	1.90	2.20	2.40
11	1.40	2.10	1.60	3.40	4.80	4.00	2.10	2.10	2.00	2.00	2.50	2.20
12	1.50	1.80	1.60	3.50	4.70	3.90	2.00	2.10	2.00	2.00	1.90	2.30
13	1.60	1.50	2.00	3.60	4.50	3.90	1.90	2.00	2.20	2.00	1.90	2.00
14	1.70	1.80	1.70	4.10	4.00	3.90	1.90	2.10	2.10	2.00	1.90	1.80
15	1.50	2.40	1.60	4.30	4.00	3.50	2.00	2.20	2.00	1.90	2.10	1.80
16	1.60	2.50	1.50	4.20	4.00	3.30	2.00	2.20	1.90	1.90	1.90	2.00
17	1.60	3.20	1.60	4.50	4.10	3.30	1.90	2.10	1.90	1.90	2.10	1.80
18	1.80	2.50	1.70	5.00	4.00	3.20	1.90	2.10	2.00	1.90	1.90	1.90
19	1.50	2.30	1.80	5.40	3.80	3.20	1.90	2.10	2.00	1.90	1.80	1.80
20	1.50	2.30	1.80	5.00	3.50	3.20	1.90	2.10	1.90	1.90	1.90	2.00
21	1.50	2.20	1.90	4.30	3.40	3.20	1.80	2.10	2.00	1.90	2.10	2.10
22	1.50	2.00	1.70	3.80	3.30	3.20	1.90	2.00	2.00	1.90	1.70	2.10
23	1.50	2.00	1.70	3.80	3.40	3.00	1.80	2.10	2.00	1.90	1.70	2.10
24	1.70	2.90	1.50	3.40	3.50	3.10	2.10	2.10	2.00	2.20	1.50	2.10
25	1.60	2.40	1.70	3.40	4.00	3.10	2.20	2.10	1.90	2.20	1.70	2.10
26	1.40	2.00	1.70	3.30	4.20	2.80	2.20	2.10	1.90	2.20	1.70	1.90
27	1.70	2.00	1.70	3.20	4.60	2.80	2.20	2.20	1.90	2.10	1.60	1.90
28	1.80	2.00	2.00	3.20	4.30	2.60	2.20	2.20	2.00	2.10	1.60	1.90
29	1.80	.....	2.00	3.40	4.70	2.50	1.90	2.20	2.00	2.00	1.80	1.90
30	1.70	.....	2.00	3.50	4.40	2.50	2.10	2.20	2.00	1.90	1.80	2.10
31	1.70	.....	2.10	.....	4.20	.....	2.20	2.20	.....	1.90	.....	2.10

Rating table for Truckee River at Mystic, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.4	268	2.6	795	3.8	1,683	5.0	3,002
1.6	319	2.8	924	4.0	1,870	5.2	3,283
1.8	383	3.0	1,055	4.2	2,069	5.4	3,596
2.0	463	3.2	1,194	4.4	2,280	5.6	3,953
2.2	559	3.4	1,345	4.6	2,505	5.8	4,370
2.4	671	3.6	1,508	4.8	2,745		

Estimated monthly discharge of Truckee River at Nevada-California State line near Mystic, Cal.

[Drainage area, 955 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	421	268	322	19,799	0.337	0.39
February	1,194	268	506	28,102	.530	.55
March	671	292	402	24,718	.421	.49
April	3,596	509	1,656	98,539	1.734	1.93
May	2,745	1,194	1,927	118,487	2.018	2.33
June	1,968	732	1,358	80,807	1.422	1.59
July	1,055	349	501	30,805	.525	.61
August	559	383	506	31,113	.530	.61
September	559	421	482	28,681	.505	.56
October	559	383	450	27,669	.471	.54
November	732	292	416	24,754	.436	.49
December	671	383	482	29,637	.505	.58
The year	3,596	268	751	543,111	.786	10.67

INDEPENDENCE CREEK BELOW INDEPENDENCE LAKE, NEAR OVERTON, CAL.

This station was established October 24, 1902, by E. C. Murphy. It is located about one-eighth of a mile below the dam at the end of Independence Lake, California. The gage is a vertical staff graduated to feet and tenths and is located about 200 feet upstream from the cable and car from which the measurements are made. The gage is read twice daily by James McNutt. The channel is straight both above and below the station. The banks are low, but not subject to overflow. The bed of the stream is permanent, being composed of gravel and clay. The bench mark is three nails driven in the root of a pine tree 55 feet northwest of the gage. Its elevation is 5.82 feet above the zero of the gage.

The following discharge measurement was made by E. C. Murphy in 1902:

October 24: Gage height, 1.23 feet; discharge, 0.27 second-foot.

Daily gage height, in feet, of Independence Creek below Independence Lake, near Overton, Cal.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1		1.33	2.20	12		1.93	1.60	23		1.93	1.60
2		1.33	2.20	13		1.73	1.60	24	1.23	1.93	1.55
3		1.33	2.00	14		(a)	1.60	25	1.23	1.93	1.55
4		1.23	1.95	15		(a)	1.50	26	1.23	1.93	1.50
5		1.23	1.90	16		1.93	1.50	27	1.13	1.93	1.50
6		1.13	1.90	17		1.93	1.50	28	1.23	1.93	1.75
7		1.23	1.80	18		1.93	1.50	29	1.23	1.93	1.85
8		1.33	1.80	19		1.93	1.50	30	1.23	1.90	1.90
9		1.18	1.80	20		1.93	1.50	31	1.33		1.90
10		1.93	1.60	21		1.93	1.50				
11		1.93	1.60	22		1.93	1.60				

(a) No record.

PROSSER CREEK NEAR BOCA, CAL.

This station was established October 23, 1902, by E. C. Murphy. It is located about 500 feet below the dam of the Prosser Creek Ice Company. It is about one-eighth of a mile above the mouth of the creek, at the footbridge between two ice houses. The gage is a vertical staff graduated to feet and tenths and located about 10 feet below the bridge. It is read twice daily by C. Lindsley. The channel is straight both above and below the station. The banks are high. The bed of the stream is permanent and is composed of sandy gravel and stone. The bench mark is a spike driven into the timber to which the gage is fastened. Its elevation is 6.0 feet above the zero of the gage.

The following discharge measurement was made in 1902 by E. C. Murphy:

October 23: Gage height, 0.85 foot; discharge, 21 second-feet.

Daily gage height, in feet, of Prosser Creek near Boca, Cal.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1		0.75	0.80	12		0.80	0.65	23	0.85	0.85	0.45
2		.80	.80	13		.85	.70	24	.95	.80	.35
3		.75	.45	14		.85	.65	25	.85	.80	.45
4		.80	.65	15		.85	.60	26	.85	.80	.35
5		.80	.85	16		.80	.55	27	.85	.80	.55
6		.75	1.05	17		.85	.65	28	.90	.85	.35
7		.80	.95	18		.85	.85	29	.85	.80	.45
8		.70	1.00	19		.80	.95	30	.85	.75	.40
9		.70	1.10	20		.80	.75	31	.80		.45
10		1.05	1.30	21		.85	.75				
11		1.00	.65	22		.80	.55				

DONNER CREEK NEAR TRUCKEE, CAL.

This station was established October 23, 1902, by E. C. Murphy. It is located about 1½ miles west of Truckee, Cal., near the dam of the Donner Creek Ice Company. The gage is a vertical staff graduated to feet and tenths, located about 50 feet upstream from the cable from which measurements are taken. The gage is read twice daily by F. R. Williams. The channel is straight both above and below the station. The banks of the stream are high. The bed of the stream is permanent, being composed of gravel. The bench mark consists of four nails driven in the root of a pine tree 35 feet north of the gage. The elevation is 6.3 feet above the zero of the gage.

The following discharge measurement was made in 1902 by E. C. Murphy:

October 23: Gage height, 1.80 feet; discharge, 3.2 second-feet.

Daily gage height, in feet, of Donner Creek near Truckee, Cal.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1	.....	1.60	1.80	12	.....	1.85	1.95	23	1.80	1.90	1.80
2	.....	1.60	1.80	13	.....	1.85	1.80	24	1.82	1.90	1.85
3	.....	1.60	1.90	14	.....	2.20	1.90	25	1.72	1.90	1.90
4	.....	1.60	1.90	15	.....	1.85	1.90	26	1.60	1.90	1.80
5	.....	1.60	1.90	16	.....	2.00	1.90	27	1.60	1.90	1.80
6	.....	1.60	2.00	17	.....	1.90	1.95	28	1.60	1.90	1.75
7	.....	1.60	1.90	18	.....	2.20	1.90	29	1.65	1.90	1.85
8	.....	1.60	1.90	19	.....	1.90	1.80	30	1.70	1.80	2.25
9	.....	1.60	2.00	20	.....	1.80	1.80	31	1.60	.....	2.35
10	.....	2.05	2.00	21	.....	1.90	1.80				
11	.....	2.05	2.00	22	.....	1.90	1.80				

SUSAN RIVER NEAR SUSANVILLE, CAL.

The gaging station is about three-fourths of a mile southwest of the town, at the electric-light plant. It was established June 3, 1900, by L H. Taylor, a temporary gage being placed at the right bank of the river. The station is designed to be equipped with a cable and suspended car from which to make measurements of the discharge. The channel is straight for a distance above and below the station and the banks are high. The stream bed is of gravel and cobbles and is rather stable. The observer is James Branham.

A short distance above the station a small irrigating ditch, known as the Masten ditch, is taken out on the right bank of the stream. Near its head is a flume in which a gage has been placed and measurements are made.

Daily gage height, in feet, of Susan River near Susanville, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.40	2.40	3.80	3.80	4.42	4.02	2.80	1.90	1.75	1.90	2.10	2.20
2	2.40	2.45	3.70	3.75	4.40	3.92	2.98	1.90	1.75	1.90	2.10	2.20
3	2.40	2.50	3.70	3.80	4.32	3.85	2.88	1.85	1.75	1.90	2.10	2.20
4	2.40	2.55	3.65	3.95	4.30	3.75	2.80	1.85	1.75	1.90	2.10	2.22
5	2.40	2.60	3.60	4.15	4.30	3.65	2.80	1.85	1.75	2.20	2.15	2.30
6	2.40	2.65	3.40	4.32	4.45	3.55	2.75	1.85	1.70	2.20	2.15	2.35
7	2.40	2.70	3.40	5.80	4.65	3.52	2.70	1.85	1.70	2.20	2.20	2.45
8	2.40	2.80	3.35	4.95	4.78	3.48	2.50	1.85	1.70	2.20	2.20	2.55
9	2.40	3.30	3.30	4.68	4.75	3.42	2.38	1.80	1.70	2.20	2.20	2.55
10	2.40	3.50	3.35	4.58	4.75	3.40	2.35	1.80	1.70	2.20	2.65	3.60
11	2.40	3.60	3.35	4.50	4.70	3.62	2.32	1.80	1.70	2.20	2.40	3.50
12	2.40	3.50	3.40	4.50	4.65	3.30	2.30	1.80	1.70	1.95	2.30	3.10
13	2.40	3.20	3.45	4.65	4.60	3.48	2.30	1.80	1.70	1.95	2.28	3.00
14	2.40	3.10	3.55	4.72	4.60	3.65	2.30	1.80	1.75	1.95	2.22	2.85
15	2.40	4.10	3.55	4.90	4.55	3.62	2.25	1.80	1.75	1.95	2.20	2.55
16	2.40	3.90	3.55	5.08	4.48	3.52	2.20	1.85	1.75	1.95	2.28	2.50
17	2.40	4.40	3.85	5.10	4.40	3.40	2.20	1.90	1.75	1.95	2.32	2.40
18	2.40	4.20	3.60	5.25	4.32	3.32	1.95	1.90	1.75	1.95	2.42	2.40
19	2.40	4.10	3.75	5.60	4.32	3.28	1.95	1.90	1.75	2.00	2.40	2.30
20	2.40	3.90	3.75	5.50	4.20	3.22	1.95	1.90	1.75	2.00	2.40	2.30
21	2.40	4.10	3.70	5.25	4.08	3.20	1.90	1.85	1.80	2.00	2.35	2.40
22	2.40	4.00	3.60	5.05	3.98	3.12	1.90	1.85	1.80	2.10	2.33	2.40
23	2.40	3.90	3.60	4.85	3.92	3.07	1.90	1.85	1.85	2.15	2.30	2.45
24	2.40	4.20	3.50	4.85	3.90	3.00	1.90	1.85	1.85	2.15	2.30	2.50
25	2.40	4.10	3.35	4.65	3.90	2.95	1.90	1.80	1.85	2.20	2.25	2.50
26	2.40	3.90	3.30	4.55	3.92	2.90	1.90	1.80	1.90	2.20	2.22	5.05
27	2.40	4.10	3.35	4.50	4.05	2.90	1.90	1.80	1.90	2.20	2.20	4.75
28	2.40	3.90	3.45	4.42	4.02	2.82	1.90	1.75	1.90	2.20	2.20	4.60
29	2.40	------	3.50	4.45	4.05	2.80	1.90	1.75	1.90	2.15	2.20	4.45
30	2.40	------	3.50	4.50	4.05	2.80	1.90	1.75	1.90	2.15	2.20	4.20
31	2.40	------	3.65	------	4.05	------	1.90	1.75	------	2.10	------	3.95

Miscellaneous measurements in Interior Basin.

HUMBOLDT RIVER BASIN.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
1902.				*Sec.-feet.*
Apr. 22	C. V. Taylor	Humboldt River	Below Pitt dam, Nev	151.0
22	do	Irish American ditch	Near head-gates, Nev	34.7
July 23	D. W. Hays	do	do	28.3
Apr. 22	C. V. Taylor	Southwest ditch	Wagon bridge south of railroad, Nev.	30.3
July 22	D. W. Hays	do	At Railroad bridge, Nev	24.7
Apr. 23	C. V. Taylor	South Riverside ditch	At head-gates, Nev	5.4
23	do	Rodgers ditch	Flume across river	48.4
July 22	D. W. Hays	do	do	41.7
Apr. 23	C. V. Taylor	Union canal	Box near head	23 0
July 23	D. W. Hays	do	do	28.3

Miscellaneous measurements in Interior Basin—Continued.

WALKER RIVER BASIN.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
1902.		*West Fork and tributaries.*		*Sec.-feet.*
Aug. 8	D. W. Hays	West Walker River	County bridge, Cal	222.0
July 26	L. H. Taylor	do	Hoys Bridge, Nev.	225.0
Aug. 7	D. W. Hays	do	do	72.0
Sept. 23	do	do	do	32.0
Oct. 4	do	do	do	44.0
July 24	L. H. Taylor	do	Lower end Smiths Valley, Nev.	180.0
Sept. 22	D. W. Hays	do	do	21.0
July 23	L. H. Taylor	do	Wilsons Ford, head of Mason Valley, Nev.	113.0
Sept. 10	D. W. Hays	Tunnel ditch	From West Walker, Mason Valley, Nev.	7.4
		East Walker and tributaries.		
Aug. 21	D. W. Hays	Robinson Creek	Below Twin Lakes, Cal	75.7
Oct. 6	do	do	do	24.0
Aug. 21	do	Buckeye Creek	Above all diversion, Cal	43.2
Oct. 4	do	do	do	20.0
7	do	Somers Creek	do	4.2
7	do	Green Creek	Above all diversion above Standard dam.	7.1
7	do	Dogtown Creek	Above all diversion, Cal	7.1
5	do	Swanger Creek	At bridge below Huntoon ranch, Cal.	5.7
July 23	L. H. Taylor	East Walker River	10 miles below Bridgeport, Cal.	196.0
Aug. 27	D. W. Hays	do	5 miles below Bridgeport, Cal.	80.0
Oct. 6	do	do	do	58.0
Aug. 28	do	Sweetwater Creek	East Walker River toll-road crossing, Nev.	.65
31	do	East Walker River	Webster's ranch, Nev	66.0
Sept. 6	do	do	do	42.0
July 23	L. H. Taylor	do	Strosnider's ranch, Nev	106.0
Sept. 11	D. W. Hays	Walker River	Nordyke, Nev	14.0
		Ditches from Walker River.		
July 23	L. H. Taylor	Meritt ditch	Mason Valley, Nev	11.9
23	do	Mason Slough	Headgates, Mason Valley, Nev.	63.8
23	do	Slough	At Mason's house, Nev	7.3

CARSON RIVER BASIN.

1902.		*Tributaries of East Fork.*		
Aug. 6	C. V. Taylor	Indian Creek	At head Cohn and Harvey ditch, Cal.	0.72
6	do	Hawkins Creek	¼ mile above Hawkins's house, Cal.	1.18
Sept. 9	L. L. Richard	do	do	1.10
Aug. 6	C. V. Taylor	Petersons Creek	Near old sawmill, Cal	1.27
Sept. 9	L. L. Richard	do	Above Cohn's meadow	.41
Aug. 5	C. V. Taylor	Long Valley Creek	Diamond Valley, Cal	4.12
5	do	do	Above Springmeyer's ranch, Nev.	2.48
5	do	do	Dam site of Long Valley reservoir site, Nev.	.51

Miscellaneous measurements in Interior Basin—Continued.

CARSON RIVER BASIN—Continued.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
1902.		*Tributaries of West Fork.*		*Sec.-feet.*
Aug. 6	C. V. Taylor	Bruns Creek	Mouth of canyon, Cal	2.84
Sept. 9	L. L. Richard	do	do	3.48
Aug. 4	C. V. Taylor	Fairview Creek	Mouth of canyon, Nev	2.30
Sept. 8	L. L. Richard	do	do	2.00
Aug. 4	C. V. Taylor	Spring	¼ mile north of Heitman's house, Nev.	.74
4	do	do	Near Heitman's house, Nev	.35
Sept. 8	L. L. Richard	do	do	.27
Aug. 4	C. V. Taylor	do	South of Heitman's house, Nev.	1.08
Sept. 8	L. L. Richard	do	do	1.06
Aug. 4	C. V. Taylor	do	Heitmans, Nev	2.39
Sept. 8	L. L. Richard	do	do	2.35
Aug. 4	C. V. Taylor	S. Sheridan Creek	¼ mile from road, Nev	2.17
Sept. 8	L. L. Richard	do	Mouth of canyon, Nev	1.04
8	do	do	Above old house, Nev	1.35
Aug. 4	C. V. Taylor	Sheridan Creek	¼ mile above Sheridan, Nev	1.25
Sept. 8	L. L. Richard	do	Near old house, Nev	1.41
Aug. 4	C. V. Taylor	Parks Creek	In canyon, Nev	3.02
Sept. 8	L. L. Richard	do	Mouth canyon, Nev	3.17
8	do	Motts Creek	do	2.16
Aug. 4	C. V. Taylor	do	¼ mile above mouth canyon, Nev.	2.26
4	do	Kingsbury Creek	In canyon, Nev	1.20
Sept. 7	L. L. Richard	do	Bridge above old mill, Nev	1.12
Aug. 3	C. V. Taylor	Genoa Creek	Above all diversions, Nev	1.25
Sept. 7	L. L. Richard	do	Mouth of canyon, Nev	1.81
Aug. 3	C. V. Taylor,	Dressler Creek	do	1.11
Sept. 7	L. L. Richard	do	do	.87
Aug. 3	C. V. Taylor	James Canyon Creek	do	.78
Sept. 11	L. L. Richard	do	Below Genoa road, Nev	.50
Aug. 3	C. V. Taylor	Jacks Valley Creek	Mouth of canyon, Nev	2.47
Sept. 7	L. L. Richard	do	Above Genoa road, Nev	.89
Aug. 2	C. V. Taylor	Pedrolis ditch	Pedrolis, Nev	.30
Sept. 11	L. L. Richard	do	do	.30
Aug. 2	C. V. Taylor	Clear Creek	do	2.02
Sept. 11	L. L. Richard	do	Above lower ditch, Nev	1.76
Aug. 2	C. V. Taylor	Kings Canyon Creek	Above all diversions, Nev	2.41
7	do	do	Robinsons Box, Nev	1.00
7	do	do	Mouth of canyon, Nev	2.71
Sept. 6	L. L. Richard	do	do	2.93
11	do	do	do	2.80
Aug. 10	C. V. Taylor	do	do	3.36
2	do	Ash Canyon Creek	¼ mile above mouth canyon, Nev.	2.76
Sept. 6	L. L. Richard	do	Mouth canyon, Nev	2.78
11	do	do	do	2.27
Aug. 7	C. V. Taylor	Walsh ditch		.07
7	do	Muldoon ditch	Head of ditch, Nev	.31
7	do	Water Co. ditch	do	.54
6	do	Thorn ditch	do	.46

SAN FRANCISCO BAY DRAINAGE BASIN.

Sacramento River, rising in northern California and flowing south, and the San Joaquin, rising in the southern sierras and flowing northeast, drain the western slope of the Sierra Nevada, traverse what is often called the Valley of California, and meet near Suisun Bay, finally discharging their waters into the Pacific Ocean through San Francisco Bay.

Sacramento River derives its water supply largely from Mount Shasta and the surrounding high ranges in the extreme northern portion of California. The stream does not have the same regular annual fluctuations that characterize the rivers discharging from the higher Sierra Nevada, in that a large part of its basin is not at an elevation sufficient to cause the winter snows to remain unmelted until the summer months. The greatest floods of this basin usually occur in January and February, when the snow is accompanied or followed by rain.

San Joaquin River is divided into two distinct parts. The valley portion forms the central drainage line of San Joaquin Valley, and during the spring is navigable for a hundred or more miles. The Stanislaus, Tuolumne, and King rivers are the largest affluents of this portion of the stream. Its valley is fertile and almost destitute of timber. The mountainous portion of the stream drains the western slopes of the Sierra Nevada between Yosemite National Park and Mount Goddard, the crest of its divide reaching an elevation on the north, in Mount Lyell, of 13,000 feet, and an elevation of 14,000 feet in Mount Goddard. The resulting steep grades of this river offer exceptional opportunities for water-power developments, and the high elevations of the basin insure a well-sustained summer flow from perpetual snow banks.

The following streams are tributary to either the Sacramento or San Joaquin rivers:

Cache Creek is the outlet of Clear Lake, in Lake County, Cal. Flowing southeasterly, its flood waters find their way into Sacramento River between the mouths of Feather and American rivers. In 1889 Clear Lake was segregated as a reservoir site, as described in the Thirteenth Annual Report, Part III, pages 405–409. During 1900 a hydrographic examination of the entire basin of Cache Creek was made by A. E. Chandler, whose detailed report has been published as Water-Supply Paper No. 45.

Feather River is the second largest tributary of Sacramento River, Pit River being the first. Its basin line follows the crest of the Sierra Nevada for about 130 miles. The rainfall in this basin is large; the mean for nineteen years at Mumfords Hill, Plumas County, is 71.64 inches; the rainfall for the year 1889–90 at this point reached 138.85 inches. The water collected by the river when rains are gen-

eral sometimes causes tremendous freshets, usually of short duration. The river has at such times overtopped its right bank and overflowed the plain lands to the northward of Sutter Buttes. This occurred even before the great reduction of waterway below the mouth of Yuba River. The channel of the river below its junction with the Yuba has become the repository of so much mining débris that its bed has become nearly filled. Its bottom is almost at the heights of its former banks. Levees have been built to prevent overflowing. There is a comparatively small portion of the summer flow of this stream used for irrigation, though the possibilities of irrigation and power development are great.

There are some excellent reservoir sites on the upper tributaries of the North Fork of the Feather. This stream is fed in part by large springs, one of which in Big Meadows was flowing 109 cubic feet per second in September, 1902, and another 64 cubic feet per second.

Stony Creek drains 760 square miles of the eastern slopes of the Coast Range. After reaching the Sacramento Valley it flows north for a number of miles, contrary to the general drainage, and then turns east and enters Sacramento River below Vina, Cal. A large portion of the basin near the heads of the stream is heavily covered with commercial timber. There are a number of good reservoir sites on this stream and its tributaries.

Tuolumne River rises on the western slope of the Sierra Nevada in California and drains the country between Stanislaus River on the north and Merced River on the south. The northern half of Yosemite National Park includes a portion of the drainage basin of this stream. The river is fed largely from small mountain lakes occurring high in the drainage basin, where the snow remains on the mountain slopes throughout the year, thus insuring a large run-off. The stream has a heavy fall, and the opportunities for power development are numerous. There are also a number of reservoir sites in the basin where flood water could be stored for use during the irrigation season. The Tuolumne is an important tributary of the San Joaquin.

Merced River above Merced Falls drains approximately 1,090 square miles of the western slopes of the Sierra Nevada. There are included in the eastern portion of its drainage area a large number of high peaks, the highest, Mount Lyell, reaching an elevation of 13,042 feet. Its basin lies south of that of the Tuolumne, the courses of the two streams being nearly parallel.

King River rises on the western slope of the Sierra Nevada, in Fresno County, Cal. The waters coming from the high catchment basin are probably of greater value for irrigation purposes than those of any other stream in central California, being used for raising grapes and deciduous fruits in the neighborhood of Fresno, Selma, and Hanford. The summer flow of the river is now entirely diverted, and during the dry season of the last few years the scarcity of water has

caused many hardships. In the spring there is a large surplus, due to the melting of snows, which, if stored in suitable reservoirs, would bring larger areas under cultivation. The river has a relatively gentle grade, affording little opportunity for power development.

Tule River drains a portion of the western slope of the Sierra Nevada. Its basin has somewhat less run-off than that of Kaweah River, which joins it on the north, and is much less elevated and snow covered than the King River Basin. The water of this stream is all appropriated during the irrigation season, and a portion is used in irrigating valuable orange lands in the vicinity of Portersville, Cal.

Kern River flows from the southern end of the Sierra Nevada, being formed by two large tributaries, known as the North and South forks. These have a general southerly and parallel course and unite a short distance below the town of Kernville. The run-off from the drainage basin as a whole is notably less than that from the catchment areas to the north. This is probably due to the fact that a portion of the basin is to the east of the high crest, and is sheltered by the mountain mass from the rain-bearing winds. The waters of Kern River are almost completely used for irrigation by the large canals in the southern end of the San Joaquin Valley. The greater part of the land is included in large holdings owned by the Kern County Land Company or by the Miller and Lux estate. The winter waters are in part stored by the Miller and Lux estate in Buena Vista Lake, into which the river naturally discharges. The waters of this lake are controlled by a system of levees, so that they can be used during the following summer to irrigate lands lying to the northwest. This lake is very broad and shallow and there is great loss by evaporation, so that as a matter of economy it would be desirable to hold this water in the upper mountain valleys. This would afford also a large supply for water power.

The fall of Kern River is sufficiently large for the development of a considerable amount of water power.

The following is a list of the stations in the San Francisco Bay drainage basin:

Cache Creek at Lower Lake, Cal.
Feather River at Oroville, Cal.
Stony Creek at Julians ranch, near Fruto, Cal.
Sacramento River at Jellys Ferry and at Iron Canyon, near Red Bluff, Cal.
Tuolumne River and Turlock Canal at Lagrange, Cal.
Merced River above Merced Falls, Cal.
King River at Kingsburg, Cal.
King River at Red Mountain, near Sanger, Cal.
Tule River near Portersville, Cal.
Kern River near Bakersfield, Cal.
San Joaquin River at Herndon, Cal.

CACHE CREEK AT LOWER LAKE, CAL.

On account of the great importance of Clear Lake as a storage reservoir, a gaging station was established at the wagon bridge across Cache Creek, one-half mile north of the town of Lower Lake, January 1, 1901. The observer is Mrs. J. R. Anderson.

Evaporation records have been kept at Lakeport on Clear Lake since February 1, 1901. The evaporation pan is 3 feet square and 1.5 feet deep and is floated on a triangular raft anchored in a cove where it is not exposed to the full force of the wind. Evaporation observations were begun on the land at the same point September, 1901. Capt. D. C. Rumsey is the observer. A table giving the evaporation, by months, from February, 1901, to December 31, 1902, will be found in the following pages.

Discharge measurements of Cache Creek at Lower Lake, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 29	J. R. Anderson	1.6	70
February 13	do	2.5	260
March 3	do	6.5	1,151
March 19	do	7.7	1,866
April 5	do	6.5	1,397
April 24	do	5.9	1,212
May 3	S. G. Bennett	5.2	1,042
May 19	J. R. Anderson	4.5	853
May 31	do	4.0	720
June 14	do	3.6	629
July 12	do	3.1	422
July 26	do	2.8	345
August 9	do	2.7	289
August 22	do	2.5	246
September 6	do	2.3	193
September 20	do	2.2	156
October 4	do	2.1	108
October 20	do	2.0	83
November 4	do	2.1	118
November 19	do	2.8	245
December 19	S. G. Bennett	2.8	300

Daily gage height, in feet, of Cache Creek at Lower Lake, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.6	1.6	5.9	6.5	5.4	4.0	3.3	2.8	2.4	2.1	2.1	2.7
2	1.6	1.6	6.6	6.5	5.3	4.0	3.3	2.7	2.4	2.1	2.1	2.7
3	1.6	1.6	6.5	6.5	5.3	3.9	3.2	2.7	2.4	2.1	2.1	2.7
4	1.6	1.7	6.5	6.5	5.2	3.9	3.2	2.7	2.3	2.1	2.1	2.7
5	1.6	1.7	6.5	6.5	5.1	3.9	3.2	2.7	2.3	2.1	2.0	2.7
6	1.6	1.8	7.2	7.0	5.0	3.8	3.2	2.7	2.3	2.1	2.0	2.7
7	1.6	1.9	7.0	6.9	5.1	3.8	3.2	2.7	2.3	2.1	2.1	2.7
8	1.6	2.0	8.0	6.8	5.1	3.8	3.2	2.7	2.3	2.1	2.2	2.7
9	1.6	2.1	8.0	6.8	5.0	3.8	3.2	2.7	2.3	2.1	3.7	2.7
10	1.6	2.1	8.1	6.8	5.0	3.7	3.1	2.6	2.3	2.1	2.8	2.8
11	1.6	3.2	8.0	6.8	4.9	3.7	3.1	2.6	2.3	2.1	2.8	2.8
12	1.6	2.4	8.0	6.7	4.7	3.7	3.1	2.6	2.3	2.1	2.8	2.8
13	1.6	2.5	8.2	6.6	4.7	3.7	3.1	2.6	2.3	2.1	2.8	2.8
14	1.6	2.6	8.0	6.6	4.8	3.6	3.1	2.6	2.3	2.1	2.8	2.8
15	1.6	2.6	7.9	6.5	4.7	3.6	3.0	2.6	2.2	2.1	2.8	2.8
16	1.6	2.6	7.8	6.5	4.7	3.6	3.0	2.6	2.2	2.1	2.8	2.8
17	1.6	2.8	7.8	6.5	4.7	3.6	3.0	2.6	2.2	2.0	2.8	2.8
18	1.5	2.7	7.7	6.5	4.6	3.5	3.0	2.5	2.2	2.1	2.8	2.8
19	1.6	2.7	7.7	6.5	4.5	3.5	3.0	2.5	2.2	2.0	2.8	2.8
20	1.5	2.8	7.6	6.3	4.5	3.5	3.0	2.5	2.2	2.0	2.8	2.8
21	1.6	3.3	7.4	6.2	4.4	3.5	3.0	2.5	2.2	2.0	2.8	2.8
22	1.7	3.1	7.4	6.0	4.3	3.5	3.0	2.5	2.2	2.0	2.8	2.8
23	1.6	4.6	7.5	5.9	4.3	3.5	2.9	2.5	2.2	2.1	2.8	2.8
24	1.7	4.4	7.2	5.9	4.2	3.4	2.9	2.5	2.2	2.2	2.7	2.8
25	1.8	6.1	7.2	5.8	4.2	3.4	2.9	2.4	2.2	2.1	2.7	2.8
26	1.7	5.0	7.1	5.8	4.1	3.4	2.8	2.4	2.2	2.1	2.7	2.9
27	1.6	5.5	7.0	5.7	4.1	3.4	2.8	2.4	2.2	2.1	2.7	2.9
28	1.6	5.4	6.8	5.5	4.1	3.3	2.8	2.4	2.2	2.1	2.7	2.9
29	1.6	.....	6.7	5.5	4.1	3.3	2.8	2.4	2.1	2.1	2.7	2.9
30	1.6	.....	6.6	5.4	4.0	3.3	2.8	2.4	2.1	2.1	2.7	2.9
31	1.6	.....	6.5	.....	4.0	.....	2.8	2.4	.....	2.1	.....	2.9

Rating table for Cache Creek at Lower Lake, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	40	2.6	250	4.4	790	6.6	1,520
1.6	52	2.7	280	4.6	850	6.8	1,590
1.7	64	2.8	310	4.8	910	7.0	1,660
1.8	78	2.9	340	5.0	970	7.2	1,730
1.9	94	3.0	370	5.2	1,030	7.4	1,800
2.0	110	3.2	430	5.4	1,100	7.6	1,870
2.1	130	3.4	490	5.6	1,170	7.8	1,940
2.2	150	3.6	550	5.8	1,240	8.0	2,010
2.3	175	3.8	610	6.0	1,310	8.2	2,080
2.4	200	4.0	670	6.2	1,380		
2.5	225	4.2	730	6.4	1,450		

Estimated monthly discharge of Cache Creek at Lower Lake, Cal.

[Drainage area, 500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	78	40	53	3,259	0.11	0.13
February	1,345	52	381	21,160	.76	.79
March	2,080	1,275	1,766	108,587	3.53	4.07
April	1,660	1,100	1,427	84,912	2.85	3.18
May	1,100	670	865	53,187	1.73	1.99
June	670	460	556	33,084	1.11	1.24
July	460	310	380	23,365	.76	.88
August	310	200	243	14,941	.49	.56
September	200	130	163	9,699	.33	.37
October	150	110	127	7,809	.25	.29
November	580	110	263	15,650	.53	.59
December	340	280	307	18,877	.61	.70
The year	2,080	40	544	394,530	1.09	14.79

Evaporation record of Clear Lake at Lakeport, Cal.

[D. C. Rumsey, observer.]

	Evaporation in inches.			Evaporation in inches.	
	Lake.	Land.		Lake.	Land.
1901.			1902.		
January (estimated)	0.85	.....	January	0.85	0.85
February	.95	.....	February	.25	.30
March	2.40	.....	March	1.60	1.55
April	3.05	.....	April	2.60	2.35
May	3.70	.....	May	4.00	3.70
June	3.95	.....	June	4.65	5.15
July	5.15	.....	July	6.65	7.40
August	5.00	.....	August	4.40	4.95
September	3.35	[a]1.6	September	4.10	4.40
October	2.30	2.45	October	1.95	1.85
November	.85	1.05	November	.45	.45
December	1.30	.95	December	.40	.45
	32.85	6.05		31.90	33.40

[a] September 15 to 29.

FEATHER RIVER AT OROVILLE, CAL.

At Oroville, where Feather River breaks from the foothills on the western slope of the Sierra Nevada into the Sacramento Valley, it has a drainage basin of 3,350 square miles.

The minimum midsummer discharge, as far as known, was in 1900 when the stream was flowing 1,123 second-feet. Observations of daily river stage were begun January 1, 1902, using the rod of the Weather Bureau, which has been in place for a number of years. Readings on this rod have been taken and reported by the Weather Bureau during flood heights when there was danger of overflow on the lower Feather and Sacramento rivers. It was found that there would be minus readings during low stage, and 2 feet have been added to the reading as observed on the rod. The observer is Miss Louise N. Lee.

Discharge measurements of Feather River at Oroville, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 29	S. G. Bennett	1.85	1,960
March 1	do	8.70	15,228
May 7	do	8.75	15,476
September 4	C. A. Miller	.96	1,385
September 10	do	.92	1,390
December 18	S. G. Bennett	3.65	3,298

Daily gage height, in feet, of Feather River at Oroville, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.0	2.0	10.7	6.5	8.6	7.5	2.9	1.4	1.0	0.8	1.2	1.3
2	2.5	2.0	10.5	7.0	7.5	7.0	3.0	1.4	1.0	.8	1.2	1.5
3	2.5	2.0	9.5	8.0	7.2	6.5	3.0	1.4	1.0	.8	1.2	1.8
4	2.0	2.0	8.8	10.0	7.1	6.3	3.0	1.3	.9	.8	1.2	2.0
5	2.0	3.0	8.5	13.0	7.0	6.2	3.0	1.3	.9	.8	1.2	2.6
6	2.0	3.5	8.3	14.0	8.0	6.2	2.9	1.3	.9	.8	1.4	3.0
7	2.0	9.0	8.1	14.0	8.5	6.0	2.7	1.3	.9	.8	2.0	3.8
8	2.0	10.2	8.2	12.3	8.4	6.0	2.5	1.3	.9	.8	3.3	3.8
9	2.0	11.3	8.8	11.2	8.4	5.9	2.5	1.3	.9	.8	3.9	4.2
10	2.0	10.5	8.4	10.6	8.4	5.8	2.4	1.3	.9	.8	8.5	7.8
11	2.0	9.7	8.5	9.2	8.3	5.8	2.4	1.3	.9	.8	5.3	10.0
12	2.0	9.8	7.4	8.9	8.7	5.7	2.3	1.3	.8	.8	3.8	9.0
13	2.0	8.3	6.9	8.7	9.0	5.5	2.2	1.3	.8	.8	3.3	8.5
14	2.0	7.2	6.7	8.6	8.8	5.4	2.2	1.3	.8	.8	3.5	6.3
15	2.0	11.8	6.4	9.9	8.5	4.7	2.1	1.3	.8	.8	3.4	5.2
16	2.0	11.3	6.4	11.5	8.4	5.0	2.0	1.3	.8	.8	3.4	4.5
17	2.0	12.5	6.5	11.0	8.3	4.8	1.9	1.3	.8	.8	4.0	4.0
18	2.0	10.2	6.7	10.5	7.8	4.5	1.9	1.3	.8	.8	5.5	3.5
19	2.0	9.2	6.6	9.5	7.5	4.3	1.8	1.3	.8	.8	6.5	3.3
20	2.0	8.5	6.8	9.4	7.3	4.3	1.8	1.3	.8	.8	5.5	3.3
21	2.0	9.0	6.8	9.8	7.0	4.1	1.7	1.3	.8	1.3	4.5	3.2
22	2.0	9.8	6.6	9.0	6.9	4.1	1.8	1.2	.8	1.8	3.2	3.1
23	2.0	9.5	6.5	9.5	6.8	4.0	1.7	1.2	.8	1.9	3.1	3.1
24	2.0	13.5	6.4	8.2	6.8	4.0	1.7	1.2	.8	3.3	3.1	3.0
25	2.0	13.0	6.3	7.8	7.5	3.8	1.6	1.1	.8	3.4	2.9	3.0
26	2.0	13.8	6.2	7.5	8.0	3.5	1.6	1.1	.8	1.2	2.5	4.0
27	2.0	13.7	6.1	7.4	7.9	3.4	1.6	1.1	.8	1.2	2.1	11.0
28	2.0	12.3	6.0	7.3	7.8	3.3	1.5	1.1	.8	1.2	1.9	8.0
29	2.0	------	6.0	8.0	7.5	3.2	1.5	1.0	.8	1.2	1.7	7.2
30	2.0	------	5.9	7.8	7.3	3.0	1.5	1.0	.8	1.2	1.5	5.0
31	2.0	------	5.9	------	7.0	------	1.4	1.0	------	1.2	------	4.5

Rating table for Feather River at Oroville, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	1,300	3.0	2,750	5.2	5,660	9.5	18,900
1.0	1,400	3.2	2,950	5.4	6,020	10.0	21,200
1.2	1,510	3.4	3,150	5.6	6,400	10.5	23,500
1.4	1,620	3.6	3,365	5.8	6,800	11.0	25,800
1.6	1,735	3.8	3,595	6.0	7,200	11.5	28,100
1.8	1,855	4.0	3,825	6.5	8,300	12.0	30,400
2.0	1,975	4.2	4,095	7.0	9,500	12.5	32,700
2.2	2,115	4.4	4,365	7.5	10,900	13.0	35,000
2.4	2,255	4.6	4,660	8.0	12,500	14.0	39,600
2.6	2,410	4.8	4,980	8.5	14,400		
2.8	2,580	5.0	5,300	9.0	16,600		

Estimated monthly discharge of Feather River at Oroville, Cal.

[Drainage area, 3,350 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	2,325	1,975	1,998	122,852	0.60	0.69
February	38,680	1,975	19,545	1,085,474	5.83	6.07
March	24,420	7,000	11,148	685,464	3.33	3.84
April	39,600	8,300	19,485	1,159,438	5.82	6.49
May	16,600	9,020	12,110	744,615	3.61	4.16
June	10,900	2,750	5,609	333,759	1.67	1.86
July	2,750	1,620	2,098	129,001	.63	.73
August	1,620	1,400	1,535	94,383	.46	.53
September	1,400	1,300	1,323	78,724	.39	.44
October	3,150	1,300	1,503	92,416	.45	.52
November	14,490	1,510	3,481	207,134	1.04	1.16
December	25,800	1,565	6,287	386,573	1.88	2.17
The year	39,600	1,300	7,177	5,119,833	2.14	28.66

STONY CREEK NEAR FRUTO, CAL.

On January 30, 1901, a gaging station was established by Burt Cole at Julian's ranch, 6 miles northwest of the town of Fruto, Cal., to determine the amount of water available for storage. The observer is Mrs. Lee Julian.

During 1902 the following discharge measurements were made by S. G. Bennett:

January 26: Gage height, 3.90 feet; discharge, 126 second-feet.
February 28: Gage height. 10.00 feet; discharge, 7,336 second-feet.
May 8: Gage height, 5.33 feet; discharge, 1,080 second-feet.
September 24: Gage height, 3.00 feet; discharge, 14 second-feet.

Daily gage height, in feet, of Stony Creek at Julian's ranch, near Fruto, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	4.0	3.9	9.2	5.4	5.1	4.6	2.9	2.7	2.8	3.5	3.9	5.9
2	4.1	4.0	9.8	5.5	5.0	4.5	2.9	2.7	2.8	3.5	3.9	5.9
3	4.0	4.0	8.3	5.6	4.9	4.4	2.9	2.7	2.8	3.5	3.9	5.8
4	4.0	3.9	7.9	5.7	4.9	4.4	2.9	2.7	2.8	3.5	3.9	5.7
5	4.0	4.0	7.3	5.8	4.8	4.4	2.9	2.7	2.8	3.5	3.9	7.2
6	3.9	4.7	7.6	7.0	4.8	4.3	2.8	2.7	2.8	3.5	4.0	5.7
7	3.9	6.9	7.6	8.5	5.3	4.3	2.7	2.7	2.8	3.5	4.0	5.6
8	3.9	7.5	8.8	7.6	5.5	4.3	2.7	2.7	2.8	3.6	4.8	5.5
9	3.9	7.5	8.4	7.3	5.4	4.2	2.7	2.7	2.8	3.6	8.7	5.6
10	3.9	7.9	7.5	7.0	5.3	4.2	2.7	2.7	2.9	3.6	7.8	5.7
11	3.9	8.8	7.3	6.8	5.2	4.1	2.7	2.7	2.9	3.6	6.7	5.7
12	3.9	7.5	7.0	6.5	5.3	4.1	2.7	2.7	2.9	3.6	6.1	5.6
13	3.9	7.0	7.0	6.0	5.3	4.1	2.7	2.7	2.9	3.6	6.0	5.6
14	3.9	7.2	7.0	6.1	5.3	4.0	2.7	2.7	2.9	3.7	5.9	5.6
15	3.9	8.3	7.0	6.1	5.1	4.0	2.7	2.7	2.9	3.7	5.9	5.5
16	3.9	7.5	7.0	6.0	5.0	3.9	2.7	2.7	2.9	3.7	5.9	5.5
17	3.9	7.4	6.9	5.9	5.0	3.8	2.7	2.7	2.9	3.7	6.0	5.5
18	3.9	6.7	6.8	5.8	5.0	3.8	2.7	2.7	2.9	3.7	7.2	5.5
19	3.9	6.7	6.6	5.7	4.9	3.7	2.7	2.7	2.9	3.7	7.8	5.4
20	3.9	6.9	6.6	5.6	4.8	3.6	2.7	2.7	2.9	3.7	7.1	5.4
21	3.9	7.6	6.5	5.7	4.8	3.5	2.7	2.7	2.9	3.7	6.7	5.3
22	4.0	8.3	6.5	5.5	4.7	3.4	2.7	2.7	2.9	3.8	6.6	5.2
23	4.0	10.1	5.6	5.6	4.7	3.4	2.7	2.7	2.9	3.8	6.5	5.2
24	4.0	13.2	5.6	5.5	4.6	3.3	2.7	2.7	3.0	4.2	6 5	5.1
25	3.9	12.6	5.5	5.6	4.6	3.3	2.7	2.7	3.0	4.3	6.4	5.4
26	3.9	11.2	5.5	5.4	4.6	3.2	2.7	2.8	3.0	4.2	6.4	6.1
27	3.9	12.4	5.4	5.3	4.5	2.8	2.7	2.8	3.0	4.1	6.3	5.8
28	3.9	10.1	5.4	5.3	4.5	2.8	2.7	2.8	3.0	4.0	6.2	5.8
29	3.9	.....	5.4	5.2	4.4	2.8	2.7	2.8	3.0	4.0	6.1	5.8
30	3.9	.....	5.4	5.1	4.5	2.8	2.7	2.8	3.0	4.0	6.0	5.7
31	3.9	.....	5.4	.....	4.6	.....	2.7	2.8	.....	3.9	.....	5.6

Rating table for Stony Creek at Julian's ranch, near Fruto, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.8	5	4.6	370	6.4	1,835	8.5	4,680
3.0	14	4.8	490	6.6	2,050	9.0	5,510
3.2	27	5.0	620	6.8	2,275	9.5	6,410
3.4	44	5.2	765	7.0	2,510	10.0	7,400
3.6	67	5.4	920	7.2	2,765	10.5	8,400
3.8	94	5.6	1,080	7.4	3,035	11.0	9,450
4.0	125	5.8	1,250	7.6	3,315	11.5	10,550
4.2	185	6.0	1,430	7.8	3,605	12.0	11,700
4.4	270	6.2	1,625	8.0	3,900	13.0	14,150

Estimated monthly discharge of Stony Creek at Julian's ranch, near Fruto, Cal.

[Darinage area, 760 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	150	109	114	7,010	0.15	0.17
February	14,650	109	4,201	233,312	5.53	5.76
March	7,000	920	2,588	159,130	3.41	3.93
April	4,680	690	1,522	90,565	2.00	2.23
May	1,000	270	578	35,540	.76	.88
June	370	5	132	7,855	.17	.19
July	9	2	3	184	.00	.00
August	5	2	3	184	.00	.00
September	14	5	9	536	.01	.01
October	225	55	92	5,657	.12	.14
November	5,005	109	1,584	94,255	2.08	2.32
December	2,765	690	1,132	69,604	1.49	1.72
The year	14,650	2	997	703,832	1.31	17.35

SACRAMENTO RIVER AT JELLYS FERRY AND AT IRON CANYON, NEAR RED BLUFF, CAL.

The gaging station at Jellys Ferry, which is located 12 miles above the town of Red Bluff, was established April 30, 1895. The right bank of the river is high, but the left bank is liable to overflow when the river rises above the 25-foot mark. The river has been known to reach the 33-foot mark. Because of the liability to overflow, it was deemed advisable to select a new gaging station where the water at flood stage would be more confined. A point in Iron Canyon, where the river had been gaged by the State engineering department in 1879 and by the commissioner of public works in 1893–94, was chosen as a new gaging station. The river stage rod used by the commissioner of public works was still in place and has been used in making river height observations since January 28, 1902, the date upon which the observations were begun. The river at this point in lower portion of Iron Canyon, 4 miles above Red Bluff, has a direct course for 2 or 3 miles. The width between banks at low water is about 500 feet. The depth of water at low stages averages 6 feet with a maximum depth of 9 feet. The banks are steep and firm. The river flows in a bed of coarse gravel and cobbles with here and there a small bowlder. The bed

rock is lava. Discharge measurements are made from a cable 800 feet long, which is anchored in the lava rock that forms the wall of the canyon. The observer at Jellys Ferry was A. A. Sergison; at Iron Canyon, F. A. Wilcox.

Daily gage height, in feet, of Sacramento River at Jellys Ferry, near Red Bluff, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1902.						
1	5.7	5.5	19.6	9.0	11.4	8.3
2	6.0	5.8	21.3	9.1	10.5	8.1
3	6.3	5.5	16.7	9.7	9.9	7.9
4	5.8	6.5	15.3	11.2	9.7	7.6
5	5.8	8.1	14.2	10.9	9.4	7.6
6	5.8	9.4	17.6	11.3	9.6	7.6
7	5.7	16.0	15.8	18.3	11.5	7.5
8	5.7	21.9	19.8	17.6	11.1	7.7
9	5.7	25.2	21.9	14.5	10.7	7.7
10	5.7	32.6	17.1	13.0	10.5	7.6
11	5.6	29.6	15.1	12.4	10.2	7.6
12	5.6	26.0	14.0	11.5	9.9	7.4
13	5.6	19.3	15.1	11.0	10.6	7.3
14	5.5	18.3	12.6	10.9	11.7	7.3
15	5.5	23.8	11.9	10.9	12.3	7.0
16	5.6	22.6	11.4	10.8	11.1	6.9
17	5.5	23.1	11.1	10.9	10.6	6.8
18	5.5	20.9	10.9	10.9	10.2	6.7
19	5.4	17.5	11.0	11.3	9.7	6.6
20	5.5	15.5	10.4	11.0	9.4	6.5
21	5.9	17.1	10.6	10.6	9.1	6.5
22	5.9	20.8	10.2	10.1	8.9	6.5
23	5.8	21.2	10.3	9.8	8.8	6.4
24	6.2	32.7	9.9	9.6	8.8	6.4
25	5.9	32.0	9.6	9.8	8.8	6.3
26	5.7	28.8	9.4	9.3	8.8	6.3
27	5.6	25.9	9.2	9.2	9.1	6.2
28	5.5	21.3	9.0	8.9	9.1	6.1
29	5.5	.....	8.9	10.7	8.9	6.1
30	5.5	.....	8.9	10.4	8.5	6.0
31	5.5	.....	8.9	.....	8.4	.....

Rating table for Sacramento River at Jellys Ferry, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.0	2,400	6.8	8,070	12.0	24,400	22.0	76,800
4.2	2,670	7.0	8,630	12.5	26,400	23.0	83,400
4.4	2,970	7.2	9,200	13.0	28,400	24.0	90,000
4.6	3,290	7.4	9,800	13.5	30,400	25.0	96,600
4.8	3,630	7.6	10,400	14.0	32,400	26.0	103,200
5.0	3,980	7.8	11,000	14.5	34,600	27.0	109,800
5.2	4,360	8.0	11,600	15.0	36,800	28.0	116,400
5.4	4,760	8.5	13,100	15.5	39,200	29.0	123,000
5.6	5,170	9.0	14,600	16.0	41,600	30.0	129,600
5.8	5,590	9.5	16,100	17.0	46,600	31.0	136,200
6.0	6,030	10.0	17,600	18.0	52,300	32.0	142,800
6.2	6,500	10.5	19,200	19.0	58,200	33.0	149,400
6.4	7,000	11.0	20,800	20.0	64,200	34.0	156,000
6.6	7,530	11.5	22,600	21.0	70,400	35.0	162,600

Estimated monthly discharge of Sacramento River at Jellys Ferry, near Red Bluff, Cal.

[Drainage area, 9,134 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	6,750	4,760	5,376	330,557	0.59	0.68
February	147,420	4,965	69,423	3,855,558	7.60	7.91
March	76,160	14,300	31,213	1,919,213	3.42	3.94
April	54,070	14,300	22,096	1,314,803	2.42	2.70
May	25,600	12,800	17,453	1,073,143	1.91	2.20
June	12,500	6,030	8,758	521,137	.96	1.07

Discharge measurements of Sacramento River at Iron Canyon, near Red Bluff, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1901.		*Feet.*	*Second-feet.*
October 30	S. G. Bennett	1.02	5,187
December 13	do	2.68	9,651
1902.			
January 28	do	1.35	5,912
February 12	Wm. F. Luning	20.60	110,824
March 3	S. G. Bennett	10.60	41,570
May 10	do	5.50	18,927
September 13	C. A. Miller	.84	4,425
December 31	S. G. Bennett	3.20	9,858

Daily gage height, in feet, of Sacramento River at Iron Canyon, near Red Bluff, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1		1.3	12.3	4.2	5.8	4.0	1.9	1.4	1.1	1.0	1.4	2.6
2		1.3	11.0	4.5	6.0	4.0	1.8	1.4	1.0	1.0	1.5	2.5
3		1.3	9.4	4.8	6.0	4.0	1.7	1.4	1.0	1.0	1.5	2.4
4		1.3	9.0	4.9	5.0	3.5	1.6	1.4	1.0	1.0	1.4	2.4
5		3.6	8.0	5.8	4.8	3.2	1.6	1.4	1.0	1.0	1.3	2.3
6		4.4	9.3	6.0	4.7	3.2	1.6	1.4	1.0	1.0	1.3	3.0
7		9.4	9.8	12.7	6.5	3.2	1.6	1.3	1.0	1.0	1.8	6.0
8		15.2	13.0	11.0	6.3	3.2	1.6	1.3	1.0	1.0	4.9	5.5
9		17.4	14.0	9.7	5.9	3.2	1.6	1.3	1.0	1.0	17.5	5.0
10		23.6	10.0	7.6	5.8	3.0	1.6	1.3	1.0	1.0	21.4	10.0
11		22.7	9.0	6.7	5.4	3.0	1.6	1.3	1.0	1.0	8.5	9.0
12		23.0	8.0	6.0	5.3	3.0	1.6	1.3	1.0	1.0	5.9	7.9
13		14.1	7.5	5.9	5.2	3.0	1.6	1.3	1.0	1.0	5.0	7.5
14		14.8	7.0	5.9	6.7	3.0	1.6	1.3	1.0	1.0	5.3	6.5
15		17.5	6.8	5.9	6.8	3.0	1.6	1.3	1.0	1.0	5.5	4.9
16		16.5	6.2	5.9	5.7	3.3	1.6	1.3	1.0	1.0	6.0	4.5
17		16.0	6.0	5.9	6.5	3.2	1.5	1.3	1.0	1.0	6.7	4.1
18		13.0	6.0	5.9	5.5	2.6	1.5	1.3	1.0	1.0	5.8	3.8
19		11.0	6.0	6.3	4.8	3.0	1.5	1.3	1.0	1.0	5.8	3.6
20		10.0	5.7	6.3	4.8	2.9	1.5	1.3	1.0	1.0	5.2	3.4
21		11.3	5.3	5.5	4.2	2.8	1.4	1.3	1.0	1.0	5.0	3.3
22		13.2	5.2	5.5	4.3	2.7	1.4	1.3	1.0	1.7	4.5	3.2
23		15.3	5.1	5.4	3.0	2.6	1.4	1.3	1.0	1.7	4.0	3.9
24		24.8	5.0	5.0	4.4	2.5	1.4	1.3	1.0	3.5	3.7	3.9
25		24.0	4.8	5.1	4.4	2.4	1.4	1.3	1.0	3.4	3.5	3.9
26		24.1	4.7	5.0	4.4	2.3	1.4	1.3	1.0	2.5	3.4	9.6
27		20.3	4.5	5.0	4.3	2.2	1.4	1.3	1.0	1.8	3.0	7.8
28	1.3	14.6	4.4	5.0	4.3	2.0	1.4	1.2	1.0	2.0	2.8	6.1
29	1.3		4.3	4.5	4.2	1.9	1.4	1.2	1.0	1.7	2.7	5.1
30	1.3		4.2	5.8	4.2	1.9	1.4	1.2	1.0	1.7	2.6	4.6
31	1.3		4.2		4.3		1.4	1.2		1.7		4.6

Rating table for Sacramento River at Iron Canyon, near Red Bluff, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	5,000	5.0	17,100	9.0	34,300	13.0	55,600
1.2	5,440	5.2	17,900	9.2	35,260	13.2	56,800
1.4	5,880	5.4	18,700	9.4	36,220	13.4	58,000
1.6	6,340	5.6	19,500	9.6	37,180	13.6	59,220
1.8	6,820	5.8	20,300	9.8	38,140	13.8	60,460
2.0	7,300	6.0	21,100	10.0	39,100	14.0	61,700
2.2	7,840	6.2	21,940	10.2	40,100	14.5	64,900
2.4	8,380	6.4	22,780	10.4	41,100	15.0	68,200
2.6	8,950	6.6	23,620	10.6	42,120	15.5	71,600
2.8	9,550	6.8	24,460	10.8	43,160	16.0	75,100
3.0	10,150	7.0	25,300	11.0	44,200	16.5	78,600
3.2	10,790	7.2	26,180	11.2	45,280	17.0	82,200
3.4	11,430	7.4	27,060	11.4	46,360	18.0	89,700
3.6	12,090	7.6	27,940	11.6	47,460	19.0	97,600
3.8	12,770	7.8	28,820	11.8	48,580	20.0	105,900
4.0	13,450	8.0	29,700	12.0	49,700	21.0	114,600
4.2	14,150	8.2	30,620	12.2	50,860	22.0	123,700
4.4	14,850	8.4	31,540	12.4	52,020	23.0	133,200
4.6	15,580	8.6	32,460	12.6	53,200	24.0	143,100
4.8	16,340	8.8	33,380	12.8	54,400	25.0	153,400

Estimated monthly discharge of Sacramento River at Iron Canyon, near Red Bluff, Cal.

[Drainage area, 9,295 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January [a]	6,750	4,760	5,376	330,557	0.59	0.68
February	151,320	5,660	69,154	3,840,619	7.44	7.75
March	61,700	14,150	27,371	1,682,977	2.94	3.39
April	53,800	14,150	21,992	1,308,615	2.37	2.64
May	24,460	10,150	17,803	1,094,664	1.92	2.21
June	13,450	7,060	9,998	594,922	1.08	1.20
July	7,060	5,880	6,192	380,731	.67	.77
August	5,880	5,440	5,674	348,881	.61	.70
September	5,220	5,000	5,007	297,937	.54	.60
October	11,750	5,000	5,931	364,683	.64	.74
November	118,200	5,660	19,767	1,176,218	2.13	2.38
December	39,100	8,110	17,506	1,076,402	1.88	2.17
The year	151,320	4,760	17,648	12,497,206	1.90	25.23

[a] Discharge at Jellys Ferry for January.

TUOLUMNE RIVER AT LAGRANGE, CAL.

The station, established August 29, 1895, is located at the wagon bridge in the town of Lagrange, Cal. It is below the high dam of the Turlock and Modesto irrigation districts and also below the head of the canal of the Lagrange Ditch and Hydraulic Mining Company, which diverts water from the left bank of the river 15 miles above Lagrange dam. The flow through this canal for 1902 was between 4 and 5 cubic feet per second.

The channel at the gaging station, both above and below the bridge, is straight for several hundred feet and the velocity of the stream is quite uniform. Both banks are high and not subject to overflow. For the last few years the channel seems to be gradually washing out. The observer is Annie P. McGinn.

During 1902 the following discharge measurements were made by S. G. Bennett and L. M. Lawson:

	Second-feet.
March 6:	
Gage height, 6.00 feet; discharge	2,351
Turlock Canal	103
Lagrange Ditch and Hydraulic Mining Company's canal	5
Total	2,459
May 13:	
Gage height, 8.35 feet; discharge	9,476
Turlock Canal	253
Lagrange Ditch and Hydraulic Mining Company's canal	5
Total	9,734
August 27:	
Gage height, 3.50 feet; discharge	15
Turlock Canal	105
Lagrange Ditch and Hydraulic Mining Company's canal	4
Total	124

Daily gage height, in feet, of Tuolumne River at Lagrange, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902												
1	4.4	4.4	6.0	5.6	6.8	7.7	6.2	4.4	3.5	3.6	4.4	4.6
2	4.3	4.4	6.7	5.6	6.6	7.2	6.1	4.4	4.0	3.7	4.4	4.6
3	5.0	4.4	6.5	5.5	6.6	7.1	5.9	4.2	4.2	3.6	4.4	4.5
4	5.1	4.4	6.1	5.6	6.5	7.4	5.9	4.1	4.0	3.6	4.3	4.6
5	4.8	4.4	5.9	5.8	6.8	7.7	5.5	4.0	4.0	3.6	4.3	4.8
6	4.6	4.3	5.9	6.6	7.0	7.9	5.5	3.8	4.0	3.6	4.4	5.2
7	4.5	4.4	5.8	9.2	7.4	7.7	5.3	3.9	4.0	3.6	4.4	5.3
8	4.4	4.4	6.3	8.9	8.1	8.0	5.2	3.8	3.9	3.7	4.3	5.1
9	4.5	4.9	7.4	7.6	8.4	8.9	5.3	4.1	3.9	3.7	4.4	5.1
10	4.7	4.8	6.6	7.1	8.4	8.7	5.4	4.0	3.9	3.7	5.9	5.0
11	4.6	4.8	6.1	6.9	8.3	8.4	5.4	3.8	4.0	3.6	6.2	6.2
12	4.5	4.8	6.1	6.8	8.0	8.6	5.3	4.0	4.0	3.6	5.6	5.8
13	4.5	4.8	6.0	6.9	7.7	8.5	5.3	4.1	3.9	3.6	5.2	5.5
14	4.5	4.8	5.9	7.1	7.4	8.0	5.2	4.1	4.0	3.7	5.1	5.4
15	4.5	5.0	5.7	7.2	7.3	7.8	5.1	4.2	4.0	3.7	4.9	5.3
16	4.4	5.6	5.7	7.3	7.4	7.7	5.2	4.1	3.9	3.7	4.9	5.1
17	4.4	5.5	5.7	7.4	7.5	7.6	5.1	4.0	4.0	3.6	4.7	5.0
18	4.4	5.4	5.8	7.6	7.5	7.3	4.9	3.9	3.9	3.6	4.8	4.9
19	4.4	5.4	5.7	7.8	7.2	7.4	4.9	3.9	3.9	3.6	4.8	4.9
20	4.3	5.3	5.5	8.5	6.6	7.5	5.0	3.8	4.0	3.6	5.0	4.8
21	4.4	5.2	5.5	8.0	6.2	7.6	5.0	3.7	4.0	3.5	4.9	4.7
22	4.3	5.7	5.5	7.6	6.1	7.5	4.9	3.5	3.9	3.5	4.9	4.8
23	4.2	5.5	5.7	7.2	6.3	7.5	4.8	3.4	3.8	3.6	4.8	4.9
24	4.3	5.8	5.7	6.9	6.8	7.3	4.8	3.4	3.9	3.7	4.9	4.9
25	4.4	6.4	5.5	6.0	7.1	7.1	4.8	3.5	3.8	4.8	4.9	4.9
26	4.5	7.3	5.5	6.0	8.0	7.0	4.8	3.5	3.8	4.6	4.8	5.0
27	4.4	7.7	5.4	5.6	8.5	6.8	4.7	3.5	3.8	4.5	4.8	5.0
28	4.3	7.6	5.5	6.0	8.9	6.4	4.6	3.4	3.8	4.6	4.8	4.9
29	4.4	.....	5.7	6.1	8.6	6.4	4.7	3.3	3.7	4.5	4.9	4.9
30	4.4	.....	5.7	6.5	8.8	6.4	4.7	3.5	3.7	4.6	4.8	4.8
31	4.3	.....	5.6	.....	8.9	.....	4.5	3.4	.....	4.5	.....	4.8

Rating table for Tuolumne River at Lagrange, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.4	7	5.0	750	6.6	3,610	8.2	8,580
3.6	25	5.2	950	6.8	4,100	8.4	9,350
3.8	55	5.4	1,180	7.0	4,630	8.6	10,140
4.0	115	5.6	1,480	7.2	5,200	8.8	10,950
4.2	200	5.8	1,850	7.4	5,810	9.0	11,780
4.4	300	6.0	2,260	7.6	6,450	9.2	12,630
4.6	410	6.2	2,690	7.8	7,120	9.4	13,500
4.8	560	6.4	3,140	8.0	7,830		

TURLOCK CANAL.

The Turlock canal, the property of the Turlock Irrigation District, takes water from the left bank of the Tuolumne River at the Lagrange dam. This canal was designed to carry 1,500 second-feet and to irrigate a large area of fertile land in the vicinity of Turlock and Ceres, Stanislaus County, Cal. During 1898 water was first turned into the canal in small quantities and used for puddling the banks. A record of the gage height has been kept since July, 1899. Meter measurements are made when the gaging station on Tuolumne River at Lagrange is visited, and Morgan flume, or flume No. 2, has been rated. The observer is J. L. Montgomery.

During 1902 the following discharge measurements were made by S. G. Bennett and L. M. Lawson:

May 13: Gage height, 2.92 feet; discharge, 253 second-feet.
July 23: Gage height, 3.00 feet; discharge, 260 second-feet.
Aug. 27: Gage height, 2.60 feet; discharge, 105 second-feet.

Daily gage height, in feet, of Turlock canal at Lagrange, Cal.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1902.							
1	(a)	3.1	0.0	3.7	3.8	3.9	1.3
2	.....	3.1	0.0	3.7	3.8	3.9	(b)
3	.....	3.1	3.0	3.7	3.8	3.7	.....
4	.....	3.1	3.0	3.7	3.8	3.7	.....
5	.....	3.1	3.4	3.7	3.8	3.7	.....
6	.....	3.1	3.5	3.7	3.8	3.8	.....
7	2.3	3.2	3.5	3.7	3.9	3.9	.....
8	2.0	3.2	3.5	3.7	4.0	3.9	.....
9	0.0	3.2	3.5	3.7	4.0	3.9	.....
10	0.0	3.2	3.5	3.7	4.0	3.9	.....
11	2.4	3.2	3.5	3.7	4.0	4.0	.....
12	2.6	3.2	3.5	3.7	4.0	4.0	.....
13	2.6	3.2	3.0	3.7	4.0	4.0	.....
14	2.0	3.2	3.0	3.7	4.0	3.8	.....
15	2.8	3.2	3.0	3.7	4.0	3.8	.....
16	2.8	3.2	3.0	3.7	4.0	3.8	.....
17	0.0	3.2	3.6	3.7	3.2	3.8	.....
18	3.0	2.5	3.6	3.7	2.7	4.0	.....
19	3.1	2.5	3.6	3.7	3.6	3.9	.....
20	3.1	2.4	3.6	3.7	3.6	3.9	.....
21	3.1	3.4	3.6	3.7	3.6	3.7	.....
22	3.1	3.4	3.6	3.8	3.6	3.6	.....
23	3.1	3.4	3.6	3.8	3.6	3.4	.....
24	3.1	3.4	3.6	3.8	3.6	3.5	.....
25	3.1	3.5	3.6	3.8	3.6	3.5	.....
26	3.1	3.5	3.6	3.8	3.6	2.8	.....
27	3.1	3.5	3.3	3.8	3.6	2.8	.....
28	0.0	0.0	2.9	3.8	3.6	2.7	.....
29	0.0	0.0	3.6	3.8	3.6	2.7	.....
30	2.4	0.0	3.6	3.8	3.6	2.6	.....
31	3.0	.....	3.6	.....	3.6	2.6	.....

(a) No record Jan. 1 to Mar. 6. (b) Sept. 2 to Dec. 31 no water in canal; making repairs.

Rating table for Turlock canal at Lagrange, Cal., for 1902.

MARCH 7 TO JULY 31.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	113	2.5	182	3.0	268	3.5	360
2.1	125	2.6	198	3.1	286	3.6	380
2.2	138	2.7	215	3.2	304	3.7	400
2.3	152	2.8	232	3.3	322	3.8	420
2.4	166	2.9	250	3.4	340	4.0	460

APPROXIMATE TABLE FOR AUGUST.

2.6	105	3.0	175	3.4	247	3.8	327
2.7	122	3.1	193	3.5	267	3.9	347
2.8	139	3.2	211	3.6	287	4.0	367
2.9	157	3.3	229	3.7	307		

Estimated monthly discharge of Tuolumne River at Lagrange, Cal.

[Drainage area, 1,501 square miles.]

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1902.			
January	850	200	352
February	6,780	250	1,443
March	5,810	1,180	2,103
April	12,630	1,320	4,735
May	11,360	2,470	6,334
June	11,360	3,140	6,519
July	2,690	350	998
August	300	0	91
September	200	35	89
October	560	15	113
November	2,690	250	676
December	2,690	350	809
The year	12,630	0	2,022

Estimated monthly discharge of Turlock canal at Lagrange, Cal.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1902.			
January	0	0	0
February	0	0	0
March	286	0	187
April	360	0	268
May	380	0	322
June	420	400	406
July	460	215	405
August	367	105	287
September	47	0	2
October	0	0	0
November	0	0	0
December	0	0	0
The year	460	0	156

Estimated monthly combined discharge of Tuolumne River and Turlock canal at Lagrange, Cal.

[Drainage area, 1,501 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	850	200	352	21,644	0.23	0.27
February	6,780	250	1,443	80,140	.96	1.00
March	5,810	1,320	2,290	140,807	1.53	1.76
April	12,934	1,606	5,003	297,699	3.33	3.71
May	11,740	2,850	6,656	409,262	4.43	5.11
June	11,760	3,560	6,925	412,066	4.61	5.14
July	3,110	730	1,403	86,267	.93	1.07
August	647	112	378	23,242	.25	.29
September	200	35	91	5,415	.06	.07
October	560	15	113	6,948	.08	.09
November	2,690	250	676	40,225	.45	.50
December	2,690	350	809	49,743	.54	.62
The year	12,934	15	2,178	1,573,458	1.45	19.63

MERCED RIVER ABOVE MERCED FALLS, CAL.

The measurement of this stream was undertaken in response to numerous requests from mining and irrigation interests. The midsummer flow of the stream is less than the combined capacity of the irrigation and power canals taking water in the vicinity of Snelling. The gaging station at a point 1 mile above Merced Falls was established April 6, 1901. Meter measurements are made from a cable. The observer is Charles Siegfeldt.

During 1902 the following discharge measurements were made by S. G. Bennett and L. M. Lawson:

March 6: Gage height, 10.10 feet; discharge, 1,302 second-feet.
May 13: Gage height, 12.15 feet; discharge, 5,413 second-feet.
September 3: Gage height, 8.10 feet; discharge, 109 second-feet.

Daily gage height, in feet, of Merced River above Merced Falls, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	8.6	8.4	10.5	9.7	10.8	11.6	10.0	8.7	8.1	7.8	8.1	8.5
2	8.7	8.5	12.3	9.8	10.8	11.4	9.9	8.7	8.0	7.8	8.1	8.5
3	9.1	8.5	11.0	9.7	10.9	11.3	9.8	8.6	8.1	7.8	8.1	8.5
4	8.9	8.5	10.5	9.6	10.9	11.4	9.6	8.6	8.1	7.8	8.1	8.5
5	8.9	8.5	10.2	9.7	11.1	11.9	9.5	8.5	8.1	7.8	8.1	8.3
6	8.8	8.5	10.1	9.9	11.4	12.0	9.4	8.5	8.1	7.8	8.0	8.6
7	8.8	8.5	10.0	11.8	11.5	12.0	9.3	8.5	8.0	7.8	8.0	8.9
8	8.7	8.6	10.0	12.4	11.9	12.3	9.3	8.6	8.0	7.8	8.1	8.8
9	8.7	8.7	12.5	11.8	12.4	12.4	9.3	8.5	8.0	7.8	8.1	10.2
10	8.7	8.7	11.5	11.5	12.4	12.3	9.3	8.8	8.0	7.9	8.4	8.8
11	8.6	8.6	10.6	11.0	12.0	12.1	9.4	8.8	8.0	7.8	10.0	9.3
12	8.6	8.7	10.4	10.8	12.2	12.1	9.3	8.9	8.0	7.8	9.2	9.5
13	8.7	8.8	10.1	10.9	12.3	11.9	9.3	8.9	8.0	7.8	8.8	9.2
14	8.6	8.8	10.1	11.0	11.6	11.4	9.3	8.7	8.0	7.8	8.7	9.0
15	8.7	8.7	9.7	11.2	11.3	11.4	9.2	8.7	8.0	7.8	8.7	8.8
16	8.6	8.9	9.6	11.1	11.1	11.2	9.2	8.5	8.0	7.9	8.6	8.8
17	8.6	9.2	9.7	11.3	11.6	11.1	9.1	8.5	7.8	7.8	8.6	8.7
18	8.6	9.3	9.8	11.8	11.8	11.1	8.9	8.4	7.9	7.8	8.6	8.7
19	8.6	9.1	9.6	12.2	11.2	11.1	9.0	8.4	8.0	7.8	9.3	8.7
20	8.6	9.0	9.6	11.9	11.0	11.1	8.9	8.4	8.0	7.8	9.0	8.5
21	8.6	9.0	9.6	11.4	10.8	11.1	9.0	8.3	8.1	7.8	8.8	8.6
22	8.5	9.5	9.4	10.9	10.8	11.0	8.9	8.3	8.0	7.8	8.8	8.6
23	8.5	9.4	9.4	10.8	11.0	10.9	8.9	8.2	8.0	7.9	8.7	8.6
24	8.5	10.5	9.5	10.7	11.3	10.7	8.9	8.2	7.9	8.2	8.7	8.6
25	8.6	10.8	9.4	10.5	11.9	10.6	8.9	8.2	7.9	8.8	8.6	8.6
26	8.6	11.3	9.3	10.5	11.7	10.5	8.9	8.2	7.8	8.4	8.6	8.6
27	8.5	11.8	9.3	10.5	12.4	10.4	8.8	8.2	7.9	8.4	8.5	8.7
28	8.5	11.3	9.2	10.4	12.7	10.1	8.9	8.1	7.9	8.3	8.7	8.8
29	8.5	.....	9.4	10.5	12.7	10.1	8.8	8.1	7.9	8.2	8.6	8.7
30	8.5	.....	9.5	10.8	12.6	10.2	8.8	8.1	7.8	8.1	8.6	8.6
31	8.5	.....	9.6	.....	12.4	.....	8.8	8.1	.....	8.1	.....	8.6

Rating table for Merced River above Merced Falls, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
7.8	65	8.9	320	10.0	1,110	11.2	2,840
7.9	75	9.0	360	10.1	1,220	11.4	3,200
8.0	90	9.1	410	10.2	1,340	11.6	3,590
8.1	110	9.2	460	10.3	1,470	11.8	4,020
8.2	130	9.3	520	10.4	1,600	12.0	4,480
8.3	150	9.4	580	10.5	1,740	12.2	4,960
8.4	170	9.5	650	10.6	1,880	12.4	5,460
8.5	195	9.6	730	10.7	2,030	12.6	5,980
8.6	220	9.7	810	10.8	2,180	12.8	6,500
8.7	250	9.8	900	10.9	2,340		
8.8	280	9.9	1,000	11.0	2,500		

Estimated monthly discharge of Merced River above Merced Falls, Cal.

[Drainage area, 1,090 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	410	195	236	14,511	0.22	0.25
February	4,020	170	749	41,597	.69	.72
March	5,720	460	1,364	83,869	1.25	1.44
April	5,460	730	2,457	146,202	2.25	2.51
May	6,240	2,180	3,795	233,345	3.48	4.01
June	5,460	1,220	3,142	186,962	2.88	3.21
July	1,110	280	481	29,576	.44	.51
August	320	110	191	11,744	.18	.21
September	110	65	88	5,236	.08	.09
October	280	65	90	5,534	.08	.09
November	1,110	90	246	14,638	.23	.26
December	1,340	195	303	18,631	.28	.32
The year	6,240	65	1,095	791,845	1.01	13.62

KING RIVER AT KINGSBURG, CAL.

This station was established in 1879 by the engineering department of the Southern Pacific Company. No meter measurements have been made since 1898 except a low-water measurement in 1902, because it was found impossible to construct a satisfactory rating table, on account of the changes in gage heights caused by the raising and lowering of the head gate of the Peoples Canal, which takes water from King River a few miles below the gaging station. The gage heights for 1902 have been furnished by William Hood, chief engineer of the Southern Pacific Company. Alf. Thompson was the observer.

Daily gage height, in feet, of King River, at Kingsburg, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.8	3.3	4.3	4.1	3.8	7.5	3.8	2.7	1.6	1.3	1.8	4.7
2	3.8	3.3	3.3	4.2	3.3	6.7	3.6	2.7	1.7	1.3	1.7	4.7
3	3.8	3.3	6.3	3.8	3.5	6.1	3.4	2.7	1.6	1.3	1.7	4.8
4	4.4	3.4	4.3	3.8	3.7	7.3	2.8	2.5	1.6	1.3	1.7	4.8
5	4.4	3.4	3.3	3.8	3.8	8.0	2.3	2.5	1.6	1.3	2.0	4.8
6	4.3	3.4	3.1	3.8	4.7	8.4	2.0	2.4	1.6	1.3	2.3	4.8
7	4.3	3.5	4.5	3.6	4.8	9.0	2.0	2.3	1.6	1.3	2.5	4.8
8	4.3	3.6	4.3	8.8	6.1	9.3	1.9	2.5	1.6	1.3	2.8	4.8
9	4.0	3.7	4.9	5.9	7.8	9.4	2.7	2.4	1.6	1.3	3.3	4.9
10	3.9	3.6	6.0	4.8	7.7	9.3	2.9	2.4	1.7	1.3	3.9	5.0
11	3.9	3.5	4.8	4.1	7.5	8.8	3.6	2.3	1.7	1.3	5.3	5.1
12	3.8	3.5	4.2	3.6	7.8	9.5	4.1	2.3	1.7	1.3	4.9	5.1
13	3.8	3.6	3.8	3.7	8.3	9.5	4.3	2.3	1.7	1.3	4.5	5.0
14	3.8	3.7	4.3	3.9	7.3	8.3	3.9	2.2	1.7	1.3	4.9	5.0
15	3.7	3.5	4.2	4.3	6.3	7.7	3.6	2.2	1.7	1.3	4.9	5.1
16	3.4	3.5	3.8	4.1	5.6	7.5	3.3	2.1	1.7	1.3	4.8	5.1
17	3.4	3.6	3.8	4.5	6.3	7.0	3.3	2.0	1.7	1.3	4.6	5.0
18	3.4	3.7	3.9	5.3	7.3	6.8	3.2	1.9	1.7	1.3	4.5	5.0
19	3.3	3.7	4.2	6.5	6.1	6.8	3.3	1.8	1.7	1.3	4.6	5.0
20	3.3	3.5	4.3	5.9	5.5	6.7	2.8	1.8	1.6	1.3	4.8	5.0
21	3.3	3.5	3.9	5.1	4.8	6.7	2.9	1.8	1.6	1.3	5.1	4.8
22	3.2	3.7	3.7	5.3	4.3	6.5	2.8	1.8	1.6	1.3	4.8	4.8
23	3.3	3.8	3.4	3.1	4.4	6.0	2.8	1.8	1.6	1.4	4.9	5.0
24	3.3	3.8	3.5	3.3	4.9	5.8	2.8	1.8	1.4	1.4	4.8	5.0
25	3.3	5.6	3.5	3.3	6.1	5.3	2.8	1.8	1.4	1.7	4.8	4.9
26	3.4	6.1	3.3	2.8	6.3	5.1	2.8	1.8	1.5	2.6	4.7	5.0
27	3.5	5.9	3.3	2.7	7.0	4.7	3.0	1.8	1.5	2.4	4.7	5.0
28	3.3	6.1	3.3	2.8	8.5	4.2	3.0	1.8	1.4	2.5	4.8	5.1
29	3.4	.....	3.3	2.8	9.0	3.9	3.1	1.7	1.3	2.5	4.7	5.0
30	3.4	.....	3.6	2.8	9.0	3.9	3.0	1.6	1.3	2.5	4.7	4.9
31	3.4	.....	4.0	.....	8.8	.....	2.8	1.6	.....	1.8	.....	4.9

KING RIVER AT RED MOUNTAIN, NEAR SANGER, CAL.

The gaging station at Red Mountain, established September 3, 1895, is located 15 miles east of Sanger, Cal., and is near the mouth of the canyon and above all diversions. The bed of the stream is in gravel and few changes have been noted in the cross section since the establishment of the station. For the last three years the station has been considered as rated for all gage heights up to 11 feet, and few meter measurements have been made. The present rating will probably hold good until a change in the channel is caused by a violent flood. The observer is O. G. Williams.

The following discharge measurement was made in 1902 by L. M. Lawson:

September 21: Gage height, 4.00 feet; discharge, 217 second-feet.

Daily gage height, in feet, of King River at Red Mountain, near Sanger, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1902.												
1	4.4	4.1	5.6	6.1	7.7	8.9	7.8	5.2	4.1	3.8	4.0	4.2
2	4.4	4.2	8.3	6.1	7.8	8.9	7.8	5.2	4.0	3.8	4.0	4.3
3	4.4	4.2	6.6	6.0	8.0	9.1	7.1	5.1	4.0	3.8	3.9	4.3
4	4.4	4.1	5.9	6.1	8.1	9.9	6.7	5.0	4.0	3.7	3.9	4.3
5	4.5	4.2	5.8	6.1	8.3	10.0	6.5	4.9	4.0	3.7	3.9	4.2
6	4.4	4.2	5.8	6.1	8.9	10.0	6.4	4.9	4.0	3.7	3.9	4.3
7	4.4	4.3	5.8	13.1	8.6	10.7	6.4	5.0	4.0	3.7	3.9	4.4
8	4.4	4.3	5.6	9.1	9.3	10.7	6.5	5.1	3.9	3.7	3.8	4.4
9	4.4	4.3	7.4	8.0	9.6	11.0	6.5	5.2	4.0	3.7	3.9	4.3
10	4.3	4.2	6.3	7.7	9.8	10.9	6.4	5.2	3.9	3.7	4.0	4.3
11	4.3	4.3	5.9	7.5	9.4	10.4	6.6	5.1	4.0	3.7	5.6	5.4
12	4.4	4.2	5.8	7.6	10.0	10.9	6.3	5.0	3.9	3.7	4.9	5.2
13	4.4	4.2	5.7	7.7	10.0	11.0	6.4	5.0	4.0	3.7	4.6	4.9
14	4.3	4.2	5.7	7.9	9.3	10.1	6.2	5.0	4.0	3.7	4.5	4.5
15	4.3	4.2	5.5	8.1	8.8	10.0	6.1	4.9	4.0	3.8	4.5	4.4
16	4.3	4.3	5.5	8.2	8.8	10.0	6.0	4.7	4.0	3.7	4.3	4.4
17	4.3	4.5	5.5	8.4	9.3	9.6	5.9	4.7	4.1	3.7	4.3	4.3
18	4.3	4.8	5.7	8.7	9.4	9.6	5.8	4.6	4.0	3.7	4.3	4.4
19	4.2	4.6	5.7	9.2	8.6	9.6	5.7	4.5	4.0	3.7	4.3	4.4
20	4.2	4.4	5.7	9.0	8.2	9.7	5.6	4.5	4.0	3.7	4.7	4.3
21	4.2	4.5	5.6	8.1	7.9	9.7	5.7	4.4	4.0	3.7	4.4	4.4
22	4.2	4.7	5.6	7.9	8.0	9.3	5.6	4.3	3.9	3.7	4.4	4.3
23	4.2	4.9	5.6	7.4	8.4	8.9	5.5	4.3	3.9	3.7	4.4	4.3
24	4.3	4.8	5.5	7.4	8.6	9.0	5.5	4.2	3.9	4.5	4.4	4.3
25	4.2	5.5	5.5	7.3	9.2	9.0	5.5	4.2	3.9	4.4	4.4	4.4
26	4.3	7.3	5.5	7.1	9.1	8.7	5.4	4.1	3.9	4.1	4.4	4.3
27	4.3	6.6	5.4	7.1	9.7	8.4	5.5	4.1	3.8	4.1	4.4	4.4
28	4.2	5.8	5.5	7.2	10.3	7.9	5.6	4.1	3.8	4.1	4.4	4.5
29	4.2	.....	5.5	7.3	11.1	8.1	5.5	4.1	3.8	4.1	4.3	4.3
30	4.1	.....	5.9	7.9	10.6	8.0	5.4	4.0	3.8	4.1	4.3	4.3
31	4.1	.....	6.0	.....	10.4	.....	5.4	4.1	.....	4.0	.....	4.2

Rating table for King River at Red Mountain, near Sanger, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.6	180	5.8	1,310	8.0	3,920	10.2	9,610
3.8	250	6.0	1,450	8.2	4,300	10.4	10,400
4.0	320	6.2	1,642	8.4	4,680	10.6	11,300
4.2	400	6.4	1,834	8.6	5,096	10.8	12,250
4.4	480	6.6	2,034	8.8	5,548	11.0	13,240
4.6	572	6.8	2,242	9.0	6,000	11.2	14,300
4.8	676	7.0	2,450	9.2	6,520	11.4	15,440
5.0	780	7.2	2,718	9.4	7,040	11.6	16,660
5.2	910	7.4	2,986	9.6	7,600	11.8	17,930
5.4	1,040	7.6	3,280	9.8	8,220	12.0	19,230
5.6	1,170	7.8	3,600	10.0	8,900		

Estimated monthly discharge of King River at Red Mountain, near Sanger, Cal

[Drainage area, 1,742 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	520	360	440	27,055	0.25	0.29
February	2,852	360	665	36,932	.38	.40
March	4,490	1,040	1,420	87,312	.82	.95
April	26,380	1,450	4,163	247,716	2.39	2.67
May	13,760	3,440	6,532	401,637	3.75	4.32
June	13,240	3,760	8,063	479,782	4.63	5.16
July	3,600	1,040	1,638	100,717	.94	1.08
August	910	320	626	38,491	.36	.42
September	360	250	304	18,089	.17	.19
October	520	215	265	16,294	.15	.17
November	1,170	250	451	26,836	.26	.29
December	1,040	400	497	30,559	.29	.33
The year	26,380	215	2,089	1,511,420	1.20	16.27

TULE RIVER NEAR PORTERSVILLE, CAL.

The gaging station is located about 8 miles east of Portersville, at a point just below the wagon bridge near the McFarland ranch and about 1 mile above the mouth of the South Fork of Tule River. The

station was established April 18, 1901. The gage rod is situated on the right bank of the river 100 feet below the bridge. The zero of the gage is 8 feet below a spike driven into a large cottonwood tree. The observer is Adah McFarland.

Discharge measurements of Tule River near Portersville, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1901.		*Feet.*	*Second feet.*
June 28	A. E. Chandler	2.00	148
1902.			
February 5	S. G. Bennett	1.33	43
March 8	do	2.20	156
May 15	do	3.03	371
October 2	L. M. Lawson	.92	15

Daily gage height, in feet, of Tule River near Portersville, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.35	1.35	2.40	2.60	2.90	2.80	1.60	1.10	0.98	0.92	1.18	1.35
2	1.35	1.35	4.40	2.70	2.90	2.70	1.55	1.10	.98	.92	1.18	1.35
3	1.35	1.35	2.80	2.50	2.80	2.60	1.55	1.10	.96	.90	1.18	1.35
4	1.35	1.35	2.40	2.65	2.80	2.80	1.55	1.10	.94	.90	1.15	1.35
5	1.30	1.35	2.30	2.70	2.80	2.70	1.50	1.08	.94	.92	1.15	1.35
6	1.30	1.40	2.20	2.65	2.85	2.60	1.50	1.08	.92	.92	1.15	1.35
7	1.30	1.40	2.20	7.20	2.90	2.60	1.50	1.05	.92	.94	1.15	1.35
8	1.30	1.40	2.20	4.00	2.90	2.60	1.45	1.05	.92	.96	1.15	1.35
9	1.30	1.40	5.60	3.70	3.00	2.60	1.50	1.03	.92	.98	1.15	1.35
10	1.35	1.40	3.00	3.50	3.00	2.55	1.40	1.08	.92	1.00	1.40	1.35
11	1.35	1.35	2.80	3.40	3.10	2.45	1.35	1.08	.90	1.02	2.00	2.30
12	1.40	1.35	2.60	3.30	3.00	2.35	1.35	1.08	.90	1.04	1.70	1.90
13	1.40	1.35	2.50	3.20	3.05	2.35	1.30	1.06	.90	1.04	1.50	1.65
14	1.35	1.40	2.40	3.10	3.00	2.30	1.30	1.06	.90	1.03	1.45	1.55
15	1.30	1.40	2.30	3.15	3.00	2.25	1.25	1.06	.90	1.03	1.40	1.53
16	1.25	1.40	2.20	3.20	3.00	2.15	1.20	1.06	.90	1.02	1.35	1.50
17	1.30	1.40	2.00	3.30	3.00	2.10	1.20	1.06	.92	1.02	1.35	1.50
18	1.35	1.40	2.20	3.30	2.95	2.10	1.20	1.06	.92	1.02	1.35	1.48
19	1.40	1.45	2.50	3.40	2.90	2.05	1.20	1.06	.94	1.00	1.70	1.45
20	1.40	1.60	2.40	3.50	2.80	2.00	1.20	1.06	.96	1.00	1.55	1.44
21	1.35	1.60	2.35	3.70	2.70	1.90	1.20	1.06	.95	.98	1.50	1.43
22	1.35	2.00	2.25	3.00	2.65	1.85	1.20	1.08	.95	.96	1.45	1.42
23	1.35	1.75	2.35	3.00	2.65	1.80	1.20	1.08	.95	.94	1.40	1.42
24	1.40	1.80	2.35	3.00	2.60	1.75	1.18	1.04	.95	1.70	1.40	1.42
25	1.40	1.85	3.00	2.90	2.65	1.75	1.15	1.04	.95	1.40	1.40	1.42
26	1.40	4.20	3.00	2.85	2.75	1.70	1.18	1.02	.95	1.30	1.35	1.42
27	1.40	4.40	3.00	2.80	2.80	1.70	1.20	1.02	.95	1.25	1.35	1.52
28	1.35	2.70	2.60	2.85	3.00	1.65	1.20	1.01	.95	1.25	1.35	1.50
29	1.35	.....	2.30	2.90	2.90	1.60	1.18	1.00	.94	1.20	1 35	1.48
30	1.35	.....	2.30	2.90	2.80	1.60	1.15	1.00	.94	1.20	1.35	1.45
31	1.35	.....	2.50	.....	2.80	.....	1.14	1.00	.....	1.20	.....	1.43

Rating table for Tule River near Portersville, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.7	9	1.7	93	2.7	298	3.7	685
.8	11	1.8	109	2.8	324	3.8	770
.9	14	1.9	126	2.9	351	3.9	875
1.0	18	2.0	144	3.0	379	4.0	980
1.1	23	2.1	163	3.1	408	4.1	1,085
1.2	30	2.2	183	3.2	440	4.2	1,195
1.3	39	2.3	204	3.3	475	4.3	1,305
1.4	51	2.4	226	3.4	515	4.4	1,415
1.5	64	2.5	249	3.5	560	4.5	1,525
1.6	78	2.6	273	3.6	615		

Estimated monthly discharge of Tule River near Portersville, Cal.

[Drainage area, 437 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	51	34	45	2,767	0.10	0.12
February	1,415	45	159	8,830	.36	.37
March	2,735	144	362	22,259	.83	.96
April	4,615	249	571	33,977	1.31	1.46
May	408	273	343	21,090	.79	.91
June	324	78	190	11,306	.43	.48
July	78	26	43	2,644	.10	.12
August	23	18	21	1,291	.05	.06
September	17	14	15	893	.03	.03
October	93	14	24	1,476	.05	.06
November	144	27	50	2,975	.11	.12
December	204	45	62	3,812	.14	.16
The year	4,615	14	157	113,320	.36	4.85

KERN RIVER NEAR BAKERSFIELD, CAL.

This station, established in 1893 by Walter Jones, chief engineer of the Kern County Land Company, is located at what is known as First Point of Measurement, 5 miles above Bakersfield and at the mouth of the canyon of the river. Miscellaneous meter measurements are taken, and an automatic gage records daily fluctuations of the river heights. A. K. Warren, the engineer in charge of this work for the Kern County Land Company, attends to the discharge measurements with accuracy and precision, and furnishes the Geological Survey with the final results.

Daily discharge, in second-feet, of Kern River at first point of measurement.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	287	258	863	850	1,615	2,306	1,314	433	201	184	237	269
2	291	268	1,119	893	1,559	2,028	1,269	402	198	190	237	250
3	291	277	1,493	849	1,522	1,811	1,205	373	198	187	241	257
4	290	270	929	831	1,504	1,904	1,090	337	191	183	230	244
5	289	260	756	930	1,520	2,018	989	333	186	172	237	251
6	293	256	772	1,078	1,589	2,215	915	338	186	168	246	269
7	312	251	725	1,647	1,704	2,527	839	328	184	162	249	294
8	314	262	620	3,438	1,765	2,608	766	327	187	167	243	302
9	307	260	717	2,461	1,880	2,701	740	366	186	185	243	296
10	299	263	957	2,000	2,004	2,726	747	374	191	190	269	283
11	287	254	787	1,896	2,065	2,735	736	369	189	185	300	278
12	274	252	770	1,748	2,108	2,642	712	386	195	180	393	314
13	264	254	782	1,752	2,156	2,910	722	385	198	186	340	325
14	274	254	790	1,806	2,135	2,755	711	346	191	190	306	298
15	282	251	723	1,877	1,997	2,400	704	340	206	186	285	272
16	286	259	645	2,008	1,797	2,313	675	330	214	194	273	250
17	286	263	655	2,130	1,827	2,244	631	321	227	195	262	271
18	289	260	728	2,332	1,884	2,195	603	319	223	190	265	299
19	294	268	790	2,620	1,868	2,159	588	307	216	193	281	292
20	292	257	813	2,807	1,697	2,169	550	295	200	195	298	281
21	296	258	758	2,740	1,549	2,159	522	279	198	194	313	267
22	291	279	751	2,306	1,447	2,173	509	278	203	197	298	262
23	281	339	759	2,030	1,403	2,119	505	258	204	200	315	248
24	278	353	794	1,772	1,451	1,887	508	256	198	214	322	237
25	285	379	734	1,682	1,555	1,836	484	254	194	237	310	245
26	272	871	694	1,559	1,673	1,726	466	238	197	262	288	250
27	255	1,252	689	1,505	1,662	1,561	469	224	200	236	292	250
28	247	1,451	667	1,556	1,780	1,410	490	220	179	236	301	253
29	260	.....	681	1,536	2,120	1,431	501	223	176	242	289	258
30	259	.....	735	1,540	2,250	1,296	480	218	179	236	277	242
31	250	.....	779	.....	2,320	.....	460	209	.....	236	.....	245

Estimated monthly discharge of Kern River at first point of measurement.

[Drainage area 2,345 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	321	242	283	17,401	0.12	0.14
February	1,828	243	371	20,604	.16	.17
March	2,029	601	790	48,575	.34	.39
April	3,758	799	1,805	107,405	.77	.86
May	2,405	1,375	1,787	109,878	.76	.88
June	3,096	1,235	2,165	128,826	.92	1.03
July	1,354	453	706	43,410	.30	.35
August	453	205	312	19,184	.13	.15
September	332	174	197	11,722	.08	.09
October	292	161	199	12,236	.09	.10
November	413	225	281	16,721	.12	.13
December	346	231	269	16,540	.11	.13
The year	3,758	161	764	552,502	.33	4.42

SAN JOAQUIN RIVER AT HERNDON, CAL.

This station was established in 1879 by the engineering department of the Southern Pacific Company. The river bed at this point is composed of small gravel and shifting sand. Because of the continual changes in the cross section, which were increased by a side channel breaking through the gravel pits on the left bank of the river just above the gaging station, meter measurements were discontinued at this station at the end of 1901.

The river stage record for 1902 has been furnished by William Hood, chief engineer of the Southern Pacific Company. G. G. Nelson was the observer.

Daily gage height, in feet, of San Joaquin River at Herndon, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.7	2.5	4.8	4.3	6.0	8.5	5.8	3.5	3.0	2.8	2.6	2.7
2	2.7	2.5	4.5	4.4	6.3	7.5	5.7	3.5	3.0	2.8	2.6	2.7
3	2.7	2.5	5.6	4.2	6.2	7.5	5.5	3.5	3.0	2.8	2.6	2.7
4	2.7	2.5	4.3	4.3	5.7	7.0	5.0	3.5	2.9	2.8	2.6	2.7
5	2.6	2.5	4.0	4.4	5.5	7.3	4.5	3.4	2.9	2.8	2.5	2.7
6	2.6	2.5	3.7	4.5	6.0	7.8	4.3	3.4	2.9	2.7	2.5	2.6
7	2.6	2.5	3.5	6.7	6.5	8.0	4.3	3.4	2.9	2.7	2.5	2.6
8	2.6	2.5	4.0	8.0	6.7	8.5	4.3	3.4	2.8	2.7	2.5	2.6
9	2.6	2.5	4.0	7.0	6.7	9.0	4.1	3.4	2.8	2.7	2.5	2.6
10	2.5	2.5	4.7	6.5	6.8	8.8	4.1	3.8	2.8	2.7	2.5	2.6
11	2.5	2.5	4.3	6.2	7.0	8.5	4.0	3.7	2.8	2.7	4.3	3.3
12	2.5	2.5	4.0	5.7	7.6	9.3	4.5	3.7	2.8	2.7	3.8	4.0
13	2.5	2.5	4.0	5.5	7.8	9.0	4.5	3.6	2.8	2.7	3.7	3.5
14	2.5	2.7	3.8	6.0	7.4	8.5	4.5	3.5	2.8	2.7	3.4	3.3
15	2.5	2.7	3.8	6.2	6.9	8.1	4.6	3.5	2.8	2.6	3.3	3.3
16	2.5	2.6	3.8	6.3	6.4	7.8	4.3	3.5	2.8	2.6	3.2	3.3
17	2.5	2.8	3.7	6.4	6.7	7.5	4.0	3.3	2.8	3.6	3.1	3.3
18	2.5	2.7	3.7	6.5	7.1	7.5	4.0	3.3	2.8	2.6	2.8	3.3
19	2.5	2.8	3.7	7.8	6.6	7.2	4.0	3.3	2.8	2.6	2.8	3.3
20	2.5	2.8	3.8	7.3	6.5	7.1	4.0	3.3	2.8	2.5	2.8	3.3
21	2.5	2.8	3.8	7.0	6.2	7.0	4.0	3.2	2.8	2.5	2.8	3.3
22	2.5	2.8	3.7	6.5	6.0	7.4	4.3	3.2	2.8	2.5	2.8	3.3
23	2.5	3.0	3.7	5.7	6.0	7.0	3.8	3.2	2.8	2.5	2.8	3.2
24	2.5	3.0	3.7	5.5	6.5	7.0	3.8	3.2	2.8	2.5	2.8	3.2
25	2.6	4.5	3.7	5.3	6.8	7.0	3.8	3.2	2.8	2.5	2.8	3.2
26	2.6	5.0	3.7	5.1	7.2	6.8	3.8	3.2	2.8	2.5	2.8	3.2
27	2.6	4.8	3.6	5.0	7.7	6.5	3.7	3.1	2.8	2.8	2.7	3.0
28	2.5	5.0	3.6	5.0	8.3	6.3	3.7	3.1	2.8	2.8	2.7	3.0
29	2.5	.....	3.6	5.0	8.3	6.0	3.6	3.0	2.8	2.7	2.7	3.0
30	2.5	.....	3.6	5.0	8.6	6.0	3.6	3.0	2.8	2.7	2.7	3.0
31	2.5	.....	4.0	.....	8.8	.....	3.6	3.0	.....	2.7	.....	3.0

Miscellaneous measurements in San Francisco Bay drainage basin.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Sept. 22	Sacramento	Upper Soda Creek, Castle Crags		15.0
22	do	Upper Bairds station		286.0
24	McCloud	Vanardsdale clubhouse, 1 mile above Squaw Creek.		1,325.0
24	Squaw Creek	Squaw Creek Bridge, Vanardsville road		68.0
		Total McCloud		1,393.0
23	do	Hirze Mountain		1,272.0
26	do	Baird post-office, U. S. fisheries		1,356.0
17	Pit	Bridge above mouth of Fall River		208.0
16	do	Fall River at bridge, Fall River Mills		1,543.0
16	do	Hat Creek at bridge, Carbon post-office		583.0
15	do	At Pecks Bridge		2,350.0
15	do	Burney, ¼ mile below falls		209.0
27	do	Squaw Creek near mouth, Copper City		37.0
27	do	Silverthorn Ferry, Copper City		2,508.0
14	Sacramento	Balls Ferry Bridge		4,455.0

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Sept. 15	Sacramento	Battle Creek Bridge, near Balls Ferry		313.0
14	do	Ditch, Battle Creek, Balls Ferry Flour Mills		27.0
		Total Battle Creek		340.0
26	do	Sacramento	a 7.22	5,848.0
8	Feather, North Fork	East Branch, Hamilton Bridge, Big Meadows.		163.0
9	do	Big Spring Branch, 1 mile below boathouse, Big Meadows.		64.0
				327.0
9	do	West Branch, ¼ mile below bridge, Bunnell Hotel, Prattville.		607.0
5	do	Iron bridge near Meadow View Hotel, ¼ mile below junction of east and west branches.		109.0
9	do	Dotta or Lower Big Spring, near mouth Big Meadows.		
8	do	Bidwell's sawmill, lower end of Big Meadows.		669.0
7	do	Butt Valley Creek, near Butt Valley Hotel		27.0
5	do	Indian Valley at bridge, lower end of valley		22.0
4	do	Spanish Creek at "Pocket Bridge," lower end of American Valley, near Quincy, Cal.		28.0
9	do	Huff Bar, Big Bend		595.0
12	do	Big Bend Tunnel, above Huff Bar		315.0
		Total Big Bend		910.0
4	do	West Branch, 300 feet above Yankee Hill Bridge.		27.0
4	Feather, Middle Fork	Above mouth of Nelson Creek		59.0
4	do	Nelson Creek, just above mouth		33.0
		Total below Nelson Creek		92.0
6	do	At mouth		215.0
3	Feather, South Fork	In Little Grass Valley		1.0
6	do	At Enterprise		1.0
6	do	Palermo canal at Enterprise		30.0
6	do	Bidwell Bar		216.0
		Total		246.0
25	Cache Creek	Yolo Bridge, 5 miles from Woodlands	1.4	56.0
1	Yuba, North Fork	Bay Counties Power Co.'s flume, below dam		221.0
1	do	Below Bay Counties Power Co.'s dam		2.0
		Total		223.0
Aug. 30	Yuba, Middle Fork	¼ mile below Delhi mine		52.0
Sept. 1	do	300 feet below Freemans Bridge		64.0
Aug. 30	Yuba, South Fork	North Bloomfield ditch at North Columbia, water from Bowman's reservoir.		7.0
30	do	Eureka Lake Co.'s ditch, North Columbia, water from French and Faucherie lakes.		9.0
29	do	Edwards Bridge		59.0
30	do	Bridgeport Bridge		55.0
30	do	Excelsior Mining and Irrigation Co.'s canal, Pleasant Valley.		32.0
		Total		87.0
Sept. 1	Yuba	Above bridge, 4 miles below Smartsville		487.0

a U. S. Weather Bureau gage. Highest water mark, 28.6 feet December 27, 1892; lowest water mark 0.0 foot October 23, 1856.

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Aug. 25	Bear	Below dam of South Yuba Water Co.		16.0
	do	Old mining ditch, ¼ mile below Headworks.		33.0
		Total flow mouth of Greenhorn River.		49.0
26	do	Old mining ditch, near Auburn.		28.0
25	American, North Fork	200 feet above Iowa Hill road bridge		59.0
25	do	South Yuba Water Co.'s new power canal, ½ mile northwest of Colfax.		35.0
		Total flow near Colfax		94.0
25	do	2½ miles above Auburn		78.0
26	American, Middle Fork	Rubicon, 300 feet above junction with Middle Fork.		42.0
26	do	300 feet above junction with Rubicon		18.0
26	do	North Fork of, 200 feet above junction with Middle Fork.		25.0
26	do	Mining ditch (takes water from North Fork of Middle Fork).		11.0
		Total flow below junction of Middle Fork.		96.0
25	do	Just above mouth		110.0
25	American, North Fork	Below junction of North and Middle forks		188.0
21	do	Near Mink's place, 5 miles above mouth of South Fork.		204.0
26	do	North Fork canal, near Folsom		14.0
23	do	5 miles above mouth of South Fork, near Mink.	3.7	145.0
27	do	do	3.8	121.0
22	American, South Fork	100 feet above Riverton stone bridge.		11.0
22	do	South Fork of Silver Creek, 300 feet above mouth.		12.0
22	do	Silver Creek, 150 feet above junction with South Fork of Silver Creek.		30.0
		Total flow below junction with South Fork.		42.0
23	do	Placerville ditch, 1 mile from Pacific post-office.		30.0
21	do	Chillie Bar Bridge, 3 miles from Placerville.		100.0
21	do	Big Canyon at junction with South Fork		5.0
21	do	At Chillie Bar		105.0
19	do	Natoma ditch, Natoma Vineyard Co.'s lateral.		8.0
19	do	Natoma ditch, Blue Ravine mine		40.0
21	do	Near mouth, 3 miles above Folsom		87.0
22	do	Natoma ditch, below dam at Salmon Falls.		29.0
22	do	Negro Hill canal, below dam at Salmon Falls.		8.0
23	do	2 miles above mouth.		102.0
15	Mokelumne, North Fork	⅛ mile above bridge, near West Point		61.0
15	Mokelumne, Middle Fork	150 feet below bridge, near West Point.		1.7
16	Mokelumne, South Fork	Ditch 2 miles southeast of Fort Mountain, "Big Trees quadrangle."		4.8
15	do	Mokelumne ditch, ⅛ mile below South Fork Bridge in flume 500 feet below head-gate.		2.1
Aug. 14	Mokelumne	Standard ditch flume No. 59, near Electra.		53.0
14	do	Amador ditch, in flume 1½ miles above Electra.		51.0

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Aug. 14	Mokelumne	500 feet above Standard Electric Co.'s power house, Electra.		51.0
14	....do	From Standard power house		30.0
		Total		81.0
13	....do	¼ mile below Lancha Plana dam		67.0
15	....do	Campo Seco, ¼ mile below old dam		126.0
14	....do	Clements at road bridge		65.0
12	....do	Bridge at Woodbridge, Cal		33.0
12	....do	Woodbridge canal, 100 feet below headworks		40.0
16	....do	....do		29.0
16	Stanislaus, North Fork	San Antonio Creek, just below mouth of Big Trees Creek.		3.5
17	....do	Old Milton (now Angels) ditch, in flume below headworks.		67.0
17	....do	Below intake, Angels ditch		1.0
		Total		68.0
17	....do	Mill Creek, 30 feet below junction of Love and Moran creeks.		2.0
21	Stanislaus, Middle Fork	Clarks Fork at mouth		53.0
21	....do	Below mouth of Clarks Fork		126.0
21	....do	Above mouth of Clarks Fork		73.0
20	Stanislaus, South Fork	Canal, Tuolumne Electric Power Co., near intake (takes all of South Fork).		54.0
20	....do	Soulsby ditch, branch of Tuolumne Electric Co. canal, 50 feet above main ditch.		16.0
22	Stanislaus	Below Colliers		193.0
21	....do	Abbotts Ferry		170.0
23	....do	Parrotts Ferry	0.6	168.0
23	....do	Robinsons Ferry		158.0
23	....do	Ditch near Robinsons Ferry		12.0
		Total		170.0
May 12	....do	Stanislaus Water Co. canal, Flume No. 3		129.0
Aug. 17	....do	Stanislaus Water Co. canal, below intake		154.0
19	....do	¼ mile below Knights Ferry		166.0
20	....do	Oakdale, ¼ mile above railroad bridge		125.0
22	Tuolumne, North Fork	In flume of Goldwin Mining Co., all of water of North Fork.		6.0
30	Tuolumne	Cherry Creek, just below Lake Eleanor trail crossing.		6.0
30	....do	Eleanor Creek, ¼ mile below trail crossing		4.4
31	Tuolumne, Middle Fork	Below bridge on road from Crockers to Hog ranch.		3.0
29	Tuolumne	Upper end Hetch Hetchy Valley		66.0
29	....do	Rancheria Creek, head of falls, ¼ mile southeast of trail.		7.0
29	....do	Till-Till Creek, just above junction Rancheria Creek.		0.5
29	....do	Falls Creek, 300 feet above junction with Tuolumne.		4.0
29	....do	Lower end Hetch Hetchy Valley		89.0
27	....do	⅛ mile above junction with South Fork		152.0
27	Tuolumne, South Fork	⅛ mile above mouth		20.0
Sept. 2	Tuolumne	225 feet above falls, lower end Tuolumne Meadows.		23.0
Aug. 26	....do	Wards Ferry, 300 feet below bridge		159.0

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Aug. 26	Tuolumne	Jacksonville, at cable crossing		150.0
25	do	Woods Creek, Jacksonville		22.0
27	do	Lagrange ditch and Hydraulic Mining Co. canal above Lagrange dam.		4.0
27	do	Turlock canal, at gate where canal leaves headworks tunnel.		105.0
27	do	Lagrange, 1,000 feet below bridge		15.0
		Total at Lagrange		124.0
Sept. 3	Merced	Illilouette Creek, 100 yards above junction with Merced.		6.0
3	do	150 feet above junction with Illilouette Creek.		33.0
		Total above intake, electric power tunnel, Yosemite Valley.		39.0
3	do	Tenaya, 50 yards above bridge, near camp, Ideal Valley.		2.7
4	do	Bridal Veil Creek, 50 yards below bridge		2.0
4	Merced, South Fork	Below buildings at Wawona		3.2
Aug. 30	Merced, North Fork	At junction		0.0
31	Merced	Bonton Mills power house, in flume		76.0
31	do	Horseshoe Bend, 900 feet below old suspension bridge.		97.0
Sept. 3	do	1 mile above Merced Falls		109.0
1	do	Merced Falls, 1,000 feet below dam		78.0
1	do	Ditch below power house, Merced Falls		15.0
4	do	Crocker Hoffman canal, at road bridge, 3 miles below Snelling.		37.0
6	San Joaquin	Granite Creek, 100 feet below sheep bridge		0.7
6	do	300 feet below junction with Jackass Creek		342.0
6	do	Jackass Creek, 50 feet above junction with San Joaquin.		3.0
8	do	Middle Fork, 300 feet above Miller Bridge		148.0
10	Mono Creek	At lowest trail crossing		51.0
10	San Joaquin, South Fork	Trail crossing from Mono to Pine Ridge		107.0
10	Big Creek	Dam site, lower end of valley, trail from Mono to Pine Ridge.		9.0
9	San Joaquin, North Fork	Canal, at reservoir in flume above San Joaquin power house.		18.0
10	San Joaquin	Below San Joaquin electric power house		310.0
8	do	Pollasky, north of pavilion		309.0
11	do	Herndon, at road bridge		323.0
12	do	Below dam, at Mendote		25.0
12	do	Miller and Lux canal, small dam intake No. 3.		260.0
12	do	Miller and Lux canal, at canal bridge No. 2	5.1	265.0
17	King	Dinkey Creek, 75 feet below old bridge, road Ockenden to Laurel Creek.		3.5
18	King, North Fork	100 yards above trail crossing, 1 mile from Cliff camp.		7.0
18	do	Bear Creek (estimated)		1.5
18	do	Deer Creek (estimated)		1.5
18	do	Blue Canyon Creek		2.0
18	King, Middle Fork	Crown Creek		5.0
20	do	300 feet below trail to Simpsons Meadows		75.0

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Sept. 22	King, South Fork	Bubbs Creek, 100 yards above junction with South Fork.		32.0
22	do	100 yards below trail, ½ mile above junction Bubbs Creek.		29.0
		Total below mouth of Bubbs Creek		61.0
22	do	Granite Creek, 50 yards above bridge on trail crossing.		0.7
22	do	Sheep Creek, just above old hotel (estimated).		2.0
23	do	Roaring River, at trail crossing		10.0
22	King, North Fork	¼ mile above mouth		35.0
22	King	Big Creek, just above mouth		0.5
21	do	At Red Mountain gaging station	4.0	217.0
24	do	76 canal, near headworks, Trimmer Springs crossroad.		31.0
22	do	Enterprise canal, Trimmer Springs crossroad.		2.0
24	do	Church canal, Trimmer Springs crossroad.		121.0
24	do	Fowler Switch canal		0.0
24	do	Kingsburg canal, Trimmer Springs crossroad.		5.0
25	do	At bridge, 1 mile north of Reedley		74.0
26	do	Kingsburg, below wagon-road bridge		117.0
25	Kaweah, North Fork	Lower end of Davis ranch		4.0
12	Kaweah, East Fork	Mount Whitney Power Co.'s flume		18.0
27	do	⅛ mile above headworks, Mount Whitney Power Co.'s flume.		15.0
27	do	200 feet below junction diversion, Mount Whitney Power Co.'s flume.		15.5
27	Kaweah, Middle Fork	Marble Fork, 100 yards above junction with Middle Fork.		4.0
28	do	100 yards below trail crossing from Soldiers Camp to Tar Gap.		11.0
27	do	100 yards above junction with Marble Fork		20.0
30	do	3 miles above Three Rivers		31.0
10	do	¼ mile above Sequoia National Park line		31.0
26	do	do		29.0
29	Kaweah, South Fork	Horse Creek at lower end of Hackett Meadow.		1.0
25	do	200 yards above bridge on road from Lemon Cove to Three Rivers.		0.7
29	do	Sequoia National Park line, Cahoon's place.		9.8
29	do	Near lower end of sand meadows		2.0
27	Kaweah	¼ mile above iron bridge		33.0
30	Tule, Middle Fork	East Mount Moses near headworks Doyle Power ditch.		2.6
30	do	Above headworks Doyle Power ditch		14.0
30	do	Trail crossing near junction East Fork		24.0
Oct. 1	Tule, East Fork	100 yards above junction with Middle Fork.		15.0
		Total below junction of Middle and East forks.		39.0
3	do	Trail crossing from Nelsons to Indian Reservation.		10.0
2	Tule, South Fork	Tom Wheaton's ranch		3.0
2	do	6 miles below Indian Agency, 50 yards above crossroads.		3.0

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

Date.	Stream.	Location.	Gage height.	Discharge.
1902.			*Feet.*	*Sec.-feet.*
Oct. 2	Tule, North Fork	At junction with main river		0.0
May 15	Tule, South Fork	Near mouth		108.0
Oct. 2	do	do		0.0
2	Tule	McFarlands Bridge, 8 miles east of Portersville.		15.0
3	do	Pioneer canal intake		13.9
3	do	Pioneer canal, 1 mile below head gate		6.8
3	do	1 mile below intake Pioneer canal, opposite above point.		8.2
3	do	Pioneer canal, Portersville orange grove, no water used for irrigation.		3.9
4	Kern, North Fork	Little Kern, 100 yards above junction with North Fork.		14.0
4	do	100 yards above Little Kern		158.0
		Total		172.0
6	do	Thurston ditch, road crossing to Hot Springs.		0.5
6	do	Upper Murphy ditch, entrance to weir		7.0
6	do	Stafford & Neil ditch at old bridge back of church.		1.5
6	do	Sumner ditch, just above dairy		7.9
6	do	West channel, point diversion, Kern River Power Co.		139.0
6	do	Center channel, point diversion, Kern River Power Co.		15.0
6	do	East channel, point diversion, Kern River Power Co.		6.0
		Total		160.0
7	do	¼ mile above mouth of Salmon, between Salmon and Tobias creeks.		224.0
7	do	Salmon Creek, 50 yards above junction with Kern.		0.5
7	do	½ mile above gaging station, Kern River Power Co.		127.0
8	do	350 yards below wagon bridge, Isabella to Kernville.		202.0
8	do	Hooper ditch at wagon bridge, Isabella to Kernville.		9.0
8	do	Stafford & Neil ditch, just above flume in gulch.		0.12
8	do	Lower Stafford ditch		0.6
8	Kern South Fork	Above junction with Kern		18.0
8	Kern, North Fork	Lower Murphy ditch, 75 yards above Weldon crossroads.		0.7
8	do	Bennett & Kelley ditch, above Weldon crossroads.		7.0
8	Kern	200 yards below junction, North and South forks.		201.0
8	do	¼ mile above power house, Kern River Power Co.		188.0
8	do	Below Clear Creek		236.0
8	do	Clear Creek at mouth		0.0
7	do	½ mile below power house at mouth of canyon.		174.0
8	do	"First point of measurement"		171.0
8	do	Democrat Springs at cable Edison Electric Co.		179.0
7	do	Proposed site of Edison power house below intake of company's tunnel.		14.0

SOUTHERN CALIFORNIA DRAINAGE.

Under the head of Southern California drainage have been included data concerning the streams of that part of the State south of the San Joaquin Basin. There are thus included the Mohave, which flows from the mountains north of San Bernardino into the Mohave Desert, a portion of the Great Interior Basin, as well as those flowing toward the south or southwest, whose waters, in times of flood at least, reach the Pacific Ocean.

Arroyo Seco rises on the eastern slope of the Santa Lucia Mountains and flows east and empties into Salinas River at Soledad, Cal.

San Lorenzo Creek drains the western slopes of the Gavilan Mountains and enters Salinas River near King City, Cal. There is a reservoir and dam site 5 miles above its mouth. The flood waters are used for winter irrigation. Salinas River drains into the Pacific through Monterey Bay.

The drainage basin of San Gabriel River lies on the southern slope of the Sierra Madre, being included in Los Angeles County, Cal. The various tributaries join the river before it enters its lowest canyon, whence it appears finally on the plain in the vicinity of Azusa. The seepage waters of this valley appear lower down in the river and finally enter the Pacific Ocean not far from the mouth of Los Angeles River. All of the surplus waters of this stream are now used for irrigation purposes, and it is only an occasional flood that passes the gaging station.

Santa Ana River has its source on the southern slope of the San Bernardino Mountains and flows southerly, appearing from its canyon 4 miles north of Redlands. Its waters are completely used in San Bernardino Valley. At the lower part of the valley the water appears again in the vicinity of Rincon where the river passes through a comparatively narrow gorge, and the general direction of the stream is thence southwesterly, emptying into the Pacific Ocean.

The headwaters of Mohave River have their source on the northern slope of the Sierra Madre. It flows north, finally disappearing in the sands of the Mohave Desert.

The following is a list of the stations in the Southern California drainage:

Arroyo Seco at Pettitt's ranch, near Soledad, Monterey County, Cal.
San Lorenzo Creek near King City, Cal.
San Gabriel River and canals at Azusa, Cal.
Santa Ana River below Warmsprings, Cal.
Mohave River at Victorville, Cal.

ARROYO SECO AT PETTITT'S RANCH, NEAR SOLEDAD, MONTEREY COUNTY, CAL.

A gaging station was established by W. W. Cockins, jr., December, 1900, at Foster's ranch, near Piney post-office, California. The high water of January, 1901, enlarged an old channel, and the gaging station was removed to Pettitt's ranch, 4 miles below. The purpose of establishing these gaging stations was to get the maximum flood discharge and the amount of water available for storage. The total area

of the basin drained above Pettitt's ranch is 215 square miles. The observer is Mrs. Charles Pettitt.

Discharge measurements of Arroyo Seco at Pettitt's ranch near Soledad, Monterey County, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
February 24	S. G. Bennett	8.2	1,720
February 25	do	11.7	7,883
February 26	do	9.0	2,777
April 29	do	5.75	144
July 18	H. Hamlin	5.08	10
August 7	do	4.9	2
November 14	do	5.42	50
November 15	do	5.40	35
December 31	S. G. Bennett	5.40	43

Daily gage height, in feet, of Arroyo Seco at Pettitt's ranch near Soledad, Monterey County, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	5.3	5.3	7.5	5.9	5.7	5.5	5.2	5.0	4.9	4.8	5.2	5.3
2	5.3	5.3	8.7	6.0	5.7	5.4	5.2	5.0	4.9	4.8	5.2	5.3
3	5.3	5.3	7.8	5.9	5.7	5.5	5.2	5.0	4.8	4.8	5.2	5.3
4	5.3	5.3	7.2	5.8	5.7	5.4	5.2	4.9	4.9	4.8	5.2	5.3
5	5.3	5.3	6.9	5.8	5.7	5.4	5.2	5.0	4.8	4.9	5.2	5.3
6	5.3	5.3	7.1	5.8	5.7	5.4	5.2	4.9	4.9	4.8	5.1	5.3
7	5.3	5.3	6.9	8.1	5.7	5.4	5.2	4.9	4.8	4.9	5.1	5.3
8	5.3	5.3	8.3	6.7	5.6	5.4	5.2	4.9	4.8	4.9	5.1	5.3
9	5.3	5.7	7.9	6.4	5.7	5.4	5.2	4.9	4.8	4.9	5.1	5.4
10	5.3	5.5	7.3	6.3	5.6	5.4	5.2	4.9	4.8	4.9	7.0	5.8
11	5.3	5.5	7.1	6.2	5.6	5.4	5.2	4.9	4.8	4.9	5.9	5.7
12	5.3	5.6	6.8	6.2	5.6	5.4	5.2	4.9	4.8	4.9	5.5	5.7
13	5.3	5.5	6.8	6.1	5.6	5.4	5.2	4.9	4.8	5.0	5.5	5.7
14	5.3	5.5	6.5	6.0	5.6	5.4	5.1	4.9	4.8	4.9	5.4	5.6
15	5.3	6.4	6.4	6.0	5.6	5.4	5.1	4.9	4.8	5.0	5.4	5.5
16	5.3	6.0	6.3	6.0	5.6	5.3	5.1	4.9	4.8	4.9	5.4	5.7
17	5.3	6.0	6.3	6.0	5.6	5.3	5.1	4.9	4.8	5.0	5.4	5.6
18	5.3	5.9	6.2	5.9	5.6	5.3	5.1	4.9	4.8	4.9	5.4	5.5
19	5.3	5.9	6.2	5.9	5.5	5.3	5.1	4.9	4.8	5.0	5.4	5.5
20	5.4	5.7	6.2	5.9	5.5	5.3	5.1	4.9	4.8	5.0	5.4	5.5
21	5.3	7.4	6.1	5.9	5.5	5.3	5.1	4.9	4.8	5.0	5.4	5.5
22	5.3	8.8	6.0	5.9	5.5	5.3	5.1	4.9	4.8	5.0	5.3	5.5
23	5.3	6.3	6.0	5.8	5.5	5.3	5.0	4.9	4.8	5.0	5.3	5.4
24	5.3	8.7	6.1	6.0	5.5	5.3	5.0	4.9	4.8	5.3	5.3	5.5
25	5.4	9.1	6.0	5.9	5.5	5.3	5.0	4.9	4.8	5.5	5.3	5.4
26	5.4	9.1	6.1	5.9	5.5	5.2	5.0	4.9	4.8	5.4	5.3	5.4
27	5.4	8.2	6.0	5.8	5.5	5.2	5.0	4.9	4.8	5.2	5.3	5.5
28	5.4	7.8	5.9	5.8	5.5	5.2	5.0	4.9	4.8	5.2	5.3	5.4
29	5.4	.....	5.9	5.8	5.5	5.2	5.0	4.9	4.8	5.2	5.3	5.4
30	5.3	.....	5.9	5.8	5.5	5.2	5.0	4.9	4.8	5.2	5.3	5.4
31	5.3	.....	5.9	.....	5.5	.....	5.0	4.9	.....	5.2	.....	5.4

Rating table for Arroyo Seco River at Pettitt's ranch near Soledad, Monterey County, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.0	7	6.8	620	8.6	2,200	10.4	5,130
5.2	15	7.0	750	8.8	2,450	10.6	5,540
5.4	40	7.2	890	9.0	2,720	10.8	5,960
5.6	75	7.4	1,030	9.2	3,010	11.0	6,380
5.8	145	7.6	1,190	9.4	3,320	11.2	6,800
6.0	230	7.8	1,360	9.6	3,650	11.4	7,220
6.2	320	8.0	1,550	9.8	4,000	11.6	7,650
6.4	410	8.2	1,750	10.0	4,360	11.8	8,090
6.6	510	8.4	1,970	10.2	4,740	12.0	8,530

Estimated monthly discharge of Arroyo Seco at Pettitt's ranch near Soledad, Monterey County, Cal.

[Drainage area, 215 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	40	25	28	1,722	0.13	0 15
February	2,860	25	605	33,600	2.81	2.93
March	2,320	185	620	38,122	2.88	3.32
April	1,650	145	270	16,066	1.26	1.41
May	105	55	74	4,550	.34	.39
June	55	15	32	1,904	.15	.17
July	15	7	12	738	.06	.07
August	7	3	4	246	.02	.02
September	3	0	0	0	.00	.00
October	55	0	9	553	.04	.05
November	750	11	57	3,392	.27	.30
December	145	25	54	3,320	.25	.29
The year	2,860	0	147	104,213	.68	9.10

SAN LORENZO CREEK NEAR KING CITY, CAL.

A gaging station was established December 16, 1900, at Hollenbeck's ranch. To obtain a reliable observer it was necessary to move the gaging station to the Mathews dam site one-half mile above the Hollenbeck ranch on November, 1901. The stream is very flashy, and the rating curve for 1902 was completed by taking the cross section and slope with a level and calculating the discharge by the Kutters formula. The observer is J. L. Mathews.

Discharge measurements of San Lorenzo Creek near King City, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 24	S. G. Bennett	0.9	5
February 24	do	1.09	43
April 30	do	.09	2
July 16	H. Hamlin		1
November 12	do	.85	6

Daily gage height, in feet, of San Lorenzo Creek near King City, Cal.

Day.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.
1902.							
1	0.9	0.9	1.1	0.9		1.0	1.0
2	.9	.9	3.0	.9		1.0	1.0
3	.9	.9	2.2	.9		1.0	.9
4	.9	.9	1.4	.9		1.0	.9
5	.9	.9	1.2	.9		1.0	.9
6	.9	.9	1.6	.9		1.0	.9
7	.9	.9	1.6	.9		1.0	.9
8	.9	.9	1.8	.9		1.0	.9
9	.9	.9	1.8	.9		1.0	.9
10	.9	.9	1.6	.9		1.0	1.0
11	.9	.9	1.2	.9		1.8	1.0
12	.9	.9	1.2	.9		1.7	1.0
13	.9	.9	1.1	.9		1.6	1.0
14	.9	.9	1.0	.9		1.6	.9
15	.9	.9	1.0	.9		1.6	.9
16	.9	.9	1.0	.9		1.6	.9
17	.9	.9	1.0	.8		1.6	.9
18	.9	.9	1.0	.8		1.5	.9
19	.9	.9	1.0	.8	0.9	1.8	.9
20	.9	.9	1.0	.8	.9	1.7	.9
21	.9	.9	.9	.8	1.0	1.6	.9
22	.9	1.7	.9	.8	1.0	1.6	.9
23	.9	1.6	.9	.8	1.0	1.4	.9
24	1.0	1.7	.9	.8	1.0	1.4	.9
25	1.0	2.9	1.0	.8	1.0	1.4	.9
26	.9	2.3	1.0	.8	1.0	1.4	.9
27	.9	1.5	.9	.9	1.0	1.4	.9
28	.9	1.2	.9	.9	1.0	1.4	.9
29	.9		.9	.9	1.0	1.2	.9
30	.9		.9	.9	1.0	1.2	.9
31	.9		.9		1.0		.9

Rating table for San Lorenzo Creek near King City, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	3	1.4	88	2.0	274	2.6	585
.9	5	1.5	110	2.1	317	2.7	650
1.0	15	1.6	135	2.2	364	2.8	720
1.1	32	1.7	166	2.3	415	2.9	795
1.2	50	1.8	200	2.4	470	3.0	875
1.3	68	1.9	236	2.5	525		

Estimated monthly discharge of San Lorenzo Creek near King City, Cal.

[Drainage area, 235 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	15	5	6	369	0.03	0.03
February	795	5	69	3,832	.29	.30
March	875	5	81	4,980	.34	.39
April	5	3	4	238	.02	.02
October 19–31			15	357	.06	.03
November	200	15	85	5,057	.36	.40
December	15	5	7	430	.03	.03

SAN GABRIEL RIVER AND CANALS AT AZUSA, CAL.

Owing to the numerous diversions it has been difficult to obtain accurate discharge measurements at Azusa; but during 1898 the San Gabriel Electric Company completed its system, and measurements are now obtained with greater ease and hence with greater accuracy. The headworks of this company are located about 6 miles above the mouth of the canyon; the water is carried along the left side by a series of tunnels and conduits, and a head of 400 feet is obtained where the electric power is generated. Weirs are placed on the conduit of the electric company, and the water is measured at this point. The capacity of the conduit is 90 second-feet.

The total flow of the river is obtained by adding the daily discharge for the river to the figures for the corresponding dates for the canals. The observer is H. F. Parkinson.

Discharge measurements of San Gabriel River at Azusa, Cal.

Date.	Hydographer.	Gage height.	Discharge.	Remarks.
1902.		*Feet.*	*Second-feet.*	
April 8	S. G. Bennett	1.4	26.0	
			34.0	Over weirs San Gabriel Power Company Canal.
			11.0	Waste gate San Gabriel Power Company.
			71.0	Total flow of San Gabriel River.
June 12	do		25.7	Flow over weirs of San Gabriel Power Company=total flow of river.
September 1	W. B. Clapp		5.0	Do.

Daily gage height, in feet, of San Gabriel River at Azusa, Cal.

Day.	Feb.	Mar.	Apr.	Nov.	Day.	Feb.	Mar.	Apr.	Nov.
1902.					1902.				
1	(a)	0.85	1.10		17		1.00	0.00	
2		3.00	1.50		18		.93	0.00	
3		1.90	1.10		19		1.25	0.00	
4		1.55	1.05		20		1.05	0.00	
5		1.40	1.02		21		.90	1.05	
6		1.57	1.00		22		.80	0.80	
7		1.20	1.20		23		.90	0.00	
8		1.20	1.20		24		1.65	0.00	
9		2.30	1.15		25		1.40	0.00	
10		1.95	1.10		26	1.75	1.30	0.00	
11		1.70	1.05	1.20	27	1.35	1.15	0.00	
12		1.50	1.00	(a)	28	1.05	1.10	0.00	
13		1.40	1.00		29		1.05	0.00	
14		1.30	0.95		30		1.20	0.00	
15		1.20	0.00		31		1.10		
16		1.10	0.00						

a River dry January 1 to February 25, May 1 to November 10, and November 12 to December 31.

Daily discharge, in second-feet, of San Gabriel canals at Azusa.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	25	30	58	62	48	30	16	7	5	6	9	16
2	25	30	60	62	48	28	16	7	5	6	8	16
3	25	30	60	62	48	26	16	8	5	6	8	16
4	25	30	60	62	47	26	17	7	5	6	8	16
5	25	30	61	62	46	25	17	8	5	6	8	17
6	25	29	62	62	46	23	16	8	5	6	8	17
7	25	29	62	62	46	21	16	7	5	6	8	18
8	25	29	62	62	45	20	14	7	4	6	9	18
9	25	29	62	62	43	20	12	8	5	6	9	24
10	25	29	62	62	43	22	12	8	5	6	9	30
11	25	29	62	62	43	25	11	8	5	7	62	36
12	24	29	62	62	42	25	10	8	5	8	43	32
13	24	28	62	46	40	22	10	8	5	8	25	28
14	24	28	62	62	44	22	10	8	5	8	23	26
15	24	28	62	62	42	21	10	8	5	6	23	25
16	24	28	62	62	40	20	10	8	6	6	23	25
17	24	28	62	62	40	20	10	8	6	6	22	46
18	27	28	62	60	37	19	10	8	6	6	22	68
19	30	27	62	61	37	18	10	8	6	6	22	61
20	28	27	62	61	37	16	8	8	6	7	22	55
21	26	32	62	62	37	16	8	7	6	7	21	48
22	26	38	62	62	36	16	8	6	6	8	20	42
23	26	34	62	60	35	14	8	6	6	9	20	35
24	51	35	62	60	34	14	8	7	6	10	20	35
25	42	40	62	56	34	14	8	6	6	10	20	35
26	32	63	62	54	34	14	9	6	6	9	20	35
27	32	62	62	52	32	14	10	6	6	8	20	35
28	32	62	62	50	30	15	10	6	6	8	20	34
29	32	------	62	48	30	15	10	6	6	8	19	33
30	31	------	55	48	30	14	9	6	6	8	17	32
31	30	------	62	------	30	------	8	6	------	8	------	31

Rating table for San Gabriel River at Azusa, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	4	1.5	37	2.2	128	2.9	288
.9	7	1.6	44	2.3	147	3.0	318
1.0	10	1.7	52	2.4	167	3.1	350
1.1	13	1.8	63	2.5	188	3.2	384
1.2	18	1.9	77	2.6	210		
1.3	24	2.0	93	2.7	234		
1.4	30	2.1	110	2.8	260		

Estimated monthly discharge of San Gabriel River at Azusa, Cal.

[Drainage area, 222 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	0	0	0	0
February	57	0	3	167
March	318	4	38	2,337
April	37	0	7	417
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
October	0	0	0	0
November	18	0	0	0
December	0	0	0	0
The year	318	0	4	2,921

Estimated monthly discharge of San Gabriel canals at Azusa, Cal.

[Drainage area 222 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	51	24	28	1,722
February	63	27	34	1,888
March	62	55	61	3,751
April	62	46	59	3,511
May	48	30	39	2,398
June	30	14	20	1,190
July	17	8	11	676
August	8	6	7	430
September	6	4	5	298
October	10	6	7	430
November	62	8	19	1,131
December	68	16	32	1,968
The year	68	4	27	19,393

Estimated monthly discharge of San Gabriel River and canals at Azusa, Cal.

[Drainage area 222 square miles.]

Month	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	51	24	28	1,722	0.13	0.15
February	120	38	37	2,055	.17	.18
March	378	63	99	6,088	.45	.52
April	99	48	66	3,928	.30	.33
May	48	30	39	2,398	.18	.21
June	30	14	20	1,190	.09	.10
July	17	8	11	676	.05	.06
August	8	6	7	430	.03	.03
September	6	4	5	298	.02	.02
October	10	6	7	430	.03	.03
November	80	8	19	1,131	.09	.10
December	68	16	32	1,968	.14	.16
The year	378	4	31	22,314	.14	1.89

SANTA ANA RIVER BELOW WARMSPRINGS, CAL.

This station, established June, 1896, is located 5 miles northeast of Mentone, Cal., three-fourths of a mile below the head works of the Santa Ana canal and opposite the warm springs in the canyon. The gage is an inclined timber fastened to a large bowlder and posts set in the bank of the river. The observer is A. Larrd.

Owing to the shifting nature of the stream bed it has not been possible to construct perfectly satisfactory rating curves, but the tables as presented are based on the best information that could be obtained. The record is not considered absolutely correct, but is given as an approximation. This river is one of the most difficult streams in the State of which to obtain an accurate record. The Edison Electric Company diverts the greater portion of the water of Santa Ana River above the gaging station, but also returns all of it above the station. They, however, allow only limited portions of the water to pass out of their conduits during certain hours of the day, holding back the water for the purpose of obtaining additional power when the greatest demand exists. The Santa Ana canal, as mentioned above, also diverts water from Santa Ana River above the station, all of which is returned to the channel of the stream after passing the point of measurement.

During the greater part of the year the canals at the mouth of the canyon divert all of the water. At such times the discharge of Santa Ana River was obtained by observations on weirs at the head works of Green Spot pipe line, Highlands canal, and Redlands canal. The water entering Redlands canal from the Redlands tunnel and Morton Canyon was assumed to offset the loss by evaporation and seepage between the old gaging station and the mouth of the canyon.

Discharge measurements of Santa Ana River and canal at Warmsprings, Cal.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
1902.		*Feet.*	*Second-feet.*	
April 5	S. G. Bennett	1.39	51	River.
			4	Santa Ana Canal.
			55	Total discharge from drainage basin.
May 31	do	.91	8	River.
			21	Santa Ana Canal.
			29	Total flow.
July 10	do	.84	5	River.
			18	Santa Ana Canal.
			23	Total.
September 3	W. B. Clapp	.95	10	River.
			14	Santa Ana Canal.
			24	Total.
November 5	S. G. Bennett	.87	5	River.
			13	Santa Ana Canal.
			18	Total.

Daily gage height, in feet, and discharge, in second-feet, of Santa Ana River and canal[a] at Warmsprings, Cal.

Day.	Jan.		Feb.		Mar.		Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1902.												
1		20		20	1.50	63	1.35	42		45		32
2		22		24	2.80	485	1.40	48		44		30
3		24		22	1.60	80	1.40	48		43		29
4		23		25	1.50	63	1.40	48		43		30
5		23		27	1.50	63	1.45	56		42		27
6		23		28	1.35	31	1.33	40		40		29
7		21		27	1.45	56	1.35	42		39		26
8		23		27	1.36	43	1.38	46		40		26
9		23		27	2.03	187	1.30	36		38		26
10		22		27	1.70	102	1.30	36		38		32
11		23		28	1.55	72	1.27	33		37		34
12		23		28	1.55	72	1.27	33		34		40
13		23		28	1.55	72	1.25	31		34		39
14		23		27	1.55	72	1.24	30		38		39
15		23		28	1.35	42	1.24	30		34		47
16		23		28	1.23	29	1.24	30		35		45
17		23		28	1.25	31	1.23	29		35		45
18		23		28	1.25	31	1.23	29		35		45
19		23		27	1.30	36	1.24	30		35		44
20		24		26	1.25	31	1.25	31		33		29
21		22		26	1.22	28	1.45	56		33		27
22		24		32	1.25	31	1.30	36		32		27
23		24		33	1.30	36	1.31	37		33		26
24		45		30	1.40	48		54		33		39
25		41		33	1.45	56		49		32		35
26		28	2.20	240	1.50	63		47		34		30
27		25	1.60	80	1.55	72		46		31		32
28		26	1.50	63	1.53	68		43		31		31
29		25			1.53	68		46		31		23
30		21			1.50	63		44		31		23
31		21			1.45	56				31		

[a] Discharge of river was obtained by measurements over weirs on days when gage heights are not given.

Daily gage height, in feet, and discharge, in second-feet, of Santa Ana River[a] and canal at Warmsprings, Cal.—Continued.

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1902.												
1		24		24		23		31		43		23
2		32		24		25		30		23		23
3		31		25		26		31		23		23
4		31		25		29		33		22		22
5		23		25		26		37		20		22
6		23		25		24		36		19		22
7		23		26		23		34		20		22
8		25		28		23		37		20		21
9		25		30		23		42		20		21
10		25		29		24		43		20		21
11		23		28		25		44		31		27
12		26		28		23		42		26		21
13		26		28		28		36		23		21
14		27		25		27		36		23		22
15		26		25		24		35		23		21
16		24		25		23		33		23		22
17		24		25		24		32		19		19
18		25		25		24		32		20		21
19		24		24		25		34		31		24
20		24		23		26		36		25		22
21		24		22		26		40		23		24
22		24		22		24		39		24		24
23		25		22		23		49		24		26
24		25		22		23		51		21		23
25		28		23		22		55		26		23
26		26		25		22		27		26		24
27		25		22		23		49		26		25
28		30		25		23		50		26		21
29		30		26		25		47		26		24
30		27		27		27		49		26		21
31		26		26				52				20

[a] Discharge of river was obtained by measurements over weirs on days when gage heights are not given.

Daily mean discharge, in second-feet, of Santa Ana canal[a] below Warmsprings, Cal.

Day.	Feb.	Mar.	Apr.	Day.	Feb.	Mar.	Apr.	Day.	Feb.	Mar.	Apr.
1902.				1902.				1902.			
1		12	11	12		0	15	23		14	12
2		0	15	13		13	15	24		0	
3		0	15	14		15	15	25		0	
4		0	15	15		15	15	26	0	0	
5		12	15	16		13	15	27	0	0	
6		11	15	17		14	14	28	0	0	
7		0	15	18		14	14	29		0	
8		0	15	19		14	13	30		0	
9		0	15	20		14	13	31			
10		0	15	21		13	13				
11		0	15	22		14	13				

[a] On days not given in above table there was no discharge.

Rating table for Santa Ana River below Warmsprings, Cal., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	12	1.6	80	2.2	240	2.8	485
1.1	18	1.7	102	2.3	277	2.9	540
1.2	26	1.8	125	2.4	315	3.0	600
1.3	36	1.9	150	2.5	355		
1.4	48	2.0	178	2.6	395		
1.5	63	2.1	208	2.7	440		

Estimated monthly discharge at Santa Ana River and canal below Warmsprings, Cal.

[Drainage area, 182 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	45	20	24	1,476	0.13	0.15
February	240	20	38	2,110	.21	.22
March	485	41	79	4,858	.43	.50
April	71	43	51	3,035	.28	.31
May	45	31	36	2,214	.20	.23
June	47	23	33	1,964	.18	.20
July	32	23	26	1,599	.14	.16
August	30	22	25	1,537	.14	.16
September	29	22	24	1,428	.13	.15
October	55	30	39	2,398	.21	.24
November	43	19	24	1,428	.13	.15
December	27	19	22	1,353	.12	.14
The year	485	19	35	25,400	.19	2.61

The above discharges include the discharges given in a separate table of Santa Ana Canal.

MOHAVE RIVER AT VICTORVILLE, CAL.

At Victorville, a station on the Atchison, Topeka and Santa Fe Railroad, the river passes through a narrow gorge, locally known as The Narrows. This place has been under investigation as a possible dam site, and soundings for the depth of bed rock were made by the United States Geological Survey during the season of 1899. The greatest depth of bed rock was found to be 54 feet. The diamond

drill showed the rock to be a fine granite. A more detailed account of this exploration will be found in the Twenty-first Annual Report, Part IV. Above The Narrows the valley broadens into a large reservoir site, but as no surveys of it have been made the capacity is unknown. In order to determine the amount of water available for storage for this reservoir a gaging station was established February 27, 1899.

During 1902 no flood passed the gaging station. The channel is in sand, which is constantly shifting. The rod readings are of little value during low stages. Between January 1, 1902, and May 3, 1902, the discharge varied from 47 to 67 cubic feet per second, though the gage reading was 0.9 for the entire time. At the latter date the rod readings were discontinued.

The mean estimated discharge for each month was obtained by averaging the discharge as obtained by meter measurements made during the month.

Discharge measurements of Mohave River at Victorville, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
January 4	P. H. Leahy	0.9	47
January 21	do	.9	53
February 1	do	.9	58
February 25	do	.9	63
March 5	do	.9	66
March 29	do	.9	66
April 5	do	.9	67
April 19	do	.9	62
April 26	do	.9	47
May 10	do	.9	37
May 25	do		49
June 8	do		53
June 27	do		47
July 5	do		38
July 26	do		41
August 9	do		48
August 15	do		33
October 20	do		49
October 30	do		45
November 10	do		43
November 27	do		50
December 11	do		68
December 19	do		69
December 27	S. G. Bennett		55

Estimated monthly discharge of Mohave River at Victorville, Cal.

[Drainage area, 400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	53	47	50	3,074	0.13	0.15
February	63	58	60	3,332	.15	.16
March	66	66	66	4,058	.17	.20
April	67	47	59	3,512	.15	.17
May	49	37	43	2,644	.11	.13
June	53	47	50	2,975	.13	.15
July	41	38	40	2,460	.10	.12
August	48	33	40	2,460	.10	.12
September [a]			44	2,618	.11	.12
October	49	45	47	2,890	.12	.14
November	50	43	46	2,737	.12	.13
December	69	55	64	3,808	.16	.18
The year	69	33	51	36,568	.13	1.77

[a] Estimated.

MISCELLANEOUS MEASUREMENTS IN SOUTHERN CALIFORNIA DRAINAGE.

Ventura River.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
		Feet.	*Sec.-feet.*	
September 25	J. B. Lippincott		2.0	Matilija, above mouth of North Fork.
September 25	do		5.23	Below diversion of Ventura City water system, Cayote Creek.
September 26	do		1.5	Power ditch near head.

Ventura River, North Fork.

September 25	J. B. Lippincott		0.33	In flume.

San Gabriel River.

September 1	W. B. Clapp		0.9	Slauson well.
July 15	J. B. Lippincott		16.5	Banta ditch, near head.
July 15	do		10.6	Cate ditch.
July 15	do		19.1	Standifer ditch.
July 15	do		23.8	San Gabriel River (Rio Hondo), Old Mission Bridge.

Santa Ana River.

SAN ANTONIO CREEK.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
1902.		*Feet.*	*Sec.-feet.*	
June 28	J. B. Lippincott		0.55	Water passing San Gabriel Power Co.'s powerhouse in creek.
July 12, 12.33 p. m	do		.47	Do.
August 2, 12.10 p. m	do		.40	Do.
August 9, 12.11 p. m	do		.40	Do.
August 29, 12.40 p. m	do		.35	Do.
September 27, 12 m	do		.36	Do.
October 18, 12 m	do		.39	Do.
June 28	do		7.40	Concrete weir basin, San Gabriel Electric Co.'s powerhouse.
July 12, 12.20 p. m	do		6.10	Do.
August 2, 12 m	do		5.59	Do.
August 9, 11.48 a. m	do		5.67	Do.
August 29, 12.30 p. m	do		4.59	Do.
September 27, 11.37 a. m	do		4.64	Do.
October 18, 11.38 a. m	do		4.31	Do.
June 28	do		.34	Fountain of Life Spring weir.
July 12, 12.15 p. m	do		.34	Do.
August 2, 12.05 p. m	do		.30	Do.
August 9, 11.42 a. m	do		.32	Do.
August 29, 12.20 p. m	do		.29	Do.
September 27, 11.33 a. m	do		.29	Do.
October 18, 12 m	do		.30	Do.
August 2	do		6.31	Spring Hill weir.
August 9, 11.22 a. m	do		6.36	Do.
August 9, 1 p. m	do		5.88	Do.
August 29, 12.07 p. m	do		5.59	Do.
August 29, 12.10 p. m	do		5.40	Do.
September 27, 12.05 p. m	do		5.28	Do.
October 18, 12.12 p. m	do		5.01	Do.
June 28	do		7.69	Baby Ruth weir.
July 12, 11.40 a. m	do		6.88	Do.
July 12, 1.13 p. m	do		6.58	Do.
August 2, 11.15 a. m	do		6.15	Do.
August 9, 11 a. m	do		6.15	Do.
August 9, 1.12 p. m	do		5.99	Do.
August 29, 11.45 a. m	do		5.61	Do.
September 29, 12.30 p. m	do		4.88	Do.
October 18, 12.30 p. m	do		4.74	Do.
April 3	S. G. Bennett		11.4	Division weir.
June 28	J. B. Lippincott		6.98	Do.
July 12, 10.58 a. m	do		6.11	Do.
July 12, 2.40 p. m	do		5.55	Do.
August 2, 10.30 a. m	do		5.19	Do.
August 2, 2.30 p. m	do		4.71	Do.
August 9, 10.18 a. m	do		5.31	Do.
August 9, 2.40 p. m	do		4.53	Do.
August 29, 10.55 a. m	do		4.64	Do.
August 29, 2.27 p. m	do		3.93	Do.
September 27, 10.30 a. m	do		4.33	Do.
September 27, 2.15 p. m	do		3.90	Do.
October 18, 10.55 a. m	do		4.36	Do.

Santa Ana River—Continued.

SAN ANTONIO CREEK—Continued.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
1902.		*Feet.*	*Sec.-feet.*	
June 28	J. B. Lippincott		1.38	San Antonio tunnel.
July 12	do		1.27	Do.
August 2	do		1.19	Do.
August 9	do		1.17	Do.
August 30	do		1.15	Do.
September 27	do		1.12	Do.
CUCAMONGA CREEK.				
April 3	S. G. Bennett		5.0	Above headworks, Iamosa Water Co.
LYTLE CREEK.				
April 4	S. G. Bennett		20.0	Above intake, Rialto canal.
September 5	W. B. Clapp		5.0	Weir headworks, Rialto canal.
WEST TWIN CREEK.				
April 4	S. G. Bennett		3.2	Mouth of canyon.
September 3	W. B. Clapp		.13	Do.
EAST TWIN CREEK.				
April 4	S. G. Bennett		5.0	Total flow.
September 4	do		.4	Do.
CITY CREEK.				
April 7	S. G. Bennett		12.6	Total flow.
September 4	W. B. Clapp		.19	Do.
PLUNGE CREEK.				
April 7	S. G. Bennett		12.4	Total flow.
September 4	W. B. Clapp		.37	Do.
HIGHLANDS CANAL.				
May 31	S. G. Bennett		7.9	Cippoletti weir at headworks.
July 10	do		11.5	Do.
September 3	W. B. Clapp		11.1	Do.
November 5	S. G. Bennett		10.0	Do.
REDLANDS CANAL.				
May 31	S. G. Bennett		19.6	Sand box weir.
July 10	do		10.6	Do.
September 3	W. B. Clapp		14.6	Do.
November 5	S. G. Bennett		7.6	Do.
REDLANDS TUNNEL.				
July 10	S. G. Bennett		0.9	Weir.

Santa Ana River—Continued.

MILL CREEK.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
1902.		*Feet.*	*Sec.-feet.*	
April 5	S. G. Bennett		11.0	Old zanja.
			5.0	Wash.
			5.0	Crafton canal.
			21.0	Total.
May 31	S. G. Bennett		19.0	Total flow.
July 10	do		10.8	Crafton weir, total flow.
September 3	W. B. Clapp		5.3	Total flow.
November 5	S. G. Bennett		12.3	Old zanja, total flow.

Return water to Santa Ana River, natural flow in second-feet, compared with developed water in San Bernardino Valley, above Colton.

[Measurements by K. Sanborn.]

Date.	Location.	Discharge.		
		Developed.	Natural.	Total.
1902.				
September 30	Hawes & Talmage ditch		0.00	0.00
September 30	Rabel dam		0.00	0.00
September 30	Shay or Stout dam		0.00	0.00
September 30	McKinzie		0.00	0.00
October 13	Beam		0.22	0.22
September 30	Riverside Water Co.'s upper canal	26.08	21.89	47.97
October 7	Gage canal, intake Santa Ana River		0.00	0.00
October 11	Gage canal, flume over road Redlands Pass	30.17		30.17
October 13	Logsdon & Farrell		0.00	0.00
October 13	Whitlock		0.00	0.00
October 13	Daley		0.00	0.00
October 7	McIntyre		0.00	0.00
October 13	Whiting		0.00	0.00
October 14	Swamp		0.93	0.93
October 7	Ranchero & Bloomington	2.28		2.28
October 14	Ward & Warren	0.30	1.58	1.88
September 30	Mill flume, Riverside Water Co		0.50	0.50
September 30	Mill pump, Riverside Water Co	1.20		1.20
October 7	Camp Carlton	1.70		1.70
October 7	Colton Terrace Water Co	1.08		1.08
October 7	City of Colton pumping plant	3.53		3.53
September 30	Meeks & Daley ditch		13.40	13.40
September 29	West Riverside 350-inch pumping plant	5.94		5.94
October 11	Rogers pumping plant	4.38		4.38
October 11	Santa Ana River flume, Riverside pumping plant No. 1	2.95		2.95
October 11	Santa Ana River flume, Riverside pumping plant No. 2	2.08		2.08
	Total	81.69	38.52	120.21

NOTE.—The West Riverside flume carries the water pumped by the West Riverside 350-inch plant, a portion of the water pumped by the Rogers pumping plant, and also a portion of the Meeks & Daley water; for these reasons it is not included under a special heading.

The Gage canal, Palm Avenue weir, and Bloomington flume torn out, Bloomington water running in the Ranchero ditch.

East Riverside Irrigation District or the Riverside Highland Water Co. running 2.7 second-feet over weir in tunnel, and pumping direct into the main pipe below end of tunnel, one pumping plant not running.

Return waters in San Bernardino Valley below Slover Mountain and above Riverside Narrows, Santa Ana.

[K. Sanborn, hydrographer.]

Date.	Location.	Discharge.
		Sec.-feet.
September 3	Santa Ana River, at Rincon wagon bridge	[a]75.00
September 29	Riverside Water Co. flume, at head of lower canal	3.07
September 29	Rubidoux canal	7.19
September 29	Evans ditch, at north line, Riverside canal	2.17
September 29	Evans ditch, 1 mile south of Riverside canal line	0.53
September 29	Evans Island ditch, at west end of West Riverside bridge	5.35
September 29	Alvetriz ditch, at east end of West Riverside bridge	1.96
October 10	Santa Ana River, at Riverside Narrows	43.25
	Total	63.52

[a] W. B. Clapp.

COLUMBIA RIVER DRAINAGE BASIN.

Next to the Colorado, Columbia River is the largest river in the arid region, its drainage basin including parts of Washington, Oregon, Idaho, and Montana and a large area in Canada. The Columbia and its numerous tributaries are of great importance, offering good sites for water-power development and an abundance of water for irrigation, while the main river is navigable for a considerable distance.

A great part of the water of Columbia River and its tributaries flows to waste, not being utilized. This is due to the fact that the river has cut so deeply into the lava-covered plains that water can not be diverted except at points near the mountains, where the streams are of small size and have not yet entered the deeply incised canyon in the plateaus. The following rivers are tributary to the Columbia:

Umatilla River rises in the well-wooded country in northeastern Oregon and flows in a general westerly direction, entering Columbia River below the mouth of Wallawalla River. The country north of Umatilla is high and rolling. A number of canals divert water from the lower course of the stream to irrigate lands on either side.

Yakima River has its source in Keechelus Lake, on the eastern slope of the Cascade Mountains, in Kittitas County, Wash. Within a short distance it receives the waters of Kachess Lake, and $2\frac{1}{2}$ miles above Clealum it receives the outlet of the last of the three large headwater lakes. It enters Columbia River 23 miles below Kiona, Wash.

Naches River has its source on the eastern slope of the Cascade Mountains, in Yakima County, Wash. It flows in a general southeasterly direction, entering Yakima River a short distance above North Yakima. Irrigation is practiced in the narrow valley along the lower course of the river, but its waters are of greater value for the irrigation of lands west of North Yakima. The river has considerable

fall and the water can easily be diverted by means of comparatively short canals. For this reason it is of more value for irrigation purposes than Yakima River, which has less fall.

Tieton River is the principal tributary of the Naches River and discharges into the latter about 17 miles above its junction with Yakima River, near North Yakima. Its source is in the Cascade Mountains in the vicinity of Cowlitz Pass. A peculiar feature of the stream is the turbid, milk-white appearance of the water, it being similar in this respect to White River, on the western slope of the Cascade Range. The water of the South Fork of the Tieton, 25 miles above the mouth, is however, perfectly clear. The forks head in the glaciers of a peak of the Cascades known locally as Goat Rock.

Spokane River rises in the northern part of Idaho, being the outlet of Lake Coeur d'Alene. It passes into Washington, flows in a northerly direction, and enters Columbia River near latitude 47° 52′ north. It is about 120 miles long.

Missoula River has its source in Silverbow County, Mont., and flows northerly until it receives the waters of Little Blackfoot River, when it takes a more northwesterly course. The name Missoula is usually applied to that portion of the river between the junction of Blackfoot and Hellgate rivers and the mouth of Pend Oreille River. From that point to its junction with Columbia River it is called Clark Fork of Columbia.

The source of Bitterroot River is in the high mountains which form the boundary line between Montana and Idaho. It flows in a northerly direction, entering Missoula River a short distance below the city of Missoula. The tributaries on the east side drain comparatively low hills and contribute little to the supply of the river. The west side branches, on the contrary, are numerous, draining a precipitous and heavily wooded area. Their discharges are regulated by many small lakes fed by banks of snow, which continue far into the summer before disappearing altogether. From Hamilton to Missoula, a distance of 48 miles, the fall of the river is 350 feet, or 7.3 feet to the mile.

Snake River, which is the largest affluent of the Columbia, rises on the southern slope of the Continental Divide in the Yellowstone National Park, draining the country west and southwest of Yellowstone Lake. From Shoshone, Lewes, and Hart Lakes, near its head, the river flows in a southerly direction through a timbered and mountainous country, resulting in a long period of high water. After continuing through this area for about 20 miles it broadens into Jackson Lake, a deep body of water about 3 miles wide and 8 miles long. Below the lake the river flows through Jackson Hole Valley—about 40 miles long and 8 miles wide—and then enters a long canyon near the Idaho-Wyoming line. All of the large tributaries come from the east, receiving their waters from the Wind River Range. The west side of the valley is bounded by the high Teton Mountains, from which

most of the drainage flows westward through Tieton River into North Fork of Snake River. It empties into Columbia River near Pasco Junction, in the State of Washington.

The headwater tributaries of Palouse River have their sources in western Idaho. After passing into Washington the streams unite to form Palouse River, which has a general southwesterly course, through a rolling country. Six miles below Hooper, Wash., the river bends suddenly to the south and enters its canyon, through which it flows until its junction with Snake River. A short distance above the mouth of the river are the Palouse Falls, approximately 130 feet high.

Weiser River drains Washington County, in the extreme western part of Idaho, and flows into Snake River at Weiser, Idaho.

The Boise drains a mountainous and well-wooded country in Elmore County, Idaho. The effects of the forests are shown in the high flow that is maintained throughout the summer season, in contrast to the discharge of Weiser River, farther to the west, which drains a more barren country. Below the gaging station, which is located in the canyon, a large number of canals divert water to irrigate lands in Boise Valley. The diversion of the water is now so great that frequent complaints of scarcity are heard.

Bruneau River rises in northern Nevada and flows in a general northerly course through southern Idaho, emptying into Snake River at a point about south of Boise. Fall River is one of the small tributaries of the Snake River at its headwaters in eastern Idaho. The following list includes the stations in the Columbia River drainage basin:

Umatilla River at Gibbon, Oreg.
Yakima River at Kiona, Wash.
Yakima River at Union Gap, Wash.
Naches River near North Yakima, Wash.
Tieton River near North Yakima, Wash.
Spokane River at Spokane, Wash.
Missoula River at Missoula, Mont.
Bitterroot River near Grantsdale, Mont.
Palouse River near Hooper, Wash.
Weiser River near Weiser, Idaho.
Boise River near Boise, Idaho.
Bruneau River near Grandview, Idaho.
Snake River at Montgomery Ferry, near Minidoka, Idaho.
Snake River (North Fork) near Ora, Idaho.
Fall River near Marysville, Idaho.

UMATILLA RIVER AT GIBBON, OREG.

The station at Gibbon, Oreg., was established July 22, 1896, and is located one-half mile west of the railroad station. The gage rod, which was located one-quarter of a mile below the railroad station, was carried away by a freshet in May, but the bench mark, a cross in black paint on the highest point of the rock to which the rod was fastened, still remains. It is 4.40 feet above datum. The same flood also carried away the entire equipment, consisting of a five-eighth-inch

cable with car, supports, tag, and stay wires. These were all renewed on September 10, 1902. The cable is situated one-half mile below the railroad station in its original position. Changes in the channel necessitated the selection of a better location for the gage rod a few hundred feet nearer to the cable and one-fourth of a mile below the railroad station. A new wire gage was established October 29, 1902. It consists of a horizontal rod attached to a beam projecting over the water and spiked to the top of the cribbing on the left shore about 10 feet north of the railroad track. The length from the end of the weight to the marker is 14.333 feet and the distance from the outside edge of the pulley to the zero of the gage scale is 6.02 feet. The bench mark is a spike on the top timber of the cribbing. Its elevation is 8.31 feet above the zero of the new gage. The initial point for soundings is the face of the tree to which the cable is attached on the right bank of the stream. The channel is straight and the bed is of gravel.

The following discharge measurements were made during 1902:

July 21: Gage height, 0.90 foot; discharge, 130 second-feet.
October 29: Gage height, 0.65 foot; discharge, 106 second-feet.
December 20: Gage height, 1.60 feet; discharge, 381 second-feet.

Daily gage height, in feet, of Umatilla River at Gibbon, Oreg.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.35	1.00	2.50	1.85	2.65	2.60	0.95	0.80	0.75	0.85	0.65	2.40
2	1.30	1.00	2.45	2.00	3.10	2.40	1.10	.80	.75	.85	.70	1.95
3	1.30	1.00	2.25	2.10	3.35	2.25	1.55	.80	.75	.85	.70	1.80
4	1.35	1.00	2.15	2.25	3.50	2.05	2.20	.80	.75	.85	.70	1.70
5	1.40	1.00	2.00	2.30	3.45	1.90	1.95	.80	.75	.85	.75	1.65
6	1.40	1.05	1.85	2.80	3.20	1.80	1.60	.80	.75	.85	.80	1.55
7	1.45	1.05	1.75	3.90	3.30	1.70	1.40	.80	.75	.85	1.10	1.50
8	1.45	1.10	1.70	3.95	3.40	1.65	1.25	.75	.75	.90	1.20	1.50
9	1.40	1.80	1.70	3.70	3.40	1.55	1.15	.75	.75	.90	1.20	3.10
10	1.40	2.50	1.75	3.40	3.45	1.50	1.10	.75	.75	.90	1.15	3.20
11	1.40	2.80	1.80	3.20	3.40	1.45	1.10	.75	.75	.90	1.10	2.95
12	1.40	2.80	1.90	2.95	3.30	1.40	1.05	.75	.75	.85	1.05	2.60
13	1.35	2.85	1.80	2.75	3.25	1.30	1.05	.75	.75	.85	1.00	2.35
14	1.35	2.90	1.70	2.60	3.20	1.25	1.05	.75	.75	.85	1.20	2.10
15	1.35	2.90	1.65	2.45	3.10	1.20	1.05	.75	.75	.85	1.20	2.00
16	1.30	2.90	1.60	2.50	3.05	1.20	1.00	.80	.75	.85	1.45	1.85
17	1.30	3.50	1.70	2.60	3.00	1.15	.95	.80	.75	.85	1.70	1.75
18	1.30	3.60	1.90	3.20	2.90	1.15	.95	.80	.75	.85	1.75	1.65
19	1.30	3.00	2.00	3.85	3.30	1.10	.90	.75	.85	.85	1.85	1.60
20	1.25	2.65	2.05	3.50	5.80	1.10	.90	.75	.85	.85	1.70	1.60
21	1.25	2.40	2.00	3.30	5.75	1.10	.90	.75	.85	.85	1.65	1.50
22	1.25	2.20	1.90	3.00	5.25	1.05	.90	.75	.85	.95	1.55	1.40
23	1.20	2.10	1.90	2.80	4.80	1.05	.90	.75	.85	1.00	1.45	1.40
24	1.20	2.25	1.90	2.65	4.40	1.05	.85	.75	.90	1.05	1.55	1.40
25	1.10	2.80	1.80	2.50	4.10	1.00	.85	.75	.90	1.05	1.60	1.80
26	1.10	2.75	1.75	2.40	3.90	1.00	.85	.75	.90	1.00	1.60	3.00
27	1.05	2.60	1.70	2.40	3.60	.95	.85	.75	.95	1.00	1.60	3.10
28	1.05	2.50	1.70	2.45	3.40	.95	.80	.75	.90	1.00	1.55	2.65
29	1.05	.....	1.65	2.50	3.25	.95	.80	.75	.85	.65	1.55	2.40
30	1.05	.....	1.70	2.60	3.00	.95	.80	.75	.85	.65	1.60	2.20
31	1.00	.....	1.75	.....	2.75	.....	.80	.75	.....	.65	.....	2.00

Rating table for Umatilla River at Gibbon, Oreg., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	50	1.4	330	2.8	1,100	4.5	2,555
.2	63	1.6	412	3.0	1,255	5.0	3,055
.4	78	1.8	502	3.2	1,415	5.5	3,555
.6	98	2.0	600	3.4	1,575	6.0	4,055
.8	135	2.2	707	3.6	1,735		
1.0	190	2.4	826	3.8	1,895		
1.2	256	2.6	957	4.0	2,055		

Estimated monthly discharge of Umatilla River at Gibbon, Oreg.

[Drainage area, 353 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	350	190	284	17,463	0.80	0.92
February	1,735	190	801	44,481	2.27	2.36
March	890	412	541	33,265	1.53	1.76
April	2,015	526	1,140	67,835	3.23	3.60
May	3,855	992	1,767	108,649	5.01	5.77
June	957	175	348	20,707	.99	1.10
July	707	135	228	14,019	.65	.75
August	135	124	128	7,870	.36	.42
September	175	124	136	8,093	.39	.44
October	206	106	155	9,531	.44	.51
November	526	106	302	17,970	.86	.96
December	1,415	330	668	41,074	1.89	2.18
The year	3,855	106	542	390,957	1.54	20.77

YAKIMA RIVER AT KIONA, WASH.

This station is the lowest point at which measurements have been made on Yakima River, and is located at the wagon bridge one-fourth mile north of the railroad station at Kiona. The gage was established August 20, 1895, and consisted of two parts, one vertical and the other inclined at an angle of 30°. It was spiked to the east end of the south pier and anchored with rocks. The initial point for soundings is on the west side of the bridge, 100 feet south of the center of the south pier of the main span. The channel for about 200 feet both above and below the station is nearly straight and the water is quite swift. The right bank is low, but is well protected by a levee, and not subject to overflow. The left bank is high and rocky. The bed of the stream is of gravel and affords an excellent cross section for discharge measurements.

A wire gage was afterwards placed on the lower side of the bridge. The distance from the end of the weight to the index marker is 27.21 feet. From the end of the rod to the outside edge of the pulley wheel it is 2 feet. A new bench mark was established in 1901. It is the top of an iron spike in the east end of the cap of the first trestle bent of the bridge approach on the south side of the river. The elevation of the bench mark above the zero of the gage is 20.53 feet and above sea level 474.24 feet. The top of the 2-inch pulley wheel of the wire gage is 4.68 feet above this bench mark. When the marker on the wire gage is at zero, the bottom of the weight has an elevation of 453.71 feet.

Discharge measurements of Yakima River at Kiona, Wash.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 25	Sydney Arnold	6.00	4,152
April 11	do	7.76	7,060
June 12	do	9.00	9,646
June 23	do	8.00	8,392
July 11	do	6.45	4,114
September 2	do	2.95	251
October 21	do	3.85	803

Daily gage height, in feet, of Yakima River at Kiona, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	8.55	5.40	6.42	6.25	9.85	10.00	(a)	5.00	2.98	3.78	4.31	5.15
2	8.58	5.30	6.35	6.33	9.90	9.20	(a)	4.96	2.95	3.95	4.35	5.52
3	8.60	5.25	6.30	6.35	9.90	8.85	(a)	4.82	2.95	3.93	4.38	5.93
4	8.64	5.20	6.45	6.42	9.95	8.30	(a)	4.73	2.94	3.90	4.40	6.70
5	8.70	5.10	6.45	6.45	10.05	8.18	(a)	4.70	2.93	3.80	4.40	6.50
6	8.80	5.00	6.50	6.60	10.15	8.20	(b)	4.65	2.90	3.72	4.42	6.35
7	8.85	5.00	6.60	6.75	10.25	8.15	(b)	4.70	2.90	3.68	4.53	6.15
8	8.95	4.95	6.70	6.90	10.30	8.07	(b)	4.80	2.90	3.65	4.58	5.95
9	9.00	5.00	6.70	7.25	10.40	7.98	(b)	4.85	2.90	3.65	4.60	5.90
10	9.15	5.05	6.64	7.70	10.68	8.02	(b)	4.72	2.88	3.65	4.78	5.85
11	8.43	5.05	6.50	7.73	10.90	8.00	6.45	4.55	2.88	3.65	4.92	5.85
12	8.10	5.10	6.55	7.65	11.40	7.95	6.43	4.30	2.88	3.65	5.05	5.70
13	7.90	5.15	6.55	7.45	11.60	7.90	6.42	4.22	2.88	3.65	5.12	5.60
14	7.75	5.20	6.60	7.25	11.40	7.78	6.40	4.10	2.88	3.64	5.18	5.50
15	7.50	5.50	6.60	7.10	11.25	7.70	6.20	3.97	2.90	3.63	5.20	5.39
16	7.05	6.13	6.55	7.00	11.00	7.65	6.26	3.90	2.98	3.70	5.22	5.30
17	6.75	7.00	6.50	7.00	10.95	7.56	6.28	3.85	3.00	3.78	5.31	5.25
18	6.75	7.12	6.45	7.15	10.80	7.42	6.25	3.85	3.00	3.80	5.38	5.20
19	6.70	7.10	6.38	7.25	10.40	7.38	6.18	3.78	3.03	3.82	5.70	5.14
20	6.68	7.16	6.35	7.40	9.93	7.30	6.08	3.70	3.01	3.87	5.75	5.07
21	6.65	7.20	6.25	7.45	9.45	(a)	6.09	3.60	3.08	3.85	5.65	4.97
22	6.55	7.20	6.20	8.10	9.15	(a)	6.38	3.52	3.08	3.88	5.55	4.92
23	6.50	7.05	6.15	8.40	9.25	8.00	6.24	3.45	3.20	3.90	5.40	4.86
24	6.50	6.95	6.05	8.75	9.45	(a)	6.14	3.35	3.20	3.92	5.34	4.80
25	6.35	6.80	6.00	9.10	9.60	7.57	6.02	3.16	3.20	4.00	5.30	4.90
26	6.25	6.75	6.10	9.20	9.85	7.54	5.92	3.13	3.20	4.07	5.27	4.99
27	6.00	6.60	6.10	9.35	10.20	7.55	5.82	3.10	3.22	4.13	5.24	5.30
28	5.90	6.50	6.13	9.40	11.00	7.55	5.66	3.08	3.35	4.18	5.30	5.52
29	5.90	.....	6.15	9.65	11.50	7.42	5.42	3.05	3.58	4.22	5.15	5.70
30	5.75	.....	6.15	9.85	11.30	7.40	5.27	2.98	3.65	4.25	5.10	5.68
31	5.60	.....	6.20	.....	10.85	.....	5.15	2.98	.....	4.27	.....	6.10

(a) Observer absent. (b) Gage broken.

Rating table for Yakima River at Kiona, Wash., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.8	200	5.8	3,310	8.8	9,340	11.8	17,480
3.0	270	6.0	3,630	9.0	9,780	12.0	18,080
3.2	370	6.2	3,970	9.2	10,240	12.2	18,680
3.4	490	6.4	4,320	9.4	10,700	12.4	19,280
3.6	620	6.6	4,680	9.6	11,160	12.6	19,880
3.8	760	6.8	5,060	9.8	11,620	12.8	20,480
4.0	910	7.0	5,450	10.0	12,080	13.0	21,080
4.2	1,070	7.2	5,850	10.2	12,680	13.2	21,680
4.4	1,260	7.4	6,270	10.4	13,280	13.4	22,280
4.6	1,490	7.6	6,700	10.6	13,880	13.6	22,880
4.8	1,760	7.8	7,140	10.8	14,480	13.8	23,480
5.0	2,060	8.0	7,580	11.0	15,080	14.0	24,080
5.2	2,365	8.2	8,020	11.2	15,680	14.2	24,680
5.4	2,675	8.4	8,460	11.4	16,280	14.4	25,280
5.6	2,990	8.6	8,900	11.6	16,880	.....	.....

Estimated monthly discharge of Yakima River at Kiona, Wash.

[Drainage area, 5,230 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	10,125	560	6,414	394,381	1.23	1.42
February	5,850	1,986	3,663	203,433	.70	.73
March	4,870	3,630	4,281	263,228	.82	.95
April	11,735	4,055	6,869	408,734	1.31	1.46
May	16,880	10,125	13,388	823,196	2.56	2.95
June	12,080	6,060	7,416	441,283	1.42	1.58
July	6,123	2,288	4,245	261,015	.81	.93
August	2,060	262	1,009	62,041	.19	.22
September	655	224	303	18,030	.06	.07
October	1,133	641	808	49,682	.15	.17
November	3,230	1,170	2,134	126,982	.41	.46
December	4,870	1,760	2,917	179,359	.56	.65
The year	16,880	224	4,454	3,231,364	.85	11.59

YAKIMA RIVER AT UNION GAP, WASH.

Yakima River enters Columbia River just above the town of Pasco. The first measurement of the river was made at this point on August 14, 1893. At that time there was an old vertical river rod attached to the central pier of the bridge. As the foot of this at low water was covered by rock and could not be read, an inclined gage was put in position at the west end of the county bridge. This consisted of two pieces of timber having a total length of 24 feet. These were firmly secured to timbers, bedded, and loaded with rock. The gage rod was painted white and lettered in vertical feet and tenths of a foot. After this new gage was located, it was ascertained that the readings on the old gage would be 1.13 feet higher than on the new. The zero of this new gage was 19.02 feet below the top of the rail of the Northern Pacific Railroad immediately west of the west end of the bridge, which was about 40 feet from the gage. The high-water mark at that time showed that a flood had risen to 8.80 feet on the old gage. Readings at this point were begun on October 2, 1893, and continued during the following winter and spring until May 19, 1894. Owing to the destruction of the gage by floods the station was for a time abandoned.

During August, 1895, Arthur P. Davis visited the locality and found that the section was not favorable for making discharge measurements. He accordingly selected the present station, which is located at Union Gap, 6 miles below North Yakima, Wash., and 1,000 feet

below the highway bridge. It is about 3 miles above the intake of the Sunnyside canal. The gage rod is inclined and is attached to a willow stump and posts set in the ground. The bench mark is the highest point of a large rock mound 43 feet north of the gage and 6.5 feet east of the fence, and is at an elevation of 17.52 feet above gage datum. The equipment consists of cable, car, and tagged wire. The station is of value as it is the only point near the large irrigated area above and below which is unaffected by the taking out of water in irrigating canals.

Discharge measurements of Yakima River at Union Gap, Wash.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
July 5	Sydney Arnold	6.75	5,352
September 3	do	4.10	917
November 3	do	4.55	1,391

Daily gage height, in feet, of Yakima River at Union Gap, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.60	5.30	6.00	5.60	7.40	9.00	7.00	5.60	4.10	4.60	4.40	6.00
2	6.60	5.20	6.20	5.60	7.30	8.30	7.00	5.60	4.10	4.60	4.40	6.30
3	6.40	5.20	6.20	5.50	7.30	7.90	6.90	5.30	4.10	4.60	4.40	6.60
4	6.30	5.00	6.30	5.50	7.50	7.50	6.90	5.10	4.10	4.60	4.60	6.60
5	6.90	5.00	6.30	5.50	7.80	7.50	6.70	5.10	4.10	4.50	4.60	6.30
6	7.00	5.00	6.20	5.90	8.00	7.30	6.70	5.10	4.10	4.50	4.60	6.00
7	7.40	5.00	6.30	7.00	8.20	7.30	6.60	5.10	4.10	4.40	4.60	6.00
8	7.60	4.90	6.30	7.60	8.20	7.20	6.60	5.00	4.10	4.40	4.60	5.90
9	8.00	5.10	6.30	7.60	8.80	7.40	6.60	5.00	4.10	4.40	4.60	5.90
10	8.20	5.10	6.30	7.60	8.90	7.50	6.30	4.90	4.00	4.20	4.60	5.60
11	8.00	5.30	6.20	7.00	9.50	7.90	6.30	4.90	4.00	4.20	4.80	5.60
12	7.60	5.30	6.20	6.90	10.10	8.20	6.30	4.90	4.00	4.20	5.00	5.30
13	7.20	5.30	6.20	6.90	10.10	8.00	6.10	4.90	4.00	4.20	5.10	5.30
14	6.90	5.30	6.20	6.90	9.80	7.90	6.10	4.80	4.00	4.30	5.20	5.30
15	6.70	5.30	6.20	6.90	9.50	7.50	6.10	4.80	4.00	4.30	5.20	5.30
16	6.60	5.70	6.00	7.00	9.50	7.50	6.00	4.70	4.00	4.30	5.40	5.20
17	6.40	6.60	6.00	7.00	9.50	7.30	6.00	4.70	4.00	4.30	5.40	5.10
18	6.40	6.60	6.00	7.10	9.50	7.30	6.00	4.60	4.00	4.40	5.40	5.00
19	6.20	7.00	5.90	7.30	9.30	7.30	6.00	4.60	4.10	4.40	5.60	4.90
20	6.00	7.00	5.90	7.90	9.30	7.30	6.00	4.50	4.10	4.40	5.60	4.90
21	5.90	6.90	5.90	8.10	8.90	7.00	6.00	4.50	4.10	4.40	5.50	4.90
22	5.90	6.90	5.90	8.00	8.30	7.00	5.90	4.40	4.10	4.40	5.40	5.00
23	5.70	6.90	5.80	7.90	8.00	7.30	5.90	4.40	4.10	4.30	5.30	5.00
24	5.70	6.90	5.80	7.90	8.00	7.30	5.90	4.30	4.10	4.30	5.30	5.30
25	5.40	6.60	5.80	7.80	9.00	7.80	5.90	4.30	4.10	4.30	5.40	5.60
26	5.40	6.60	5.80	7.80	9.40	7.80	5.90	4.30	4.10	4.30	5.50	5.60
27	5.20	6.30	5.70	7.60	9.80	7.80	5.80	4.20	4.10	4.30	5.50	5.80
28	5.20	6.00	5.70	7.50	10.20	7.60	5.80	4.20	4.40	4.30	5.60	5.80
29	5.00	.....	5.70	7.50	10.10	7.30	5.70	4.20	4.40	4.30	5.60	5.60
30	5.20	.....	5.70	7.40	9.80	7.30	5.70	4.20	4.50	4.30	5.80	5.60
31	5.40	.....	5.70	.....	9.50	.....	5.60	4.20	.....	4.40	.....	5.60

[a] Rating table for Yakima River at Union Gap, Wash., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.0	820	5.8	3,160	7.6	7,800	9.4	15,000
4.2	1,020	6.0	3,550	7.8	8,500	9.6	15,900
4.4	1,230	6.2	3,980	8.0	9,200	9.8	16,800
4.6	1,450	6.4	4,450	8.2	10,000	10.0	17,700
4.8	1,690	6.6	4,950	8.4	10,800	10.5	19,950
5.0	1,940	6.8	5,450	8.6	11,600	11.0	22,200
5.2	2,210	7.0	5,950	8.8	12,400	11.5	24,450
5.4	2,500	7.2	6,550	9.0	13,200	12.0	26,700
5.6	2,810	7.4	7,150	9.2	14,100		

[a] Measurements made since this table was constructed show that it is correct below a gage height of 5.00 feet; above that height the discharge given in the table is too low.

Estimated monthly discharge of Yakima River at Union Gap, Wash.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	10,000	1,940	4,804	295,386	1.46	1.68
February	5,950	1,810	3,481	193,325	1.05	1.09
March	4,210	2,980	3,621	222,647	1.10	1.27
April	9,600	2,650	6,442	383,326	1.95	2.18
May	18,600	6,850	13,105	805,795	3.97	4.58
June	13,200	5,950	7,800	464,132	2.36	2.63
July	5,950	2,810	4,057	249,455	1.23	1.42
August	2,810	1,020	1,625	99,979	.49	.56
September	1,340	820	925	55,041	.28	.31
October	1,450	1,020	1,196	73,539	.36	.42
November	3,160	1,230	2,117	125,970	.64	.71
December	4,950	1,810	2,869	176,408	.87	1.00
The year	18,600	820	4,337	3,145,003	1.31	17.85

NACHES RIVER NEAR NORTH YAKIMA, WASH.

This station was established August 14, 1893, by F. H. Newell, at a point a few hundred yards above the mouth of Naches River, near the bridge of the Northern Pacific Railroad. The vertical gage was nailed to the cribwork on the right-hand side of the river, above the railroad bridge, and could be read easily from the track. The 12-foot mark was 9.97 feet below the top of the rail on the bridge, the gage being about 60 feet easterly from the rail. The top of the iron pier, on the southeast end of the county bridge, was 5.87 feet above this 12-foot mark. Measurements were made from the county bridge. The locality was, however, not favorable for the purpose, as the water is very swift, and was broken by the piers of the bridge. Owing to the difficulty of securing accurate measurements the readings were discontinued on September 20, 1894, and not resumed until August 19, 1895. The flood of November, 1896, modified the channel very greatly, depositing a large mass of coarse gravel and small bowlders along the right side of the channel at the section, so that the rod was about 50 feet from the edge of the water at low stages. The current is swift, even at low water. On account of the instability of the channel the station was abandoned in February, 1897, although a number of discharge measurements were made during the season. The station was located below the heads of a number of ditches. May 19, 1897, a station was established on Yakima River, 5 miles above the mouth of the Naches, at the Northern Pacific Railway bridge near Selah, Wash., with the idea that the difference in discharge between this station and the one at Union Gap would give approximately the discharge of Naches River. Two ditches, those of Moxee Valley, are taken out between the two points, but their amount is about counterbalanced by that received from Atanum Creek and the wastage at Old Town.

The North Yakima station was reestablished on February 1, 1898, and the station at Selah, on Yakima River, was discontinued. Since the reestablishment of the Naches station the river channel has been in a condition more favorable for meter observations than formerly. Discharge measurements are made from the lower side of the highway bridge. A new horizontal gage rod, with wire and weight, was attached to the main span of the Northern Pacific Railway bridge at the mouth of the Naches, a few hundred feet downstream from the highway bridge. The length of the gage wire from index to foot of weight was 30.41 feet. The pulley distance was 5.844 feet. The elevation of top of pulley was 24.57 feet. The bench mark was the top of the north end of east sill of clearance posts, about 150 feet north of Northern Pacific Railway bridge. Elevation, 23.766 feet above zero of gage. On December 27, 1898, Mr. Arnold connected the highway bridge with this bench mark. The top of the northeast

concrete pier was found to be at an elevation of 22.09 feet, and the top of the bridge post at the 150-foot mark at an elevation of 26.76 feet above zero. The distance from the top of the post to the surface of the water has been carefully measured at each discharge measurement, so that the exact river height at the highway bridge is known.

On June 20, 1901, the gage rod and bench mark having been disturbed during alterations to the railroad bridge and approaches, a new 4-inch by 4-inch inclined gage rod was established on the left bank of the river, 30 feet downstream from the railroad bridge. The bench mark is U.S.G.S. B.M. established by H. S. Crowe. It is a copper plug marked "1090 T." Its elevation is 1,089.959 feet above sea level. It is located on Naches River opposite the point where it empties into Yakima River, in the center of the west end of the stone pier of the railroad bridge. The elevation of the zero of the gage is 1,070.22 feet above sea level. The initial point for measurements is the center of the east pier of the highway bridge. The lower section of the gage rod is inclined at an angle of 36° 30′ with the horizontal. The upper section is inclined at an angle of 80°.

Owing to unfavorable conditions at the highway bridge due to the accumulation of drift and a changing channel, a cable station has been established between the highway bridge and the railway bridge. A careful measurement under favorable conditions made in 1903 at the new station made by Geo. H. Bliss gave a discharge of 461 second-feet at 5.25 feet of gage height.

Discharge measurements of Naches River near North Yakima, Wash.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 14	Sydney Arnold	6.65	1,657
April 30	do	7.20	2,581
May 8	do	8.45	5,788
June 13	do	7.80	3,811
August 28	do	5.20	302
August 28	do	5.20	[a]528
November 4	do	5.45	459

[a] Measured at Nelson bridge, 4 miles above gaging station.

Daily gage height, in feet, of Naches River near North Yakima, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.50	5.80	6.50	6.20	7.20	8.10	7.30	6.20	5.20	5.40	5.50	6.20
2	6.40	5.80	6.40	6.20	7.10	7.90	7.30	6.10	5.20	5.40	5.60	6.40
3	6.40	5.80	6.30	6.30	7.10	7.60	7.20	6.05	5.20	5.40	5.70	6.20
4	6.60	5.80	6.30	6.30	7.20	7.40	7.20	6.00	5.10	5.40	5.60	6.10
5	7.05	5.80	6.30	6.30	7.30	7.40	7.10	6.00	5.10	5.30	5.60	6.10
6	7.50	5.80	6.30	6.90	7.50	7.30	7.05	5.90	5.10	5.20	5.50	6.00
7	7.50	5.80	6.30	7.50	7.90	7.30	7.00	5.90	5.10	5.20	5.50	5.95
8	8.40	5.80	6.40	7.60	8.90	7.70	6.90	5.90	5.10	5.20	5.60	5.90
9	8.20	5.75	6.45	7.30	8.70	8.10	6.80	5.80	5.10	5.20	5.80	6.00
10	7.80	5.70	6.50	7.20	8.80	8.20	6.80	5.80	5.10	5.20	6.00	6.10
11	7.60	5.70	6.50	6.90	8.85	8.20	6.80	5.80	5.10	5.20	6.00	6.10
12	7.50	5.70	6.50	6.80	8.90	8.10	6.80	5.70	5.10	5.20	6.00	6.10
13	7.40	5.70	6.50	6.75	8.80	7.90	6.80	5.70	5.10	5.20	6.00	6.10
14	7.20	5.70	6.40	6.70	8.80	7.80	6.80	5.60	5.05	5.20	6.10	6.00
15	6.90	5.80	6.40	6.80	8.70	7.75	6.80	5.60	5.00	5.20	6.10	5.90
16	6.70	6.40	6.30	6.90	8.60	7.70	6.80	5.50	5.00	5.30	6.20	5.80
17	6.60	7.00	6.20	7.40	8.50	7.70	6.80	5.50	5.00	5.40	6.30	5.80
18	6.50	7.00	6.20	7.50	8.30	7.70	6.70	5.50	5.00	5.50	6.40	5.70
19	6.45	6.90	6.20	8.20	8.10	7.60	6.70	5.50	5.00	5.50	6.30	5.70
20	6.40	6.90	6.20	8.05	7.80	7.60	6.70	5.40	5.00	5.50	6.10	5.70
21	6.40	6.80	6.20	7.90	7.80	7.60	6.70	5.40	5.00	5.50	6.00	5.70
22	6.30	6.70	6.20	7.80	7.70	7.80	6.70	5.40	5.00	5.40	5.90	5.70
23	6.20	6.70	6.15	7.70	7.90	8.00	6.70	5.30	5.00	5.40	5.90	5.80
24	6.10	6.70	6.10	7.60	8.10	8.10	6.60	5.30	5.00	5.40	5.90	5.80
25	5.80	6.70	6.10	7.50	8.25	8.10	6.60	5.30	5.00	5.40	5.80	6.00
26	5.80	6.70	6.10	7.50	8.40	7.90	6.50	5.30	5.20	5.40	5.80	6.20
27	5.80	6.60	6.10	7.45	9.00	7.80	6.40	5.20	5.30	5.40	5.80	6.60
28	5.80	6.60	6.10	7.40	9.40	7.60	6.30	5.20	5.40	5.40	5.70	6.50
29	5.80	.....	6.10	7.30	9.20	7.45	6.30	5.20	5.50	5.40	5.70	6.40
30	5.80	.....	6.10	7.20	8.70	7.30	6.20	5.20	5.50	5.40	5.95	6.40
31	5.80	.....	6.10	.....	8.30	.....	6.20	5.20	.....	5.40	.....	6.30

Rating table for Naches River at North Yakima, Wash., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.0	200	6.2	1,125	7.4	2,950	8.6	6,290
5.2	300	6.4	1,350	7.6	3,360	8.8	6,830
5.4	425	6.6	1,595	7.8	3,810	9.0	7,470
5.6	570	6.8	1,860	8.0	4,370		
5.8	735	7.0	2,152	8.2	5,010		
6.0	920	7.2	2,580	8.4	5,650		

Estimated monthly discharge of Naches River near North Yakima, Wash.

[Drainage area, 1,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	5,650	735	1,943	119,470	1.94	2.24
February	2,152	650	1,210	67,200	1.21	1.26
March	1,470	1,020	1,211	74,461	1.21	1.39
April	5,010	1,125	2,638	156,972	2.64	2.95
May	8,750	2,311	5,282	324,777	5.28	6.08
June	5,010	2,760	3,782	225,045	3.78	4.22
July	2,760	1,125	1,845	113,445	1.85	2.13
August	1,125	300	589	36,216	.59	.68
September	495	200	263	15,650	.26	.29
October	495	300	390	23,919	.39	.45
November	1,350	495	820	48,793	.82	.91
December	1,595	650	975	59,950	.98	1.13
The year	8,750	200	1,746	1,265,898	1.74	23.73

TIETON RIVER NEAR NORTH YAKIMA, WASH.

The gaging station on this stream was established April 14, 1902, at a point immediately below the mouth of Oak Creek, in sec. 3, T. 14 N., R. 16 E. of the Willamette meridian, and about 22 miles from North Yakima by road. The gage rod is inclined at an angle of 55° with the horizontal and is on the left bank of the stream. It consists of a 1 by 5 inch cedar plank supported and braced by stout logs. The equipment with which measurements are made consists of a five-eighth-inch galvanized-iron cable supporting a wooden car, tag wire, and stay wire. The initial point for soundings is a cross chiseled in a ledge with a black ring painted around it. It is under the cable, 4 feet east of the west shear legs. The observer is Omer Tetherow, a farmer. There are no side channels and the banks are not subject to overflow. The bed of the stream is rocky, with shifting gravel bars, which make it difficult to find suitable cross-sections for meter measurements. The point selected for the station is, however, a fairly good one, and the channel is straight both above and below the station for several hundred yards.

Discharge measurements of Tieton River near North Yakima, Wash.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
June 21	Sydney Arnold	8.90	1,471
June 28	do	8.55	1,106
July 16	do	8.45	906
August 25	do	7.30	392
September 16	do	6.90	306
October 27	do	6.55	228
November 29	do	6.80	289

Daily gage height, in feet, of Tieton River near North Yakima, Wash.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1		8.10	8.85	8.60	7.98	7.10	6.80	6.60	7.93
2		8.00	8.70	8.43	7.83	7.12	6.75	6.73	7.45
3		8.00	8.55	8.30	7.70	7.15	6.75	6.80	7.30
4		8.00	8.45	8.35	7.68	7.20	6.73	6.70	7.25
5		8.10	8.40	8.50	7.68	7.13	6.72	6.60	7.08
6		8.40	8.40	8.28	7.68	7.20	6.72	6.65	7.00
7		8.80	8.40	8.13	7.83	7.26	6.75	6.75	7.00
8		9.40	8.70	8.13	7.88	7.25	6.75	7.23	7.00
9		9.60	9.25	8.20	7.75	7.18	6.72	7.33	7.00
10		9.75	9.30	8.20	7.70	7.15	6.75	7.18	7.50
11		9.90	9.20	8.25	7.55	7.05	6.75	7.13	7.33
12		9.50	8.95	8.25	7.65	7.03	6.73	7.08	7.23
13		9.40	8.90	8.10	7.53	6.92	6.68	6.95	7.10
14		9.40	8.85	8.13	7.53	7.00	6.70	6.93	6.95
15		9.40	8.85	8.28	7.48	7.05	6.70	6.90	7.00
16		9.60	8.90	8.40	7.43	6.95	6.90	7.13	7.48
17		9.25	8.60	8.20	7.33	6.87	6.93	7.45	6.65
18		9.05	8.65	8.13	7.23	6.82	6.80	7.35	6.63
19		8.85	8.65	8.25	7.18	6.85	6.70	7.18	6.58
20		8.70	8.80	8.35	7.20	6.82	6.70	7.13	6.93
21		8.60	8.90	8.40	7.23	6.75	6.65	7.05	8.80
22		8.70	9.03	8.30	7.28	6.75	6.70	7.00	6.90
23		8.70	9.30	8.30	7.28	6.72	6.60	6.93	6.85
24	8.50	8.80	9.33	8.23	7.25	6.75	6.60	6.95	6.68
25	8.40	9.00	9.23	8.13	7.22	6.72	6.60	6.90	7.40
26	8.40	9.45	8.88	8.10	7.25	6.72	6.60	6.85	8.10
27	8.30	10.05	8.75	8.18	7.15	7.27	6.60	6.85	7.60
28	8.30	10.20	8.63	7.93	7.20	7.03	6.70	6.85	7.50
29	8.30	9.65	8.50	7.80	7.10	6.88	6.75	6.80	7.33
30	8.20	9.30	8.62	7.73	7.10	6.83	6.65	6.85	7.25
31		9.05		7.95	7.05		6.65		7.28

Rating table for Tieton River near North Yakima, Wash., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.0	120	7.2	372	8.4	900	9.6	2,310
6.2	160	7.4	420	8.6	1,110	9.8	2,550
6.4	200	7.6	484	8.8	1,350	10.0	2,790
6.6	240	7.8	560	9.0	1,590		
6.8	284	8.0	640	9.2	1,830		
7.0	328	8.2	750	9.4	2,070		

Estimated monthly discharge of Tieton River near North Yakima, Wash.

[Drainage area, 289 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
May	3,030	640	1,693	104,100	5.86	6.76
June	1,986	900	1,378	82,000	4.77	5.32
July	1,110	533	779	47,900	2.70	3.11
August	632	339	450	27,670	1.56	1.80
September	390	269	327	19,460	1.13	1.26
October	313	236	265	16,290	.92	1.06
November	435	240	321	19,100	1.11	1.24
December	1,350	236	409	25,150	1.42	1.64

SPOKANE RIVER AT SPOKANE, WASH.

The falls at Spokane, aggregating 142 feet in height, have been utilized to a considerable extent by a number of flour mills, as well as by the power plant of the Washington Water Power Company, which furnishes electric power for the street-car service and for the lighting of the city. The river station established by C. C. Babb, October 17, 1896, is a short distance above Spokane Falls, at the bridge of the Oregon Railway and Navigation Company. The rod of the first wire gage was fastened to the upper guard rail in the west span of the bridge. The distance from the end of the weight to the index was 22.00 feet, and from the zero of the rod to the outside edge of the pulley 1.80 feet. The gage was connected with a bench mark of the city engineering department and referred to sea level, the rod datum being 1,880 feet above sea level. The channel is straight for some distance above and below the section. The bed is gravelly and is practically unchangeable. The banks are high and are only overflowed during extraordinary floods.

During 1901 new gages and bench marks were established at this point. The bench mark is a railroad spike driven into the electric-light pole close to and on the south side of the railroad track, at the west end of the bridge, at an elevation of 1,896.86 feet. The new wire gage on the north side of the west span of the bridge is the one used for recording the gage height. The zero of this gage is at an elevation of 1,879.35 feet, coinciding exactly with the position of the zero of the old gage. The distance from the end of the weight to the marker is 22 feet, the same as for the old gage, but the distance from the zero of the rod to the outside edge of the pulley is now 1.90 feet. As a safeguard, a new vertical gage rod has also been placed on the west face of the west pier of the bridge, the datum of which corresponds with that of the wire gage.

The Oregon Railway and Navigation Company's bridge to which the gage is fastened and from which measurements of flow are taken, has been under reconstruction during 1902, so that no gagings could be made during that year. The bed of the river, however, has not changed, and the 1901 rating table is applicable for the 1902 discharges.

Daily gage height, in feet, of Spokane River at Spokane, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.20	3.15	4.70	3.70	6.00	9.60	4.55	3.80	2.15	1.75	1.70	3.00
2	3.20	3.10	4.75	3.70	6.00	9.40	4.45	3.75	2.10	1.75	1.70	3.00
3	3.20	3.00	4.80	3.70	6.00	9.20	4.45	3.65	2.05	1.75	1.70	3.05
4	3.20	3.00	4.80	3.70	6.00	9.00	4.55	3.55	2.00	1.75	1.75	3.05
5	3.20	2.95	4.80	3.75	6.05	8.75	4.85	3.45	2.00	1.75	1.75	3.05
6	3.25	2.90	4.75	3.85	6.05	8.50	6.05	3.40	2.00	1.75	1.75	3.05
7	3.30	2.80	4.75	3.95	6.05	7.90	6.45	3.30	2.00	1.75	1.75	3.05
8	3.50	2.80	4.70	4.10	6.15	7.80	6.90	3.20	2.00	1.75	1.75	3.00
9	3.90	2.80	4.70	4.45	6.40	7.60	7.05	3.10	2.00	1.75	1.90	3.00
10	4.25	2.85	4.70	4.70	6.60	7.40	7.10	3.05	1.95	1.70	2.25	3.05
11	4.45	2.80	4.70	4.90	6.95	7.20	7.05	3.00	1.90	1.70	2.50	3.15
12	4.70	2.80	4.70	5.00	7.20	7.20	6.95	2.95	1.90	1.70	2.60	3.25
13	4.70	2.80	4.70	5.00	7.40	7.00	6.80	2.90	1.90	1.70	2.70	3.35
14	4.70	2.80	4.70	5.00	7.60	7.00	6.65	2.85	1.90	1.70	2.80	3.50
15	4.70	2.75	4.75	5.00	7.75	6.80	6.50	2.75	1.90	1.70	2.85	3.55
16	4.60	2.75	4.70	5.00	8.00	6.70	6.30	2.75	1.85	1.70	2.90	3.50
17	4.55	2.80	4.65	5.00	8.25	6.50	6.15	2.70	1.85	1.70	2.90	3.45
18	4.40	2.95	4.60	5.00	8.40	6.15	5.95	2.65	1.80	1.65	3.00	3.45
19	4.30	3.30	4.55	5.10	8.50	6.05	5.75	2.60	1.80	1.60	3.10	3.35
20	4.30	3.65	4.45	5.30	8.50	6.00	5.60	2.60	1.75	1.60	3.30	3.25
21	4.20	3.85	4.40	5.55	8.55	5.80	5.45	2.50	1.75	1.60	3.30	3.20
22	4.10	3.95	4.35	5.80	8.70	5.70	5.25	2.50	1.75	1.55	3.25	3.15
23	4.05	4.10	4.25	5.90	9.05	5.55	5.10	2.50	1.75	1.55	3.25	3.15
24	3.95	4.10	4.20	6.00	9.40	5.40	5.00	2.50	1.75	1.55	3.25	3.10
25	3.80	4.20	4.15	6.05	9.70	5.30	4.90	2.45	1.75	1.50	3.15	3.05
26	3.70	4.35	4.10	6.10	9.80	5.15	4.70	2.35	1.75	1.50	3.15	3.05
27	3.60	4.50	4.05	6.05	9.80	5.00	4.50	2.35	1.75	1.50	3.05	3.05
28	3.45	4.60	4.00	6.05	9.70	4.90	4.40	2.30	1.75	1.60	3.00	3.05
29	3.35	.....	3.90	6.05	9.70	4.75	4.30	2.25	1.75	1.60	2.95	3.10
30	3.25	.....	3.85	6.00	9.70	4.65	4.20	2.20	1.75	1.60	2.95	3.15
31	3.20	.....	3.80	.....	9.70	.....	4.00	2.20	.....	1.60	.....	3.15

Rating table for Spokane River at Spokane, Wash., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	1,341	3.8	6,523	6.6	14,253	9.4	23,800
1.2	1,611	4.0	7,000	6.8	14,885	9.6	24,531
1.4	1,897	4.2	7,489	7.0	15,525	9.8	25,269
1.6	2,199	4.4	7,990	7.2	16,173	10.0	26.012
1.8	2,517	4.6	8,503	7.4	16,829	10.2	26,759
2.0	2,851	4.8	9,028	7.6	17,493	10.4	27,510
2.2	3,200	5.0	9,565	7.8	18,165	10.6	28,265
2.4	3,566	5.2	10,114	8.0	18,845	10.8	29,024
2.6	3,946	5.4	10,673	8.2	19,533	11.0	29,787
2.8	4,340	5.6	11,243	8.4	20,228	11.2	30,554
3.0	4,749	5.8	11,824	8.6	20,928	11.4	31,325
3.2	5,172	6.0	12,416	8.8	21,636	11.6	32,099
3.4	5,609	6.2	13,019	9.0	22,351	11.8	32,875
3.6	6.059	6.4	13,631	9.2	23,073	12.0	33,653

Estimated monthly discharge of Spokane River at Spokane, Wash.

[Drainage area, 4,005 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	8,764	5,172	6,759	415,595	1.69	1.95
February	8,503	4,241	5,453	302,844	1.36	1.42
March	9,028	6,523	8,215	505,121	2.05	2.36
April	12,716	6,289	9,618	572,311	2.40	2.68
May	25,269	12,416	18,558	1,141,087	4.63	5.34
June	24,531	8,634	15,110	899,107	3.77	4.21
July	15,848	7,000	11,223	690,075	2.80	3.23
August	6,523	3,200	4,464	274,481	1.11	1.28
September	3,112	2,437	2,647	157,507	.66	.74
October	2,437	2,046	2,289	140,745	.57	.66
November	5,389	2,356	4,010	238,612	1.00	1.12
December	5,946	4,749	5,115	314,509	1.28	1.48
The year	25,269	2,046	7,788	5,651,994	1.94	26.47

MISSOULA RIVER AT MISSOULA, MONT.

This station, established July 10, 1898, is located at Higgins Avenue bridge in Missoula. The river at this point flows in two channels, and in order to study their fluctuations a second rod was placed on the south channel January 28, 1899. This second rod is vertical and attached to the pier of the bridge. The readings of the two rods were made to correspond on the date of the establishment of the second rod. The original rod is known as rod No. 1, and the gage in the south channel is known as rod No. 2. Discharge measurements are always made at the bridge of the Bitterroot Valley division of the Northern Pacific Railway, some distance below the Higgins Avenue bridge. The river at this point is practically in one channel, except in times of flood, when some water finds its way through a slough 600 feet south of the bridge. On account of the difficulty of accurately measuring the fluctuations of the river at rods Nos. 1 and 2 a third rod was placed May 27, 1899, below the junction of the two branches and 150 yards east of the railroad bridge. The rod at this point consists of a horizontal 20-foot timber bolted to a cottonwood tree immediately below the buildings of the Garden City Bottling Works. The rod is securely braced with timbers both above and below and guyed by wires on both sides. To the horizontal timber is attached a wire gage, the length of which is 22 feet. The bench mark consists of a United States Geological Survey iron post, at the junction of McCormick and West Cedar streets, 100 yards east of the gage, on the north side of the highway. Its elevation above sea is 3,194.642 feet. The top of the horizontal bar of the gage, at a point exactly over the iron bolt which holds the rod to the cottonwood tree, is 3,178.338 feet. The height of the river was read at the three rods during 1899, but all subsequent readings have been made from No. 3.

During 1902 the following discharge measurements were made by H. B. Waters:

April 24: Gage height, 4.61 feet; discharge, 2,570 second-feet.
April 24: Gage height, 4.59 feet; discharge, 2,542 second-feet.
July 12: Gage height, 5.97 feet; discharge, 5,302 second-feet.
August 27: Gage height, 4.02 feet; discharge, 1,941 second-feet.

Daily gage height, in feet, of Missoula River at Missoula, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	(a)	(a)	3.88	3.70	4.73	9.72	5.87	4.67	3.90	3.90	3.87	3.70
2	.....	.....	3.83	3.68	4.80	9.47	5.92	4.57	3.90	3.80	3.88	3.70
3	.....	.....	3.75	3.73	4.83	9.15	6.15	4.42	3.85	3.80	3.80	3.60
4	.....	.....	3.73	3.90	4.85	8.90	6.47	4.45	3.82	3.82	3.80	3.65
5	.....	.....	3.78	4.40	4.80	8.50	6.50	4.40	3.77	4.05	3.82	.....
6	.....	.....	3.80	4.35	4.73	8.00	6.70	4.35	3.87	3.87	3.80	(a)
7	.....	.....	3.80	4.53	4.88	7.75	6.57	4.32	3.72	3.77	3.82	.....
8	.....	.....	3.88	4.78	5.23	7.57	6.37	4.27	3.80	3.77	3.98	.....
9	.....	(a)	3.85	4.80	5.65	7.42	6.27	4.25	3.77	3.80	4.10	.....
10	.....	.....	3.93	4.53	6.35	8.23	6.15	4.35	3.77	3.82	4.18	4.17
11	.....	.....	3.93	4.30	6.78	8.32	6.10	4.15	3.70	3.85	4.32	4.05
12	.....	.....	3.90	4.13	7.28	8.20	6.05	4.15	3.72	3.90	4.20	4.00
13	.....	.....	3.90	4.13	8.18	7.90	5.97	4.12	3.75	3.85	4.20	3.92
14	.....	.....	3.88	4.05	7.72	7.67	5.82	4.15	3.70	3.83	4.15	3.90
15	.....	(a)	3.78	4.05	8.65	7.60	5.75	4.30	3.72	3.85	4.15	3.89
16	.....	.....	3.63	4.10	9.52	7.45	5.65	4.25	3.75	3.80	4.10	.....
17	3.25	.....	3.75	4.23	9.42	7.32	5.60	4.17	3.80	3.85	4.00	.....
18	.....	.....	3.75	4.55	9.20	6.82	5.75	4.32	3.77	3.87	4.00	(a)
19	.....	.....	3.75	4.73	8.77	6.62	5.80	4.30	3.80	3.80	4.02	.....
20	.....	.....	3.73	4.83	8.60	6.47	5.65	4.27	3.82	3.80	3.95	.....
21	.....	.....	3.73	4.88	8.75	6.37	5.55	4.17	3.97	3.80	3.90	.....
22	.....	(a)	3.75	4.80	9.10	6.25	5.42	4.15	3.80	3.80	3.80	.....
23	.....	.....	3.58	4.63	9.22	6.27	5.35	4.10	3.80	3.80	3.70	.....
24	(a)	.....	3.53	4.60	9.22	6.35	5.22	4.10	3.82	3.83	3.72	(a)
25	.....	.....	3.60	4.60	9.22	6.32	5.15	4.12	3.75	3.87	3.70	.....
26	.....	4.05	3.75	4.58	9.22	6.27	5.07	4.05	3.80	3.87	3.70	.....
27	.....	4.05	3.85	4.65	9.55	6.27	4.97	4.00	3.87	3.87	3.65	.....
28	.....	4.03	3.80	4.63	9.80	6.12	4.92	4.00	3.82	3.85	3.60	5.00
29	.....	.....	3.70	4.43	10.15	6.05	4.85	3.95	3.80	3.85	3.70	5.00
30	.....	.....	3.48	4.50	10.18	5.95	4.82	3.90	3.97	3.80	3.80	5.00
31	(a)	.....	3.53	.....	9.80	.....	4.75	3.90	.....	3.83	.....	5.00

(a) Ice at gage.

Rating table for Missoula River at Missoula, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.4	1,525	5.2	3,610	7.0	7,695	8.8	12,850
3.6	1,650	5.4	4,010	7.2	8,200	9.0	13,475
3.8	1,780	5.6	4,435	7.4	8,750	9.2	14,120
4.0	1,940	5.8	4,875	7.6	9,250	9.4	14,725
4.2	2,115	6.0	5,325	7.8	9,810	9.6	15,425
4.4	2,320	6.2	5,790	8.0	10,400	9.8	16,125
4.6	2,570	6.4	6,230	8.2	11,000	10.0	16,825
4.8	2,870	6.6	6,740	8.4	11,610		
5.0	3,240	6.8	7,205	8.6	12,250		

Estimated monthly discharge of Missoula River at Missoula, Mont.

[Drainage area, 5,960 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March	1,900	1,580	1,766	108,587	0.30	0.35
April	3,050	1,715	2,383	141,798	.40	.45
May	17,350	2,787	10,236	629,387	1.72	1.98
June	15,775	5,212	8,852	526,771	1.49	1.66
July	6,975	2,787	4,725	290,529	.79	.91
August	2,637	1,865	2,136	131,338	.36	.42
September	1,865	1,715	1,778	105,798	.30	.33
October	1,980	1,750	1,808	111,170	.30	.35
November	2,215	1,650	1,875	111,570	.31	.35
December, 14 days			2,236	62,091	.38	.20

BITTERROOT RIVER NEAR GRANTSDALE, MONT.

This station was established April 25, 1902, by H. B. Waters. It is located on the highway bridge 2 miles southwest of Grantsdale and 5 miles southwest of Hamilton, Mont. The gage is the usual wire type fastened to the downstream truss of the bridge. It is graduated to feet and tenths and is read daily by T. J. Holt who lives about a quarter of a mile north of the gage. The stream at this section is straight and has a moderate velocity. The right bank has a gentle slope and is liable to overflow. The left bank is high and rocky. The bed of the stream is composed of gravel and bowlders. Bench mark No. 1 is a wire nail driven in the northeast side of a large pine stump and marked B. M. 24.40. The stump is across the road from the west end of the bridge. The elevation above the zero of the gage, 24.40 feet. Bench mark No. 2 is the northwest bolt in the northwest abutment plate of the bridge. It is marked B. M. 19.36. Its elevation above the zero of the gage is 19.36 feet.

Discharge measurements of Bitterroot River near Grantsdale, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 25	H. B. Waters	2.57	1,098
Do	do	2.55	1,055
July 11	do	3.38	2,424
August 26	do	1.50	247
Do	do	1.50	247
November 29	J. S. Baker	1.72	345

Daily gage height, in feet, of Bitterroot River near Grantsdale, Mont.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1		2.50	5.80	3.50	2.30	1.40	1.40	1.60	1.80
2		2.60	5.60	3.40	2.30	1.30	1.40		1.80
3		2.50	5.00	3.70	2.20	1.30	1.40		1.80
4		2.40	4.90	3.70	2.20	1.30	1.50		1.80
5		2.40	4.70	4.00	2.10	1.20	1.50		1.80
6		2.50	4.50	3.80	2.10	1.20	1.50		1.70
7		2.80	4.50	3.70	2.00	1.10	1.50		1.80
8		3.30	4.70	3.50	2.00	1.10	1.60		1.80
9		4.00	5.50	3.30	1.90	1.10	1.60	1.80	1.80
10		4.60	6.30	3.40	1.90	1.20	1.60	1.80	2.00
11		4.80	5.70	3.50	1.90	1.20	1.60	1.80	2.00
12		5.00	5.40	3.60	1.90	1.10	1.60	1.80	1.90
13		5.20	5.20	3.50	1.80	1.10	1.50	1.70	1.90
14		5.80	5.00	3.40	1.80	1.10	1.40	1.70	1.80
15		6.20	4.70	3.30	1.80	1.10	1.40	1.70	1.90
16		6.00	4.50	3.30	1.80	1.20	1.40	1.70	2.00
17		5.40	4.30	3.20	1.80	1.20	1.40	1.70	1.80
18		4.90	4.40	3.20	1.80	1.30	1.50	1.70	1.80
19		4.50	4.00	3.10	1.80	1.20	1.50	1.70	1.80
20		4.10	4.00	3.00	1.80	1.30	1.50	1.70	2.00
21		3.90	4.00	3.00	1.70	1.30	1.50	1.70	2.00
22		3.80	4.10	3.00	1.70	1.30	1.60	1.70	2.00
23		3.80	4.50	2.90	1.70	1.30	1.60	2.00	2.00
24		4.00	4.60	2.90	1.60	1.40	1.50	2.10	2.00
25	2.50	4.20	4.30	2.80	1.60	1.40	1.50	1.60	2.10
26	2.60	4.50	4.10	2.80	1.60	1.40	1.50	1.60	2.60
27	2.60	5.50	4.00	2.70	1.50	1.40	1.50	1.60	1.90
28	2.60	6.20	3.90	2.60	1.50	1.40	1.50	1.60	1.90
29	2.50	6.80	3.80	2.50	1.50	1.40	1.50	1.70	1.90
30	2.50	6.20	3.70	2.50	1.40	1.30	1.50	1.70	1.80
31		6.00		2.40	1.40		1.60		1.80

Rating table for Bitterroot River near Grantsdale, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	125	2.4	900	3.8	3,255	5.2	6,380
1.2	150	2.6	1,150	4.0	3,700	5.4	6,855
1.4	205	2.8	1,430	4.2	4,140	5.6	7,325
1.6	280	3.0	1,745	4.4	4,575	5.8	7,790
1.8	395	3.2	2,085	4.6	5,005	6.0	8,340
2.0	530	3.4	2,450	4.8	5,440	6.2	8,970
2.2	700	3.6	2,850	5.0	5,900		

Estimated monthly discharge of Bitterroot River near Grantsdale, Mont.

[Drainage area, 1,550 square miles]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 25–30	----------	----------	1,085	12,912	0.70	0.16
May	11,075	900	4,823	296,555	3.11	3.59
June	9,285	3,050	5,176	307,993	3.34	3.73
July	3,700	900	2,143	131,768	1.38	1.59
August	790	205	428	26,316	.28	.32
September	205	135	167	9,937	.11	.12
October	280	205	242	14,879	.16	.18
November	615	280	353	21,005	.23	.26
December	1,150	340	472	29,022	.30	.35

PALOUSE RIVER NEAR HOOPER, WASH.

For some distance above Hooper, Palouse River consists of a succession of deep pools, from 10 to 15 feet in depth, connected by short riffles. Its valley is about one-half mile in width and bordered with basaltic cliffs approximately 300 feet in height.

The measurements of Palouse River are of value in showing the amount of water that could be utilized for irrigation on the lands of Washtucna Valley, and in the section north of Pasco. The gaging station was established April 1, 1897, by the land department of the Northern Pacific Railroad. September 9, 1897, the Geological Survey took charge of the station, placing the gage rod 1 mile below the former location and opposite the water tank, and stretching a cable across the river for discharge measurements. The rod is inclined, and fastened

to posts driven into the right bank. The bench mark is a point of rock, marked with red paint, on a ledge on the left bank of the river opposite the gage, and its elevation is 7.60 feet above datum. When the new gage reads 2.1 feet the height on the Northern Pacific Railroad gage is 6.1 feet. The channel is gravelly and not liable to change. The left bank is high and can not overflow. The right bank overflows at extreme high water. The initial point for sounding is the cable post on the left bank. The station is about 3 miles above the mouth of Cow Creek, and 2 miles below the head of the ditch of the Palouse Irrigation Company, carrying 25 second-feet when full. No measurements were made during 1901, the rating table for 1900 being used for that year. The 1902 table gives larger discharges, and it is probable that the discharges as published for 1901 are too small.

The following discharge measurements were made during 1902:

July 10: Gage height, 3.80 feet; discharge, 532 second-feet.
November 6: Gage height, 0.85 foot; discharge, 71 second-feet.

Daily gage height, in feet, of Palouse River near Hooper, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.30	1.60	5.80	3.00	2.70	3.20	1.35	1.20	0.60	0.70	0.75	1.60
2	2.25	1.50	5.50	2.90	2.70	3.00	1.35	1.20	.60	.70	.80	1.65
3	2.15	1.50	5.30	2.90	2.65	3.00	1.30	1.20	.60	.75	.85	3.30
4	2.20	1.50	5.05	3.00	2.65	3.00	1.40	1.20	.60	.80	.85	3.00
5	2.25	1.60	4.60	3.20	2.65	2.70	1.60	1.20	.60	.80	.85	2.90
6	2.20	1.80	4.30	3.40	3.40	2.60	1.80	1.20	.60	.80	.85	3.90
7	2.50	2.10	4.20	3.40	3.40	2.40	4.90	1.20	.60	.80	1.00	3.30
8	2.90	2.50	4.20	3.70	3.30	2.40	4.30	1.20	.60	.75	1.00	3.05
9	3.50	2.50	4.00	3.80	3.25	2.40	3.30	1.20	.55	.75	1.15	2.80
10	3.70	3.80	4.30	4.10	3.10	2.40	2.70	1.15	.55	.70	1.30	5.20
11	4.00	4.50	4.30	4.20	3.00	2.30	2.50	1.10	.55	.70	2.30	5.50
12	3.60	4.40	4.50	3.80	3.00	2.10	2.40	1.10	.55	.70	2.60	5.10
13	3.30	4.75	4.30	3.60	2.90	2.00	2.20	1.05	.55	.70	2.20	4.90
14	3.10	4.60	4.50	3.40	2.80	1.90	2.00	1.05	.55	.75	2.00	3.50
15	3.00	4.40	4.40	3.30	2.75	1.90	1.90	1.00	.50	.75	1.80	3.30
16	2.90	4.70	4.20	3.20	2.60	1.80	1.85	.95	.50	.75	1.70	3.00
17	2.80	5.60	4.20	3.00	2.50	1.80	1.85	.95	.50	.75	1.60	2.60
18	2.60	7.00	4.10	3.00	2.50	1.80	1.80	.90	.50	.75	1.60	2.10
19	2.40	7.70	4.00	3.00	2.40	1.60	1.80	.85	.55	.75	2.10	2.10
20	2.20	7.50	3.80	3.20	2.60	1.60	1.70	.85	.55	.75	2.70	2.20
21	2.15	7.00	3.70	3.30	2.80	1.60	1.65	.80	.55	.75	2.65	2.20
22	2.10	6.30	3.60	3.60	3.70	1.50	1.50	.75	.55	.75	2.45	2.20
23	2.10	5.60	3.60	3.60	5.90	1.50	1.50	.70	.55	.75	2.20	2.20
24	2.05	5.30	3.60	3.40	6.40	1.50	1.45	.70	.55	.75	2.10	2.20
25	2.00	5.10	3.50	3.30	6.30	1.40	1.45	.70	.60	.75	1.80	2.20
26	1.90	5.00	3.50	3.10	5.40	1.40	1.40	.70	.60	.75	1.80	2.70
27	1.80	5.80	3.40	3.00	4.60	1.40	1.40	.70	.60	.80	1.70	4.60
28	1.75	6.00	3.30	2.90	4.00	1.40	1.40	.70	.60	.85	1.70	4.40
29	1.70	.....	3.10	2.80	3.70	1.40	1.40	.65	.65	.80	1.70	4.10
30	1.60	.....	3.10	2.80	3.40	1.40	1.30	.65	.70	.75	1.60	3.90
31	1.60	.....	3.00	.....	3.30	.....	1.25	.65	.....	.75	.....	3.70

Rating table for Palouse River near Hooper, Wash., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	63	2.2	150	3.8	535	6.0	1,835
.8	69	2.4	175	4.0	625	6.5	2,150
1.0	75	2.6	205	4.2	725	7.0	2,465
1.2	85	2.8	240	4.4	835	7.5	2,780
1.4	95	3.0	280	4.6	953	8.0	3,095
1.6	106	3.2	325	4.8	1,079		
1.8	118	3.4	380	5.0	1,205		
2.0	130	3.6	455	5.5	1,520		

Estimated monthly discharge of Palouse River near Hooper, Wash.

[Drainage area, 2,210 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	625	106	216	13,281	0.10	0.12
February	2,906	100	1,088	60,424	.49	.51
March	1,709	280	716	44,025	.32	.37
April	725	240	370	22,076	.17	.19
May	2,087	175	515	31,666	.23	.27
June	325	95	150	8,926	.07	.08
July	1,142	87	178	10,945	.08	.09
August	85	64	75	4,612	.03	.03
September	66	60	62	3,689	.03	.03
October	70	66	67	4,181	.03	.03
November	220	67	118	7,081	.05	.06
December	1,520	106	452	27,792	.20	.23
The year	2,906	60	334	238,698	.15	2.01

WEISER RIVER NEAR WEISER, IDAHO.

The drainage basin of this river is mountainous and rocky, in contrast to the well-wooded areas of the Boise and Payette basins, and the effect is shown in the high flood discharges and low summer flow. A number of small ditches utilize considerable water from this river, but the principal canal is the Galloway canal, which irrigates lands north of Weiser. Above this canal is a bench country susceptible of cultivation if water could be brought to it. The gaging station, established December 6, 1894, is located in the canyon of the river, about 10

miles from Weiser. The gage rod which was set in 1898 was covered during the process of grading for the roadbed of the new Pacific and Idaho Northern Railroad, a line intended to run from Weiser to the mining country in the mountainous district to the north. The new gage, located on October 31, 1899, 100 feet above the old one, is inclined and bolted to a rock bluff; 1.15 feet along the gage equals one foot in elevation. The bench mark consists of a cross cut in the top of the lava rim rock above the gage, and is at an elevation of 12.90 feet. The elevation of the zero of the gage taken from the levels of the railroad is 2,191.34 feet above sea level. Discharge measurements are made from a cable and car about 300 feet below the gage. Both banks are high and not liable to overflow. The bed of the river is of gravel and not likely to change.

The following discharge measurements were made during 1902:

June 26: Gage height, 2.20 feet; discharge, 871 second-feet.
July 19: Gage height, 1.20 feet; discharge, 310 second-feet
August 4: Gage height, 0.40 foot; discharge, 53 second-feet.
September 18: Gage height, 0.30 foot; discharge, 56 second-feet.

Daily gage height, in feet, of Weiser River near Weiser, Idaho.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.20	1.20	4.80	1.95	3.15	3.90	1.80	0.50	0.25	0.50	0.80	1.20
2	1.20	1.15	4.30	2.00	3.10	3.80	1.70	.45	.25	.50	.80	1.20
3	1.20	1.10	4.00	2.20	3.00	3.50	1.60	.40	.25	.50	.80	1.20
4	1.35	1.10	3.80	2.40	2.85	3.30	1.50	.40	.25	.50	.80	1.20
5	1.35	1.30	3.55	2.50	2.75	3.20	1.70	.40	.25	.50	.85	1.20
6	1.45	1.60	3.40	2.70	2.80	3.20	1.90	.35	.25	.55	.85	1.25
7	1.65	2.00	3.20	2.90	2.95	3.20	2.10	.35	.20	.55	.90	2.20
8	1.80	2.60	3.10	3.60	3.60	3.30	2.10	.35	.20	.55	1.00	2.50
9	1.75	5.60	3.10	3.90	3.65	3.40	2.00	.30	.20	.55	1.10	2.60
10	1.70	7.40	3.00	3.20	4.45	3.70	1.90	.30	.25	.55	1.10	2.80
11	1.65	7.40	2.90	3.00	4.10	3.60	1.80	.25	.30	.60	1.10	3.30
12	1.60	4.50	2.80	3.00	4.15	3.50	1.70	.20	.25	.60	1.10	3.40
13	1.55	3.80	2.60	2.90	4.20	3.40	1.65	.20	.25	.60	1.10	3.00
14	1.50	3.30	2.55	3.00	4.35	3.30	1.60	.20	.25	.60	1.15	2.80
15	1.45	4.30	2.50	3.20	4.30	3.00	1.50	.25	.25	.60	1.15	2.70
16	1.40	4.30	2.50	3.30	4.25	2.90	1.40	.40	.30	.60	1.15	2.50
17	1.40	4.35	2.45	3.45	4.00	2.80	1.30	.45	.30	.60	1.20	2.00
18	1.35	4.40	2.40	3.50	3.90	2.60	1.30	.65	.30	.60	1.20	1.90
19	1.30	3.90	2.30	3.85	3.50	2.50	1.20	.60	.30	.60	1.20	1.80
20	1.30	3.85	2.20	4.20	3.20	2.50	1.15	.55	.35	.60	1.20	1.70
21	1.25	3.55	2.20	4.00	3.10	2.40	1.10	.50	.35	.65	1.20	1.60
22	1.20	3.30	2.25	3.80	3.20	2.40	1.00	.50	.35	.65	1.20	1.60
23	1.20	3.25	2.30	3.80	3.20	2.30	.90	.50	.40	.65	1.20	1.50
24	1.20	5.40	2.30	3.70	3.10	2.20	.85	.45	.40	.70	1.20	1.60
25	1.35	7.30	2.25	3.60	3.20	2.10	.80	.40	.40	.70	1.20	2.00
26	1.35	7.20	2.25	3.50	3.30	2.10	.80	.40	.45	.70	1.20	2.20
27	1.45	6.00	2.20	3.40	3.60	2.05	.75	.35	.50	.75	1.20	3.00
28	1.65	5.90	2.20	3.00	4.10	2.00	.70	.30	.50	.75	1.20	2.80
29	1.50	.....	2.10	3.00	4.20	1.90	.65	.30	.50	.75	1.20	2.70
30	1.40	.....	2.00	3.10	4.10	1.85	.60	.25	.50	.80	1.20	2.50
31	1.30	.....	2.10	.....	4.00	.....	.55	.25	.....	.80	.....	2.40

Rating table for Weiser River near Weiser, Idaho, for 1902.

Gage height	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	39	2.0	720	3.8	2,585	5.6	5,015
.4	71	2.2	875	4.0	2,855	5.8	5,285
.6	105	2.4	1,050	4.2	3,125	6.0	5,555
.8	150	2.6	1,235	4.4	3,395	6.2	5,825
1.0	215	2.8	1,425	4.6	3,665	6.4	6,095
1.2	290	3.0	1,625	4.8	3,935	6.6	6,365
1.4	375	3.2	1,840	5.0	4,205	6.8	6,635
1.6	470	3.4	2,075	5.2	4,475	7.0	6,900
1.8	585	3.6	2,325	5.4	4,745	7.2	7,170

Estimated monthly discharge of Weiser River near Weiser, Idaho.

[Drainage area, 1,670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	585	290	388	23,857	0.23	0.27
February	7,340	250	3,086	171,388	1.85	1.93
March	3,935	720	1,456	89,526	.87	1.00
April	3,125	685	1,886	112,225	1.13	1.26
May	3,463	1,378	2,354	144,742	1.41	1.63
June	2,720	618	1,546	91,993	.93	1.04
July	795	96	384	23,611	.23	.27
August	115	39	68	4,181	.04	.05
September	87	39	58	3,451	.03	.03
October	150	87	110	6,764	.07	.08
November	290	150	248	14,757	.15	.17
December	2,075	290	918	56,446	.55	.63
The year	7,340	39	1,042	742,941	.62	8.36

BOISE RIVER NEAR BOISE, IDAHO.

The station, established December 15, 1894, is located about 9 miles above Boise, Idaho, at the mouth of the canyon. The original gage was in two sections: The lower part is of 2 by 6 inch plank, inclined, and marked from 1 foot to 7.5 feet; the upper part is a 4 by 4 inch timber, placed vertically, and marked from 7.5 to 12 feet, both portions painted white. The bench mark for it was a bridge spike driven into a cottonwood tree 20 feet from gage and 20 feet from river. It is

3.4 feet above the 8-foot mark on the gage. Measurements are made from a cable just below the gage.

In the latter part of July, 1895, it was decided to locate a secondary gage on Boise River to obtain the slope of the water surface. This was placed 425 feet below the old gage and carefully connected by means of a wye level. Both were referred to the same datum. At that time the lower end of the old gage was found to be warped and was corrected. A gage was also placed on the lower Boise in order to determine the water going by at the lowest stage during the irrigating season. The meter can generally be used by wading, but in high water measurements can be made from a wagon bridge.

April 18, 1897, the river cut into the right bank of the station, carrying out the cable and leaving the gage on a small island, so that the record after that date is unreliable. A temporary gage was therefore established May 12 at the Broadway Bridge, at Boise, and a record kept by it until June 17, when a new gage, which is now used, was again placed in the canyon 1 mile above the old location. The inclined rod is firmly attached to a cottonwood tree. The bench mark is a 20-penny spike in the upstream face of the 6 by 8 cable support, about 2 feet above the ground. Its elevation is 15 feet above datum. Two spikes in same post are 14 feet above datum. Discharge measurements are made from a cable and car 50 feet below the gage. An auxiliary cable for flood measurements is placed 117 feet above the main cable. At ordinary stages the channel is straight, both above and below the station. The banks are high and not liable to overflow. About 300 feet below the cable is a gravel bar, reducing the width of the river at low water to about one-third of the channel and forcing the entire flow against the south bank. The channel is liable to change during extreme high floods. During 1900 the New York Canal Company built a wing dam of timber and loose rock, headed about 150 feet below the station and extending from the north bank diagonally down and across the stream a distance of about 50 feet, in order to protect the north bank from erosion. The construction of this wing dam did not seem to interfere with the flow of the river at the station. During the year new cable supports were set and bench marks were carefully verified.

Discharge measurements of Boise River near Boise, Idaho.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
July 11	N. S. Dils	1.80	1,808
July 25	do	1.10	1,346
August 7	do	.70	899
August 13	do	.60	845
September 15	do	.33	610

Daily gage height, in feet, of Boise River near Boise, Idaho.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.00	1.20	1.70	1.35	3.20	4.70	2.25	0.90	0.45	0.45	0.50	0.80
2	1.20	1.30	1.60	1.85	3.10	4.30	2.35	.80	.45	.45	.50	.80
3	1.10	1.30	1.50	1.93	2.90	4.00	2.30	.70	.40	.42	.50	.90
4	1.03	1.40	1.45	2.40	2.90	3.90	2.55	.70	.40	.42	.50	.95
5	.95	1.30	1.40	2.40	2.90	3.85	2.20	.60	.35	.40	.55	.80
6	1.00	1.30	1.40	2.40	3.10	3.80	2.10	.70	.35	.40	.60	.80
7	1.00	1.25	1.40	3.00	3.30	3.85	2.00	.70	.33	.40	.70	.80
8	1.03	1.80	1.40	3.40	4.30	4.15	1.90	.60	.30	.40	.82	.80
9	1.00	2.00	1.40	2.80	4.60	4.55	1.90	.12	.30	.40	.85	.90
10	.90	2.00	1.38	2.50	4.40	4.90	1.95	.20	.35	.40	.85	1.20
11	.70	1.90	1.38	2.50	4.40	4.80	1.95	.30	.40	.40	.90	1.22
12	.65	1.80	1.35	2.55	4.60	4.60	2.00	.60	.35	.40	.80	1.10
13	.60	1.55	1.35	2.55	5.00	4.45	2.05	.65	.30	.40	.85	.85
14	.70	1.30	1.30	2.50	5.00	4.20	1.95	.67	.35	.40	.80	.60
15	.70	1.25	1.30	2.60	4.70	3.90	1.90	.68	.40	.40	.70	.40
16	.85	1.20	1.30	3.20	4.70	3.50	1.85	.65	.35	.40	.60	.40
17	.95	1.30	1.30	3.40	4.60	3.40	1.80	.60	.30	.40	.70	.40
18	1.00	1.40	1.30	4.00	4.20	3.30	1.70	.60	.35	.40	.80	.48
19	.95	1.35	1.30	4.20	4.00	3.30	1.70	.60	.40	.40	.80	.90
20	.90	1.30	1.30	4.40	3.85	3.20	1.60	.55	.40	.40	.70	.95
21	.85	1.20	1.40	4.00	3.70	3.10	1.50	.55	.40	.40	.65	.98
22	.80	1.20	1.40	3.80	3.65	3.10	1.30	.52	.40	.45	.60	1.00
23	.70	1.20	1.40	3.60	3.60	3.10	1.10	.50	.40	.50	.65	1.10
24	.60	2.70	1.40	3.40	3.55	3.20	1.10	.50	.40	.60	.70	1.10
25	.60	2.40	1.40	3.25	3.65	3.10	1.10	.50	.40	.70	.75	1.20
26	.60	2.20	1.40	3.30	4.00	2.90	1.00	.45	.40	.70	.80	1.15
27	.60	2.10	1.45	3.30	4.40	2.80	1.00	.45	.40	.65	.90	1.20
28	.50	1.80	1.40	3.20	4.90	2.60	1.00	.45	.40	.60	.70	1.00
29	.40	.....	1.40	3.10	5.20	2.55	1.00	.40	.40	.55	.70	.90
30	.60	.....	1.40	3.20	5.10	2.45	1.00	.40	.45	.50	.75	.40
31	1.00	.....	1.40	.....	5.00	.....	.90	.42	.....	.50	.....	.85

Rating table for Boise River at Boise, Idaho, for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	575	1.6	1,610	3.0	3,365	4.4	6,396
.4	695	1.8	1,800	3.2	3,740	4.6	6,844
.6	830	2.0	2,000	3.4	4,156	4.8	7,292
.8	970	2.2	2,220	3.6	4,604	5.0	7,740
1.0	1,115	2.4	2,460	3.8	5,052	5.2	8,188
1.2	1,270	2.6	2,730	4.0	5,500		
1.4	1,435	2.8	3,030	4.2	5,948		

Estimated monthly discharge of Boise River near Boise, Idaho.

[Drainage area, 2,450 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	1,270	695	989	60,811	0.40	0.46
February	2,880	1,270	1,615	89,692	.66	.69
March	1,705	1,350	1,433	88,112	.58	.67
April	6,396	1,392	3,559	211,775	1.45	1.62
May	8,188	3,190	5,701	350,541	2.33	2.69
June	7,516	2,528	4,786	284,787	1.95	2.18
July	2,662	1,040	1,721	105,820	.70	.81
August	1,040	530	798	49,067	.33	.38
September	728	635	682	40,582	.28	.31
October	900	695	735	45,193	.30	.35
November	1,040	760	907	53,970	.37	.41
December	1,270	695	1,024	62,963	.42	.48
The year	8,188	530	1,996	1,443,313	.81	11.05

SEEPAGE MEASUREMENTS IN BOISE VALLEY.

A series of measurements of the discharge of canals taking water from Boise River between Boise and Caldwell, Idaho, was made during August 11 to 15, 1902, by N. S. Dils, to determine the amount of seepage water returning to the river. These measurements were similar to those made in 1898, 1899, 1900, 1901, and which are published in the reports for those years.

Miscellaneous discharge measurements of Boise River and other streams in Boise Valley.

Date.	Stream.	Locality of heading or place of measurement.	Discharge.
1902.			*Sec.-feet.*
Aug. 11	Sebree canal	North side in Caldwell Canyon	0.0
11	Seibenberg Slough	do	.5
11	Boise River	Caldwell bridge	.7
11	Riverside canal	South side in Caldwell Canyon	23.5
11	Wastein Tenmile Creek	South side below Star	1.0
11	Strahorn canal	do	18.0
11	Boise River	Star bridge	21.6
12	Eureka canal	South side below Soldiers' Home	8.5
12	Phyllis canal	do	15.8
12	Settlers canal	South side above Soldiers' Home	114.3
12	Davis canal	do	30.8
12	McCarty canal	do	103.0
13	Jacobs canal	North side above Soldiers' Home	61.2
13	Ellis canal	do	12.1
13	Goodwin Mill or Penault canal	do	91.5
13	Boise River	At regular gaging station, near Boise	845.0
13	New York canal	South side at gaging station	79.5
13	Costin canal	South side above Soldiers' Home	3.0
13	Lamburger & Ryan	do	.8
13	Ridenbaugh canal	do	433.7
13	Paynne canal	do	11.1
13	Rossi Logging canal	do	118.0
13	Small ditch	do	1.1
13	Rossi waste	do	101.0
13	Electric Light Works waste	do	25.0
14	Waste Car Line Power House	North side above Soldiers' Home	39.7
14	Farmers' Union and Boise Valley canals.	North side at Soldiers' Home	93.3
14	Waste ditch	North side above Star	3.6
14	Waste in sand draw	do	1.0
14	Union canal	do	15.0
14	Dry Creek canal	do	14.8
14	Conway & Akin, 2 ditches	Eagle Island	12.0
14	Catlin & Macey, 2 ditches	do	6.5
14	Davis & Hart	do	14.0
14	Midleton Mill Slough	North side above Star	5.4
14	Midleton Canal Company canal	do	8.5
14	Pioneer canal	do	9.3
15	Midleton Water Company canal	North side below Star	10.4
15	Waste east of Midleton	do	3.0
15	Waste from Willow Creek	do	.1
15	Sebree River	At Caldwell Canyon, north side	16.0
15	Seibenberg Slough	do	.4
15	Boise River	Caldwell bridge	1.5
15	Riverside canal	At Caldwell Canyon, south side	1.0

Summary of seepage measurements made on Boise River, August 11–15, 1902.

	Visible supply.	Diverted.
	Sec.-feet.	*Sec.-feet.*
Boise River and New York canal at gaging station	924.5	
Diverted by canals, south side, between gaging station and Soldiers' Home		895.3
Diverted by canals, north side, between gaging station and Soldiers' Home		258.1
Return waste, south side, between gaging station and Soldiers' Home	126.0	
Return waste, north side, between gaging station and Soldiers' Home	39.7	
Total from gaging station to Soldiers' Home	1,090.2	1,153.4
Diverted by canals, south side, between Soldiers' Home and Star		24.3 85.5
Return waste, north side, between Soldiers' Home and Star	4.6	
Boise River at Star		21.6
Total from gaging station to Star	1,094.8	1,284.8
Gain from gaging station to Star	190.0	
Boise River at Star	21.6	
Diverted by canals, south side, between Star and Caldwell Canyon		18.0
Diverted by canals, north side, between Star and Caldwell Canyon		10.4
Return waste, south side, between Star and Caldwell Canyon	1.0	
Return waste, north side, between Star and Caldwell Canyon	3.1	
Diverted by canals, south side, at Caldwell Canyon		1.0
Diverted by canals, north side, at Caldwell Canyon		16.4
Boise River at Caldwell		1.5
Total from Star to Caldwell	25.7	47.3
Gain from Star to Caldwell	21.6	
Total diverted on south side of river to Caldwell		938.6
Total diverted on north side of river to Caldwell		370.4
Total waste on south side of river to Caldwell	127.0	
Total waste on north side of river to Caldwell	47.4	
Boise River and New York canal at gaging station	924.5	
Boise River at Caldwell		1.5
Total from gaging station to Caldwell	1,098.9	1,310.5
Gain from gaging station to Caldwell	211.6	

BRUNEAU RIVER NEAR GRANDVIEW, IDAHO.

Systematic measurements on this river have been maintained immediately below the headworks of the canal system of the Owyhee Land and Irrigation Company, 10 miles east of Grandview, Idaho. There are two gages, one on the north and one on the south side of the river, each at the same elevation. The channel is straight, both above and below the station, the banks high and rocky, and the bed changing little, if any, the section being a good one with the exception that the velocity is very slight at low water.

Daily gage height, in feet, of Bruneau River near Grandview, Idaho.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.65	1.45	1.75	1.75	2.50	3.90	2.20	1.50	1.25	1.55	1.70	1.75
2	1.65	1.45	1.75	1.75	2.50	3.90	2.20	1.50	1.25	1.50	1.75	1.80
3	1.65	1.45	1.75	1.75	2.50	3.75	2.20	1.45	1.25	1.50	1.75	1.80
4	1.65	1.45	1.75	1.80	2.45	3.70	2.20	1.45	1.30	1.50	1.75	1.85
5	1.70	1.50	1.75	1.85	2.40	3.55	2.15	1.45	1.30	1.50	1.75	1.85
6	1.70	1.55	1.70	1.90	2.35	3.45	2.15	1.45	1.30	1.50	1.75	1.85
7	1.70	1.60	1.70	2.00	2.35	3.25	2.10	1.45	1.30	1.50	1.75	1.90
8	1.70	1.65	1.75	2.15	2.35	3.40	2.50	1.40	1.34	1.50	1.75	1.90
9	1.70	1.70	1.70	2.70	2.70	3.45	2.00	1.40	1.30	1.50	1.80	1.90
10	1.65	1.70	1.70	2.75	2.80	3.50	1.95	1.35	1.30	1.55	1.80	1.90
11	1.65	1.70	1.70	2.60	3.55	3.60	1.40	1.35	1.30	1.55	1.80	1.90
12	1.60	1.70	1.70	2.30	3.35	3.75	1.25	1.35	1.30	1.50	1.80	1.95
13	1.60	1.65	1.70	2.35	3.30	3.65	1.80	1.35	1.30	1.50	1.80	1.95
14	1.60	1.65	1.70	2.40	3.35	3.50	1.80	1.35	1.30	1.50	1.80	1.85
15	1.55	1.70	1.75	2.40	3.45	3.40	1.80	1.30	1.30	1.55	1.80	1.85
16	1.55	1.70	1.75	2.35	3.40	3.25	1.80	1.30	1.30	1.55	1.80	1.75
17	1.55	1.70	1.75	2.40	3.35	3.15	1.80	1.30	1.35	1.55	1.80	1.75
18	1.60	1.70	1.75	2.65	3.25	3.00	1.80	1.30	1.40	1.55	1.85	1.75
19	1.60	1.70	1.75	2.75	3.20	2.90	1.75	1.30	1.40	1.55	1.85	1.75
20	1.60	1.70	1.70	3.00	3.10	2.90	1.70	1.25	1.45	1.55	1.85	1.75
21	1.60	1.70	1.70	3.20	3.00	2.70	1.70	1.25	1.55	1.60	1.85	1.75
22	1.60	1.70	1.70	3.10	3.00	2.60	1.70	1.25	1.50	1.60	1.80	1.75
23	1.60	1.75	1.75	2.90	2.95	2.55	1.70	1.25	1.55	1.65	1.80	1.75
24	1.60	1.75	1.75	2.75	2.90	2.55	1.65	1.25	1.55	1.65	1.80	1.75
25	1.60	1.80	1.75	2.60	2.90	2.50	1.60	1.25	1.55	1.65	1.75	1.75
26	1.53	1.80	1.75	2.55	2.90	2.45	1.55	1.25	1.55	1.70	1.75	1.90
27	1.50	1.80	1.75	2.50	3.00	2.45	1.50	1.25	1.60	1.70	1.75	1.90
28	1.45	1.80	1.75	2.55	3.15	2.40	1.50	1.25	1.55	1.70	1.75	1.85
29	1.45	.....	1.75	2.50	3.35	2.40	1.50	1.25	1.55	1.70	1.75	1.85
30	1.45	.....	1.75	2.50	3.55	2.35	1.50	1.25	1.55	1.70	1.75	1.75
31	1.45	.....	1.75	.....	3.70	.....	1.50	1.25	.....	1.70	.....	1.70

SNAKE RIVER AT MONTGOMERY FERRY, IDAHO.

Ten miles above the gaging station at Montgomery Ferry occurs a natural dam site, from which, as a starting point, surveys for canal lines have been run, covering the large extent of level country susceptible of irrigation on both sides of the river. Measurements at Montgomery Ferry show the amount of water available for irrigation purposes there, and also the amount that could be developed for power purposes at Shoshone Falls, about 45 miles below. The station, established August 5, 1895, is located at Montgomery Ferry, on the stage road from Minidoka to Albion. The gage is inclined and fastened to posts set in the ground. The bench mark is the head of a spike in the east post of the tool house, 1.2 feet above the ground and 52 feet west of the gage. Its elevation is 17.50 feet above gage datum. The letters "B. M." are marked in black paint on the post. The river is 800 feet wide at this section, with a hard gravel bottom not subject to change. When the station was visited by N. S. Dils on

October 14, 1899, a comparison was made of the gage rod with the bench mark, and it was found that the rod had moved to a considerable extent, due to the action of the quicksand on the inclined portion of the rod. The heights as recorded by the observer, as well as the discharge measurements, were corrected. The rod is inclined from zero to 6.5 feet, and is vertical above this latter elevation. The lower portion is fastened at various intervals to posts driven into the ground. Gage readings were not taken during 1900.

The station was reestablished May 1, 1901, and the gage read morning and evening for the remainder of the year. Part of the inclined gage rod which had been moved by quicksand was corrected August 9, 1901, and all previous gage readings were carefully adjusted to correspond with the present position of the rod.

The following discharge measurements were made during 1902:

September 8: Gage height, 1.00 foot; discharge, 2,333 second-feet.
October 27: Gage height, 2.20 feet; discharge, 4,229 second-feet.

Daily gage height, in feet, of Snake River at Montgomery Ferry, near Minidoka, Idaho.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.80	2.40	2.80	2.10	3.45	7.05	4.90	1.90	0.90	1.80	2.40	2.90
2	4.20	2.30	2.80	2.10	3.50	7.50	4.75	1.75	.90	1.90	2.40	3.00
3	3.80	2.30	2.70	2.10	3.60	7.80	4.70	1.60	.90	1.90	2.40	3.10
4	3.40	2.30	2.70	2.10	3.60	8.00	4.60	1.45	.90	1.90	2.40	3.20
5	3.20	2.40	2.70	2.10	3.60	7.60	4.60	1.30	1.00	1.90	2.40	2.95
6	2.90	2.55	2.60	2.10	3.60	7.15	4.60	1.20	1.00	1.90	2.40	2.65
7	2.40	2.85	2.50	2.20	3.60	6.75	4.70	1.10	.90	1.90	2.50	2.50
8	2.40	2.90	2.50	2.30	3.50	6.60	4.70	1.05	1.00	1.90	2.60	2.50
9	2.40	3.60	2.50	2.40	3.60	6.60	4.55	1.00	1.00	2.00	2.60	2.60
10	2.40	3.65	2.50	2.50	3.70	6.50	4.35	.90	1.00	2.00	2.60	2.75
11	2.40	3.90	2.40	2.60	4.00	6.65	4.10	.90	1.00	2.00	2.70	2.90
12	2.40	3.10	2.40	2.60	4.60	7.15	3.95	.90	1.00	2.00	2.80	3.00
13	2.40	2.70	2.40	2.60	5.10	7.60	3.75	.90	1.00	2.00	2.80	2.80
14	2.40	2.70	2.40	2.50	5.50	7.90	3.55	.90	1.10	2.00	2.80	2.55
15	2.30	2.70	2.40	2.40	5.85	7.95	3.35	.85	1.10	2.10	2.90	2.90
16	2.20	2.70	2.30	2.40	6.00	7.90	3.30	.80	1.10	2.10	2.90	3.15
17	2.20	2.70	2.30	2.30	6.45	8.00	3.20	.85	1.20	2.10	2.90	3.70
18	2.20	2.70	2.30	2.30	6.50	7.65	3.15	.90	1.20	2.20	2.90	5.15
19	2.20	2.70	2.30	2.20	6.90	7.25	3.15	.90	1.20	2.20	2.90	3.90
20	2.20	2.70	2.30	2.40	6.90	7.10	3.15	.90	1.30	2.20	2.90	3.80
21	2.20	2.70	2.20	2.55	6.40	6.95	2.95	.90	1.40	2.20	2.80	4.40
22	2.30	2.70	2.20	3.00	6.15	6.50	2.80	.90	1.30	2.20	2.80	4.30
23	2.30	2.70	2.30	3.35	5.85	5.95	2.65	.90	1.30	2.20	2.80	3.95
24	2.30	2.70	2.30	3.55	5.55	5.40	2.45	.90	1.40	2.20	2.70	3.45
25	2.40	2.60	2.30	3.60	5.45	5.15	2.35	.90	1.40	2.20	2.60	2.85
26	3.00	2.60	2.20	3.50	5.25	5.15	2.25	.90	1.60	2.20	2.50	2.70
27	3.10	2.80	2.20	3.45	5.30	5.20	2.15	.90	1.50	2.20	2.60	2.60
28	3.30	2.80	2.20	3.40	5.40	5.20	2.10	.90	1.60	2.20	2.70	2.70
29	3.00	.....	2.20	3.30	5.75	5.15	2.10	.90	1.70	2.30	2.75	2.90
30	2.70	.....	2.20	3.30	6.25	4.95	2.00	.90	1.80	2.30	2.90	3.40
31	2.40	.....	2.10	.....	6.70	.....	1.95	.90	.....	2.30	.....	5.25

SNAKE RIVER (NORTH FORK) NEAR ORA, IDAHO.

This station was established August 20, 1902, by N. S. Dils. It is located at the North Fork Bridge 2 miles south of Ora and 10 miles above St. Anthony, Idaho. A temporary vertical gage was set on the lower side of the first pier from the north shore, at which point the permanent gage will be located. The observer is Mrs. Martha J. Fritz. The initial point for soundings is a bolt through the toe of the cantilever on the north end of the lower side of the bridge. The bridge is 210 feet from toe to toe of cantilever. It consists of four spans resting on three rock-filled crib piers. Measurements are made from the lower side of this bridge. The channel is straight both above and below this station. The banks are high and do not overflow. The bed of the stream is hard gravel, quite smooth, and not liable to change.

The following discharge measurements were made during 1902:

August 20: Gage height, 2.00 feet; discharge, 1,241 second-feet.
September 29: Gage height, 2.00 feet; discharge 1,244 second-feet.

Daily gage height, in feet, of Snake River (North Fork) near Ora, Idaho.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						1902.					
1	------	2.00	2.00	2.10	1.90	17	------	2.00	2.00	2.10	1.90
2	------	2.00	2.00	2.00	1.90	18	------	2.00	2.00	2.10	1.90
3	------	2.00	2.00	2.00	1.90	19	------	2.00	2.00	2.00	1.10
4	------	2.00	2.00	2.00	1.90	30	2.00	2.00	2.00	1.90	2.00
5	------	2.00	2.00	2.00	1.90	21	2.00	2.00	2.00	1.90	2.00
6	------	2.00	2.00	2.00	1.90	22	2.00	2.00	2.00	1.90	2.00
7	------	2.00	2.00	2.00	1.90	23	2.00	2.00	2.00	1.90	2.00
8	------	2.00	2.00	2.00	1.90	24	2.00	2.00	2.00	1.90	2.00
9	------	2.00	2.00	2.00	2.00	25	2.00	2.00	2.00	1.90	2.00
10	------	2.00	2.00	2.00	2.00	26	2.00	2.00	2.00	1.90	2.00
11	------	2.00	2.00	2.00	2.00	27	2.00	2.00	2.00	1.90	2.00
12	------	2.00	2.00	2.10	2.00	28	2.00	2.00	2.00	1.90	2.00
13	------	2.00	2.00	2.10	2.00	29	2.00	2.00	2.10	1.90	2.00
14	------	1.90	2.00	2.10	2.00	30	2.00	2.00	2.10	1.90	2.00
15	------	2.00	2.00	2.10	2.00	31	2.00	------	2.10	------	2.00
16	------	2.00	2.00	2.10	2.00						

FALL RIVER AT WILSON'S MILL, NEAR MARYSVILLE, IDAHO.

This station was established August 21, 1902, by N. S. Dils. It is located at P. Wilson's sawmill, 12 miles southeast of Marysville, Idaho. The gage is a plain staff graduated to feet and tenths and is firmly spiked to the lower side of the first bent from the south shore. It is read by P. Wilson, the owner of the mill. The initial point for soundings is the face of the south abutment and measurements are made from the bridge. The bridge rests on crib abutments. The river is straight both above and below the station. The banks are high and not liable to overflow. The bed of the river is hard gravel

with occasional lava bowlders. George Harringfield, a local civil engineer, states that the river in this vicinity has a fall of from 37½ to 39 feet per mile. The Harringfield canal is being built to divert the water from above this station.

The following discharge measurements were made during 1902:

August 21: Gage height, 2.00 feet; discharge, 916 second-feet.
October 1: Gage height, 1.90 feet; discharge, 857 second-feet.

Daily gage height, in feet, of Fall River near Marysville, Idaho.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						1902.					
1	.....	1.90	1.90	1.80	1.80	17	.....	1.90	1.80	1.80	1.80
2	.....	1.90	1.90	1.80	1.80	18	.....	1.90	1.80	1.80	1.80
3	.....	1.90	1.90	1.80	1.80	19	.....	1.90	1.80	1.80	1.80
4	.....	1.90	1.90	1.80	1.80	20	.....	1.90	1.80	1.80	1.80
5	.....	2.00	1.90	1.80	1.80	21	.....	1.90	1.80	1.80	1.80
6	.....	2.00	1.90	1.80	1.80	22	.....	1.90	1.80	1.80	1.80
7	.....	1.90	1.90	1.80	1.80	23	.....	1.90	1.80	1.80	1.80
8	.....	1.90	1.90	1.80	1.80	24	2.00	1.90	1.80	1.80	1.80
9	.....	1.90	1.90	1.80	1.80	25	2.00	1.90	1.80	1.80	1.80
10	.....	1.90	1.90	1.80	1.80	26	2.00	1.90	1.80	1.80	1.80
11	.....	1.90	1.90	1.80	1.80	27	2.00	1.90	1.80	1.80	1.80
12	.....	1.90	1.90	1.80	1.80	28	2.00	1.90	1.80	1.80	1.80
13	.....	1.90	1.90	1.80	1.80	29	2.00	1.90	1.80	1.80	1.80
14	.....	1.90	1.90	1.80	1.80	30	2.00	1.90	1.80	1.80	1.80
15	.....	1.90	1.90	1.80	1.80	31	2.00	.....	1.80	.....	1.80
16	.....	1.90	1.80	1.80	1.80						

Miscellaneous measurements in Columbia River drainage basin.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
1902.				
June 10	N. S. Dils	All of the springs flowing into Snake River.	Between Shoshone Falls and the Cedars.	112
11				
Aug. 7	....do	New York canal	Near Boise gaging station	46
13	....do	....do	....do	80
15	....do	....do	....do	Dry.
25	....do	Snake River	1 mile above mouth of Blackfoot River.	Dry.
27	....do	Blue Lakes Creek	At Blue Lakes, Idaho	80
Sept. 1	....do	Snake River	Between Shoshone Falls and Twin Falls.	1,987
25	....do	Black Springs Creek	Near Ora gaging station	9
Nov. 28	J. S. Baker	Big Blackfoot	Bonner	4.01

PUGET SOUND DRAINAGE BASIN.

For convenience in arrangement the smaller rivers which have their headwaters on the western slope of the Cascade Range and which flow into Puget Sound north of Seattle have been grouped as the Puget Sound drainage. Of these White River has its source near Mount

Rainier and flows into Puget Sound near Seattle, Wash. Cedar River is a tributary of White River. Snoqualmie and Skykomish rivers unite to form the Snohomish, which flows into the Sound about 10 miles beyond the junction near Everett, Wash. The Stillaquamish lies north of the Skykomish and has a parallel course. The following list includes the stations in the Puget Sound drainage basin:

White River at Buckley, Wash.
Cedar River near Maple Valley, Wash.
Cedar River at Cedar Lake, near Northbend, Wash.
Snoqualmie River above Snoqualmie Falls, near Snoqualmie, Wash.
Skykomish River (south fork) near Index, Wash.
Stilaguamish River near Robe, Wash.

WHITE RIVER AT BUCKLEY, WASH.

In order to determine the amount of power that could be developed on White River, a station was established by Sydney Arnold, April 22, 1899, at the new highway bridge, 500 feet above the Northern Pacific Railway bridge, and one-half mile north of the town of Buckley, Wash. The location is in sec. 34, T. 20 N., R. 6 E. of the Willamette meridian. The rod of the wire gage is fastened to the guard rail of the highway bridge. The length of the wire rope is 20 feet. The elevation of the top of the guard rail at the pulley is 19.56 feet above gage datum. The bridge is a clear span of 180 feet, crossing the river a trifle obliquely. The channel is straight for some distance above and below the bridge, but the section is not a very good one, owing to the sudden fall a short distance below. About 300 feet above the bridge is a good section, with fine gravel bottom in calmer water, but in order to utilize it it would be necessary to install a cable. An examination of the river channel for some distance above and below this point was made, but the present location is about the only one available for accurate results.

No measurements of discharge were made at this station during 1902.

Daily gage height, in feet, of White River at Buckley, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1802.												
1	1.15	0.85	1.15	0.80	1.30	1.95	1.95	1.40	0.85	0.70	0.65	4.23
2	1.20	.85	1.15	.80	1.30	1.80	2.10	1.35	.90	.65	1.15	2.78
3	1.35	.80	1.10	.95	1.65	1.75	1.90	1.30	1.00	.60	1.48	2.43
4	2.53	.75	1.10	1.10	1.60	1.70	2.15	1.20	.95	.60	1.15	2.93
5	2.25	.70	1.15	1.10	1.55	1.60	2.15	1.25	.80	.60	1.05	2.60
6	3.30	.70	1.15	1.60	1.70	1.60	1.95	1.30	.90	.55	.85	1.80
7	3.35	.70	1.15	1.50	2.05	1.60	1.80	1.45	1.00	.55	1.20	1.65
8	3.70	.75	1.20	1.40	2.15	1.80	1.75	1.45	.90	.60	2.73	2.10
9	2.85	.85	1.20	1.25	2.15	2.15	1.70	1.35	.85	.60	2.13	3.05
10	2.35	.85	1.20	1.15	2.55	2.15	1.80	1.20	.75	.60	1.70	2.40
11	2.10	.80	1.40	1.15	2.65	2.10	1.90	1.20	.75	.55	1.80	2.10
12	1.80	.75	1.35	1.15	2.40	2.05	1.80	1.15	.70	.60	1.65	1.80
13	1.65	.70	1.30	1.10	2.15	2.00	1.70	1.10	.70	.60	1.40	1.65
14	1.50	.70	1.20	1.10	2.15	2.00	1.70	1.10	.70	.65	1.25	1.65
15	1.45	1.30	1.15	1.05	2.20	1.95	1.80	1.10	.70	.65	1.20	1.50
16	1.35	2.80	1.10	1.15	2.20	1.80	1.90	1.10	.65	1.05	1.55	1.40
17	1.25	2.60	1.15	1.40	2.35	1.70	1.75	1.05	.65	.80	1.70	1.30
18	1.15	2.15	1.10	1.60	2.15	1.70	1.65	.95	.65	.65	1.85	1.25
19	1.15	1.80	1.10	2.15	2.00	1.80	1.65	.95	.85	.65	1.65	1.20
20	1.10	1.65	1.10	1.90	1.90	1.95	1.80	1.00	.60	.60	1.40	1.15
21	1.05	1.60	1.05	1.60	1.80	2.15	1.95	1.10	.50	.60	1.25	1.10
22	1.00	1.50	1.00	1.55	1.80	2.20	1.85	1.10	.50	.60	1.30	1.10
23	.90	1.40	1.00	1.50	1.95	2.35	1.70	1.05	.45	.55	1.30	1.05
24	.85	1.40	.95	1.40	1.95	2.60	1.60	1.00	.80	.55	1.50	1.88
25	.65	1.35	.95	1.35	2.05	2.60	1.60	.90	.75	.50	1.30	3.00
26	.90	1.30	.95	1.35	2.40	2.35	1.60	.90	.90	.50	1.30	3.43
27	.80	1.20	.90	1.35	3.00	2.15	1.50	.90	1.80	.50	1.20	2.60
28	.80	1.20	.90	1.35	3.10	1.95	1.45	.85	.95	.75	1.20	2.15
29	.90	------	.90	1.30	2.75	1.85	1.35	.80	.80	.60	1.15	1.90
30	.90	------	.85	1.30	2.40	1.95	1.30	.75	.90	.75	1.78	1.90
31	.90	------	.85	------	2.15	------	1.50	.80	------	.75	------	1.90

CEDAR RIVER NEAR MAPLE VALLEY, WASH.

This station is located at the intake of the Seattle waterworks and is 15 miles below Cedar Lake, 4 miles from the Northern Pacific Railway at Ravensdale, and 6 miles from the Columbia and Puget Sound Railway at Maple Valley. The station was established September 27, 1902, by T. A. Noble. The gage is a plain staff graduated to feet and hundredths, to which is attached a hook gage and vernier reading to thousandths. When this gage reads zero the hook is level with the crest of the dam. It is fastened securely to the head gates above the dam, and is read daily by George Landsburg. The bench mark is the crest of the dam. The elevation, from city levels, of the south end is 535.831 feet and of the north end 535.840 feet. The gagings at this station are made at two points. The first is 142 feet below the dam where the cross section is small, the current rapid and suitable for gaging the stream at stages below 1 foot on the gage. The measurements at this point are made from a cable. The initial point for soundings is on the right bank; the channel is straight; the right bank is steep; the left bank has a sloping gravelly beach; and the bed of the stream is rocky. At all stages of the river above 1 foot on the

gage the measurements are made from a cable located 600 feet above the dam, where the cross section is large and suitable for gaging the higher stages of the river. The initial point for soundings is a spike driven into the top of a hemlock stump about 12 inches in diameter near the water. The right bank is a sloping sandy beach; the left bank is steep and of hardpan formation. The bed is permanent—rocky near the right bank and sand and gravel near the left bank.

To the discharge measurements made below the dam should be added the amount of water flowing into the gravity system which supplies the city of Seattle. This varies from 34 to 37 second-feet. The discharge of this pipe line was measured during the winter of 1901–2, by T. A. Noble, and the results have been published in Volume XLIX, page 112, Transactions of the American Society of Civil Engineers.

During 1902 the following discharge measurements were made by T. A. Noble.

September 28: Gage height, 0.88 feet: discharge, 435 second-feet.
October 22: Gage height, 0.38 feet; discharge, 124 second-feet.
November 23: Gage height, 1.31 feet; discharge, 755 second-feet.
December 25: Gage height, 1.74 feet; discharge, 1,043 second-feet.
December 26: Gage height, 2.04 feet; discharge, 1,399 second-feet.

Daily gage height, in feet, of Cedar River near Maple Valley, Wash.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.53	0.92	1.35	1.01	1.32	1.56	1.05	0.68	0.47	0.70	0.63	3.28
2	1.49	.92	1.18	1.05	1.39	1.55	1.12	.68	.53	.66	.70	3.08
3	1.45	.90	1.18	1.05	1.68	1.51	1.14	.68	.53	.62	1.12	2.54
4	1.90	.90	1.22	1.05	1.80	1.47	1.30	.66	.53	.58	1.22	2.40
5	1.99	.90	1.30	1.05	1.76	1.39	1.55	.64	.53	.55	1.19	2.20
6	2.36	.95	1.32	1.05	1.72	1.35	1.64	.62	.51	.52	1.10	1.85
7	2.53	.95	1.39	1.07	1.80	1.35	1.68	.60	.51	.51	1.11	1.67
8	2.86	.99	1.39	1.24	1.88	1.32	1.54	.60	.51	.52	1.60	1.47
9	2.61	1.05	1.47	1.30	1.93	1.41	1.53	.58	.51	.50	1.90	1.91
10	2.34	1.01	1.55	1.30	1.93	1.41	1.47	.58	.49	.48	1.83	1.83
11	2.11	.97	1.68	1.26	1.93	1.41	1.39	.58	.49	.47	1.79	1.71
12	1.90	.97	1.68	1.22	1.88	1.39	1.30	.55	.47	.46	1.83	1.58
13	1.78	.97	1.55	1.18	1.84	1.32	1.28	.55	.45	.36	1.72	1.56
14	1.65	.92	1.43	1.05	1.80	1.30	1.14	.53	.45	.36	1.55	1.45
15	1.53	.91	1.35	1.01	1.84	1.22	1.05	.53	.43	.35	1.43	1.37
16	1.40	1.39	1.35	.99	1.82	1.18	1.09	.53	.41	.36	1.42	1.27
17	1.36	1.64	1.30	1.05	1.97	1.18	1.05	.60	.39	.35	1.58	1.22
18	1.28	1.85	1.26	1.59	2.05	1.16	1.01	.58	.37	.40	1.85	1.15
19	1.23	1.80	1.22	1.47	2.01	1.14	.99	.55	.47	.39	1.85	1.61
20	1.11	1.60	1.22	1.55	1.89	1.09	.97	.55	.35	.35	1.69	1.60
21	2.07	1.55	1.22	1.55	1.87	1.14	.93	.55	.33	.35	1.54	1.49
22	2.03	1.51	1.26	1.53	1.84	1.09	.91	.53	.33	.38	1.42	1.73
23	.99	1.43	1.28	1.51	1.76	1.14	.89	.53	.33	.65	1.34	1.30
24	.97	1.35	1.24	1.47	1.80	1.12	.85	.53	.33	.62	1.36	1.36
25	.97	1.30	1.22	1.43	1.72	1.12	.80	.51	.28	.56	1.32	1.66
26	.97	1.30	1.18	1.39	1.68	1.09	.80	.51	.28	.52	1.28	2.03
27	.97	1.35	1.14	1.35	1.66	1.09	.76	.49	1.01	.48	1.25	1.92
28	.95	1.35	1.14	1.30	1.80	1.09	.74	.49	.88	.53	1.24	1.75
29	.95	.....	1.09	1.32	1.88	1.05	.74	.47	.80	.53	1.23	1.69
30	.95	.....	1.05	1.35	1.80	1.12	.72	.47	.70	.53	1.36	1.78
31	.90	.....	1.18	.....	1.72	.....	.70	.47	.....	.61	.....	1.93

CEDAR RIVER AT CEDAR LAKE, NEAR NORTHBEND, WASH.

This station was established October 17, 1902, by T. A. Noble. It is located 9 miles southeast of Northbend, Wash. The gage is a plain staff graduated to feet and tenths. A hook and vernier are used for reading to hundredths. It is securely nailed to a large cedar stump. The bench mark is located on the stump which holds the gage. Its elevation is 1,542.07 feet above the datum of the city of Seattle, Wash. The initial point for soundings is a nail driven into the root of a hemlock stump on the right bank. The gagings are made from a cable. The channel is straight both above and below the station. The right bank is steep, high, and never overflows; the left bank is steep and overflows at extreme high water. The bed of the stream is rocky near the left bank, and of gravel and sand at the right bank. Underlying the bed is a formation of very compact hardpan, which shows no sign of washing away. This formation also underlies the river up to and including the lower portion of Cedar Lake, which is about 800 feet upstream from the gaging station. Cedar Lake contains about 1,200 acres at low water.

During 1902 the following discharge measurements were made by T. A. Noble:

October 17: Gage height, 2.21 feet; discharge, 245 second-feet.
October 18: Gage height, 1.70 feet; discharge, 112 second-feet.
October 18: Gage height, 2.17 feet; discharge, 217 second-feet.
October 19: Gage height, 1.13 feet; discharge, 34 second-feet.
October 19: Gage height, 1.49 feet; discharge, 89 second-feet.

Daily gage height, in feet, of Cedar River at Cedar Lake, Washington.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1	.....	2.04	8.65	12	.....	4.61	3.53	23	2.16	3.22	2.38
2	.....	2.38	7.60	13	.....	4.30	3.35	24	2.00	3.23	2.33
3	.....	3.01	6.35	14	.....	3.87	3.24	25	1.97	3.14	2.99
4	.....	3.12	5.58	15	.....	3.56	2.95	26	1.75	3.08	4.22
5	.....	2.98	4.94	16	.....	3.60	2.81	27	1.67	3.04	4.44
6	.....	2.91	4.31	17	2.21	4.00	2.68	28	1.73	3.01	4.00
7	.....	3.06	3.90	18	2.18	4.57	2.59	29	1.70	3.02	3.77
8	.....	4.14	3.62	19	1.49	4.44	2.49	30	1.79	3.53	3.99
9	.....	4.94	4.00	20	.....	4.03	2.44	31	1.95	.....	4.38
10	.....	4.57	4.02	21	.....	3.67	2.37				
11	.....	4.59	3.95	22	2.40	3.41	2.37				

SNOQUALMIE RIVER ABOVE SNOQUALMIE FALLS, WASH.

This station was originally established by T. A. Noble on September 14, 1902. The gage was then located below the falls, but was destroyed by the flood of December 1, 1902. On November 2 another gage was placed about 3 miles above Snoqualmie Falls post-office. The gage consisted of a plain staff graduated to feet and tenths and reading to

hundredths of a foot by means of a hook and vernier. The elevation of the zero on the gage was assumed to be 100 feet. The gage was fastened to an alder tree. January 3, 1903, this gage was washed out and on January 7 was replaced by a gage in two parts, 7 and 8 feet long, respectively. The elevation of the zero of the gage is 100.06 feet. The bench mark is on a large maple stump on the right bank. It consists of a spike driven into the stump about 4 feet from the ground. This is also the initial point for the soundings. The right bank is high and never overflows; the left bank overflows at extreme high water. The bed of the stream is of gravel and sand and is not liable to shift. The station is located below the junction of the North, South, and Middle forks of Snoqualmie River. At Snoqualmie Falls, about 4 miles below this station, the river flows over a precipice 268 feet high. Above the falls the Snoqualmie Falls Power Company has built a dam and water power plant. The slack water from this dam reaches back from the falls about 3 miles and probably affects the flow of the river slightly at the gaging station. This is the only possible location for a gaging station which will include all three forks of the river.

During 1902 the following discharge measurements were made by T. A. Noble:

[a] September 20: Gage height, 1.15 feet; discharge, 727 second-feet.
[a] October 14: Gage height, 1.04 feet; discharge, 641 second-feet.
[b] November 3: Gage height, 5.04 feet; discharge, 3,231 second-feet.
[b] December 14: Gage height, 3.37 feet; discharge, 1,888 second-feet.
[b] December 17: Gage height, 2.76 feet; discharge, 1,384 second-feet.

Daily gage height, in feet, of Snoqualmie River below Snoqualmie Falls, Washington.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.					1902.					1902.				
1	------	1.80	2.45	(c)	12	------	1.15	3.70	(c)	23	0.97	1.19	2.60	(c)
2	------	1.60	4.02	------	13	------	1.10	3.15	------	24	1.05	1.08	3.13	------
3	------	1.47	3.50	------	14	0.95	.99	2.73	------	25	1.39	1.04	2.70	------
4	------	1.45	3.00	------	15	.93	1.09	2.60	------	26	1.50	1.00	2.63	------
5	------	1.35	2.50	------	16	.92	1.25	4.17	------	27	3.80	.93	2.65	------
6	------	1.25	2.20	------	17	.92	1.29	4.25	------	28	2.60	1.62	2.64	------
7	------	1.22	2.23	------	18	.90	1.20	3.85	------	29	2.05	1.70	2.45	------
8	------	1.30	5.05	------	19	1.50	1.10	3.13	------	30	2.02	2.41	6.53	------
9	------	1.30	3.55	------	20	1.19	1.10	2.73	------	31	------	2.75	------	------
10	------	1.23	3.30	------	21	1.06	1.08	2.47	------					
11	------	1.25	4.55	------	22	1.00	1.18	2.73	------					

[a] Below the falls. [b] Above the falls. [c] Gage washed out. Station removed above falls.

Daily gage height, in feet, of Snoqualmie River above Snoqualmie Falls, Washington.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1902.			1902.			1902.		
1	.....	15.00	12	5.99	3.84	23	3.82	2.82
2	.....	7.41	13	4.72	3.80	24	3.23	3.45
3	5.23	5.64	14	3.94	3.47	25	3.46	10.45
4	4.21	6.46	15	3.46	3.20	26	3.08	9.45
5	3.19	5.30	16	4.59	2.98	27	3.19	6.39
6	3.20	4.47	17	5.63	2.81	28	3.08	5.05
7	3.87	3.93	18	6.20	2.66	29	3.00	4.36
8	6.26	3.72	19	4.88	2.50	30	3.23	5.09
9	4.94	7.30	20	4.06	2.80	31	.....	5.83
10	5.38	5.24	21	3.59	2.90			
11	6.19	4.34	22	3.73	3.01			

SKYKOMISH RIVER (SOUTH FORK) NEAR INDEX, WASH.

This station was established October 6, 1902, by T. A. Noble. It is located about 2 miles above Index and about 300 feet from the railroad track. The gage is a plain staff graduated to feet and tenths. A hook and vernier are used for reading to hundredths of a foot. Readings are made daily by Louis G. Heybrook. The gage is fastened by means of plugs driven in drill holes in the solid rock. The bench mark is a cross cut in the rock about 6 feet above low water and 40 feet downstream from the gage. Its elevation as obtained from the Great Northern Railway is 679.158 feet. The elevation of the zero of the gage is 669.926 feet. The initial point for sounding is on the left bank at a plug driven in the solid rock 10 feet from the edge of stream at low water. The gagings are made from a cable. The channel is straight, both above and below the station. Both banks are of solid rock. The bed of the stream is of sand and gravel, not liable to change except near the left bank, where the sand shifts at high water. This does not cause any important change in the cross section. This station is 300 feet upstream from Sunset Falls, where the river plunges down a solid granite ledge with a slope of about two horizontal to one vertical. The ledge answers the purpose of a spillway in regulating the flow of the river at the gaging station, since the water has a free discharge and a permanent bed just below the station.

Daily gage height, in feet, of Skykomish (South Fork) River near Index, Wash.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1		3.65	11.41	12	1.31	5.27	3.53	23	0.88	3.25	2.10
2		4.10	7.28	13	1.23	4.39	3.35	24	.99	3.69	2.50
3		4.70	5.65	14	1.21	3.76	3.10	25	.99	3.53	8.20
4		4.15	5.52	15	1.22	3.57	2.85	26	.91	3.26	8.59
5		3.54	4.82	16	1.31	4.72	2.65	27	.91	3.65	6.36
6		3.02	4.26	17	1.29	5.64	2.49	28	1.31	3.33	5.51
7	1.61	3.92	3.69	18	1.18	6.09	2.38	29	2.51	3.09	4.50
8	1.53	5.65	3.52	19	1.13	4.88	2.29	30	3.42	5.95	5.31
9	1.52	5.21	5.35	20	1.09	4.09	2.30	31	3.92		6.01
10	1.46	4.76	4.55	21	1.07	3.62	2.12				
11	1.39	5.85	4.03	22	.90	3.38	2.14				

Discharge measurements of Skykomish River (South Fork) near Index, Wash.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
October 7	T. A. Noble	1.58	685
October 8	do	1.53	657
October 22	A. B. Carter	1.25	565
December 7	T. A. Noble	3.64	1,674
December 8	do	3.72	1,805
December 9	do	5.33	2,850
December 19	do	2.23	946

STILAGUAMISH RIVER NEAR ROBE, WASH.

This station was established December 3, 1902, by T. A. Noble. It is located at the bridge of the Everett and Monte Cristo Railway, 1½ miles east of Robe, Wash. The gage is a plain staff graduated to feet and tenths, and read by means of a hook gage and vernier to hundredths. It is fastened to the east bridge pier, and is read daily by Wm. A. Dobson. Arrangements will be made for gaging the river during the coming summer. The bench mark is the top of the rail above the east pier of the bridge. Its elevation is 901.06 feet above sea level. The elevation of the zero of the gage is 873.184 feet. The elevation of the bridge to which the gage is attached was furnished by the Everett and Monte Cristo Railway Company.

Daily gage height, in feet, of Stilaguamish River near Robe, Wash.

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
1902.		1902.		1902.		1902.	
1		9	8.40	17	1.56	25	9.94
2		10	8.50	18	1.36	26	6.39
3	3.54	11	9.10	19	1.40	27	4.21
4	3.92	12	8.30	20	2.28	28	3.06
5	2.85	13	2.48	21	1.84	29	3.07
6	2.30	14	1.07	22	1.96	30	5.28
7	3.40	15	1.87	23	1.78	31	3.77
8	8.40	16	1.56	24	4.61		

HUDSON BAY DRAINAGE BASIN.

Red River drains a large basin in the United States, covering portions of Minnesota and North and South Dakota, characterized by a level topography, broken up in places by moraines and other glacial deposits. The major part is prairie, and its eastern half has an abundance of lakes and some woods. The main river flows nearly due north, cutting a deep channel in its broad level valley and is subject to sudden rises caused by heavy spring rains, entailing frequently considerable loss of life and property. The valley of Red River comprises about 9,000,000 acres of excellent agricultural lands which to a large extent still await settlement. A number of water powers have been developed during recent years on the tributaries entering from both sides.

Red River drains into Hudson Bay through Lake Winnipeg and Nelson River. Red Lake River, one of its principal tributaries in Minnesota, drains Red Lake in the northern part of the State. Sheyenne River, its principal tributary from North Dakota, joins the Red River about 10 miles below Fargo, N. Dak.

St. Mary River heads in northern Montana, near the Canadian boundary line, on the eastern slope of the main range of the Rocky Mountains, in a region of perpetual snow and in the midst of numerous glaciers. It starts from the great Blackfoot Glacier (probably the largest in the Rocky Mountains within the United States) and receives affluents from at least a dozen lesser ones. These small streams unite within a short distance from their sources and flow into a lake hemmed in by high mountains, known as upper St. Mary Lake. Below this, separated by a narrow strip of land, is lower St. Mary Lake. The aggregate length of these two lakes is about 22 miles. The River flows out of the lower lake, the elevation of which is 4,460 feet above sea level, and within two miles is joined by a stream nearly, if not quite, as large as itself, known as Swiftcurrent Creek, which receives the water of the Grinnell Glacier and four lesser ones. From the confluence of these streams to the boundary of the British possessions, a distance of 12 miles, the river flows in a northerly direction. Enter-

ing Alberta, it empties into Belly River, its waters at length finding their way through Saskatchewan River into Hudson Bay. A canal has been constructed in Canada, by the Canadian Northwest Irrigation Company, which diverts water from the right bank of St. Mary River about 5 miles below the international boundary line.

The following list includes the stations of the Hudson Bay drainage basin:

St. Mary River at international line near Cardston, Alberta.
St. Mary River at Main, Mont.
Swiftcurrent Creek at Henkel's ranch near St. Mary, Mont.
St. Mary River at dam site near St. Mary, Mont.
Red River at Emerson, Manitoba.
Red Lake River at Crookston, Minn.
Red River at Grand Forks, N. Dak.
Sheyenne River at Haggart, N. Dak.
Red River at Fargo, N. Dak.
Devils Lake at Devils Lake, N. Dak

ST. MARY RIVER AT INTERNATIONAL LINE NEAR CARDSTON, ALBERTA.

This station was established October 11, 1902, by C. T. Prall. It is located one-quarter mile north of the Montana line and 17 miles south of Cardston, Alberta. The gage is of the usual wire type with the gage board graduated to feet and tenths. The length from the bottom of the weight to the marker is 10.85 feet. It is fastened to a tree and a post. The initial point for sounding is on the left bank. The channel is straight for 300 feet above and 150 feet below the station. The right bank is high and not liable to overflow. The left bank is sloping and liable to overflow at very high water. The bed of the stream is of sand and gravel, but not liable to scour. The measurements are made from a car and cable. The observer is Vernon Shaw. Bench mark No. 1 is a 60-penny spike driven in a cottonwood tree located directly back of the rod. Its elevation is 12.92 feet above the zero of the gage. Bench mark No. 2 is a 60-penny spike driven in a post 1 foot in diameter and 2 feet high. The post is set in the ground 92 feet northwest of the gage rod. Its elevation is 17.56 feet above the zero of the gage.

The following discharge measurements were made during 1902:

October 11: Gage height, 3.90 feet; discharge, 501 second-feet.
October 23: Gage height, 3.65 feet; discharge, 387 second-feet.

Daily gage height, in feet, of St. Mary River at International line, near Cardston, Alberta.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.					1902.				
1		4.00	3.45	3.65	17	4.00	3.95	3.65	5.15
2		4.00	3.45	3.60	18	4.00	3.95	3.65	5.05
3	4.25	4.05	3.50	3.50	19	4.00	3.90	3.60	5.00
4	4.25	4.00	3.50	3.30	20	4.00	3.90	3.65	5.00
5	4.20		3.50	3.60	21	4.10	3.90	3.65	5.00
6	4.10		3.45	3.80	22	4.10	3.90	3.65	5.00
7	4.12		3.45	3.80	23	4.00	3.65	3.65	4.60
8	4.10		3.50	4.00	24	4.10	3.60	3.60	4.65
9	4.10		3.60	4.00	25	4.00	3.60	3.65	5.00
10	4.10		3.65	4.00	26	4.10	3.50	3.25	5.00
11	4.00		3.65	4.20	27	4.00	3.50	3.35	4.80
12	4.00	3.85	3.70	5.20	28	4.00	3.50	3.00	4.75
13	4.00	3.90	3.65	5.00	29	4.10	3.50	3.20	4.70
14	4.00	4.00	3.65	5.20	30	4.00	3.45	3.60	4.65
15	3.11	3.95	3.60	5.20	31		3.45		
16	4.10	3.95	3.60	5.20					

ST. MARY RIVER AT MAIN, MONT.

This station was established by C. C. Babb, July 14, 1901, and is located at the highway bridge at Main, about 1 mile below the mouth of Swiftcurrent Creek. During 1900 a number of measurements were made at this point, and a temporary bench mark was established, consisting of a notch in the timber on the downstream side of the right abutment. When the station was established the height of this notch on the gage was found to be 1.60 feet. The rod is vertical and is spiked to the timbers on the lower end of the left abutment. Bench mark No. 1 is a nail in the blaze of a cottonwood tree 13 feet northwest of the rod, and is at an elevation of 4,418.49 feet. Bench mark No. 2 is a temporary bench mark of the topographic division, consisting of a stone in the road 400 feet northwest of the bridge, at an elevation of 4,419 feet. The elevation of the zero of the rod is 4,411.72. The channel above and below the station is straight, and the velocity of the water is swift. The right bank is high, and the left bank is low and liable to overflow. A short distance west of the bridge is a slough which carries some water during flood stages, and, therefore, has to be gaged on such occasions. The bed of the stream consists of gravel and bowlders. The station was discontinued November 1, 1902. Stations at Dam Site and at Henkel's ranch give the discharge at Main.

Discharge measurements of St. Mary River at Main, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 9	J. S. Baker	0.10	168
August 22	W. B. Freeman	1.50	944
September 2	do	1.11	661
September 22	C. T. Prall	.61	420
September 30	W. B. Freeman	.61	407
October 8	C. T. Prall	.57	402
October 17	do	.55	402
October 23	do	.35	311
October 30	do	.25	281

Daily gage height, in feet, of St. Mary River at Main, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.										
1	0.05	0.25	0.05	−0.05	0.70	4.40	3.40	2.25	1.25	0.30
2	.00	.25	.05	− .05	.75	4.20	3.70	2.15	1.15	.40
3	.00	.25	.05	− .05	.75	4.00	6.25	2.05	1.05	.40
4	.00	.25	.05	.00	.80	3.70	6.50	1.95	1.00	.40
5	.00	.25	.00	.00	.90	3.60	5.80	1.90	1.00	.30
6	− .10	.20	.00	.05	.95	3.40	5.00	1.90	1.00	.30
7	− .10	.20	.00	.05	1.00	3.30	4.80	1.90	1.00	.30
8	− .10	.20	.00	.10	1.10	3.30	4.00	1.90	1.00	.25
9	− .10	.20	.05	.10	1.30	3.40	3.60	1.95	.90	.25
10	− .15	.20	.05	.10	1.60	3.50	3.40	1.95	.90	.25
11	− .15	.15	.05	.15	1.80	3.50	3.20	1.95	.90	.20
12	− .15	.15	.10	.15	2.00	3.40	.....	1.90	.85	.20
13	− .10	.15	.10	.20	2.30	3.40	2.90	1.85	.85	.20
14	+ .10	.15	.10	.20	2.80	3.30	2.80	1.80	.80	.25
15	.10	.10	.10	.20	3.10	3.40	2.70	1.75	.75	.20
16	.15	.10	.10	.30	3.40	3.30	2.60	1.70	.80	.20
17	.15	.10	.10	.40	3.80	3.20	2.60	1.70	.80	.20
18	.20	.10	.10	.40	3.90	3.10	2.50	1.70	.75	.25
19	.20	.10	.05	.50	3.60	3.00	2.40	1.65	.75	.....
20	.20	.10	.05	.50	4.20	2.90	2.30	1.60	.70	.....
21	.20	.05	.05	.50	5.00	2.80	2.40	1.65	.60	.....
22	.15	.05	.05	.55	4.50	3.10	2.40	1.60	.50	.....
23	.15	.05	.00	.55	4.40	3.10	2.50	1.50	.40	.....
24	.15	.05	.00	.60	4.50	3.10	2.50	1.50	.35	.....
25	.15	.05	.00	.60	4.40	3.10	2.60	1.50	.35	.....
26	.15	.05	.00	.65	4.30	3.30	2.60	1.50	.35	.....
27	.15	.05	− .05	.65	4.25	3.30	2.60	1.45	.30	.....
28	.15	.05	− .05	.65	4.35	3.30	2.60	1.45	.30	.....
29	.20	.....	− .05	.70	4.60	3.30	2.50	1.40	.30	.....
30	.20	.....	− .05	.70	4.80	3.40	2.45	1.35	.30	.....
31	.20	.....	− .05	.....	4.50	.....	2.35	1.30	.....	.....

Rating table for St. Mary River at Main, Mont.

FROM JANUARY 1 TO JUNE 30, 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
—1.4	41	0.8	415	3.0	2,422	5.2	5,106
—1.2	48	1.0	501	3.2	2,666	5.4	5,350
—1.0	57	1.2	587	3.4	2,910	5.6	5,594
— .8	70	1.4	673	3.6	3,154	5.8	5,838
— .6	87	1.6	790	3.8	3,398	6.0	6,082
— .4	108	1.8	960	4.0	3,642	6.2	6,326
— .2	137	2.0	1,202	4.2	3,886	6.4	6,570
.0	175	2.2	1,446	4.4	4,130	6.6	6,814
.2	220	2.4	1,690	4.6	4,374	6.8	7,058
.4	273	2.6	1,934	4.8	4,618		
.6	338	2.8	2,178	5.0	4,862		

FROM JUNE 30 TO DECEMBER 31, 1902.

—1.0	57	0.0	190	1.0	612	2.0	1,290
— .8	70	.2	257	1.2	720	[a]2.2	1,446
— .6	87	.4	330	1.4	842		
— .4	108	.6	424	1.6	986		
— .2	143	.8	518	1.8	1,138		

[a] From this height the tables are the same.

Estimated monthly discharge of St. Mary River at Main, Mont.

[Drainage area, 298 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	220	146	193	11,867	0.65	0.75
February	232	185	205	11,385	.69	.72
March	195	165	181	11,129	.61	.70
April	373	165	257	15,292	.86	.96
May	4,862	373	2,490	153,104	8.36	9.67
June	4,130	2,178	2,873	170,955	9.64	10.76
July	6,692	1,568	2,737	168,292	9.18	10.59
August	1,507	780	1,090	67,010	3.66	4.22
September	750	293	488	29,038	1.64	1.83
October 1 to 18	----------	----------	282	10,074	.95	.64

SWIFTCURRENT CREEK AT HENKEL'S RANCH, NEAR ST. MARY, MONT.

This station was originally established April 8, 1902, by J. S. Baker, and was located one-half mile northwest of Henkel's ranch and 36 miles northwest of Browning, Mont. The nearest post-office is Wetzel. Henkel's ranch is reached by regular stage from Wetzel, Mont. The gage is of the usual wire type, with the gage rod graduated to feet and tenths. It is firmly nailed to a horizontal support, and is read daily by Henry Henkel. The initial point for sounding is on the left bank, and measurements are made from a cable and car. The channel is straight for 500 feet above and 200 feet below the station. The right bank is low and liable to overflow; the left bank is high and rocky. The bed of the stream is rocky. The station as originally established by J. S. Baker was washed away by the high water in June, 1902, and was reestablished July 30, 1902, by W. W. Schlecht. The original gage was placed on the right bank of the stream. The new gage is located 1,800 feet above the first gage and on the same bank of the stream. The gage was again moved on September 27, 1902, by C. T. Prall, as the second location was directly above a dam. The present gage is located about 900 feet above the former station. The length from the pointer to the bottom of the weight is 14.60 feet. The distance from the zero of the rod to the outside of the pulley is 2.15 feet. Bench mark No. 1 is a point chipped on a large bowlder 32.4 feet south of the gage. Its elevation is 12.52 feet above the zero of the gage. Bench mark No. 2 is the head of a 20-penny wire nail driven in a cottonwood tree 64.4 feet east of the gage. Its elevation is 12.86 feet above the zero of the gage.

Discharge measurements of Swiftcurrent Creek at Henkel's ranch, near St. Mary, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 9	J. S. Baker	1.50	67
Do	do	1.50	68
August 11	W. B. Freeman	2.40	338
August 22	do	2.22	254
September 2	do	1.94	170
October 8	do	2.00	156
October 17	C. T. Prall	1.92	139
October 23	do	1.70	101
October 30	do	1.68	98
July 30	W. B. Freeman	2.50	418
September 22	C. T. Prall	1.85	113
September 29	do	2.05	163

Daily gage height, in feet, of Swiftcurrent Creek at Henkel's ranch near St. Mary, Mont.

Day.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1	.....	2.00	5.00	3.20	2.50	2.00	1.90	1.60	1.40
2	.....	2.20	4.60	3.50	2.40	2.10	1.90	1.60	1.40
3	.....	2.40	4.00	5.00	2.40	2.10	1.90	1.50	1.40
4	.....	2.20	3.50	7.00	2.40	2.00	1.90	1.50	1.40
5	.....	2.20	3.30	6.30	2.30	2.10	1.80	1.50	1.40
6	.....	2.00	2.90	5.40	2.30	2.50	1.90	1.50	1.40
7	.....	2.00	3.10	5.00	2.20	2.40	1.90	1.50	(a)
8	1.50	2.00	3.10	4.70	2.10	2.10	1.90	1.50	(a)
9	1.50	2.60	3.50	3.80	2.10	2.10	1.90	1.50	(a)
10	1.50	2.80	3.80	3.20	2.40	2.10	1.90	1.50	(a)
11	1.50	2.90	4.00	3.00	2.30	2.00	1.90	1.50	(a)
12	1.50	2.90	4.00	3.00	2.30	2.00	1.90	1.50	(a)
13	1.40	3.10	4.10	2.80	2.30	2.00	1.80	1.50	(a)
14	1.40	3.10	3.50	2.80	2.30	1.90	1.80	1.50	(a)
15	1.50	4.00	3.30	2.70	2.20	1.90	1.80	1.50	(a)
16	1.60	4.10	3.20	2.70	2.20	2.00	1.80	1.50	(a)
17	1.60	4.40	3.20	2.60	2.20	2.00	1.80	1.50	(a)
18	1.60	4.40	3.10	2.60	2.20	1.90	1.70	1.50	(a)
19	1.60	4.00	3.00	2.50	2.30	1.90	1.70	1.50	(a)
20	1.80	4.40	3.00	2.40	2.30	1.90	1.70	1.50	(a)
21	2.00	5.70	2.70	2.40	2.30	1.90	1.70	1.50	(a)
22	2.10	4.90	2.60	2.30	2.20	1.90	1.70	1.50	(a)
23	2.30	4.70	2.40	2.30	2.20	1.90	1.70	1.50	(a)
24	2.30	4.30	2.20	2.40	2.20	1.90	1.70	1.50	(a)
25	2.00	4.10	2.20	2.30	2.20	1.80	1.70	1.40	1.80
26	2.00	3.90	3.50	2.50	2.20	2.00	1.60	1.40	1.90
27	2.00	3.70	3.50	2.40	2.20	2.00	1.60	1.40	1.90
28	2.00	3.80	3.40	2.70	2.20	2.00	1.60	1.40	1.70
29	2.00	4.50	3.40	2.70	2.20	2.00	1.60	1.40	1.70
30	2.00	5.00	3.20	2.50	2.20	2.00	1.70	1.40	1.60
31	.....	5.30	.....	2.50	2.10	.....	1.60	.....	1.60

a River frozen.

Rating table for Swiftcurrent Creek near St. Mary, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	36	2.8	578	4.6	1,577	6.4	2,576
1.2	45	3.0	689	4.8	1,688	6.6	2,687
1.4	58	3.2	800	5.0	1,799	6.8	2,798
1.6	78	3.4	911	5.2	1,910	7.0	2,909
1.8	108	3.6	1,022	5.4	2,021	7.2	3,020
2.0	156	3.8	1,133	5.6	2,132	7.4	3,131
2.2	245	4.0	1,244	5.8	2,243	7.6	3,242
2.4	356	4.2	1,355	6.0	2,354	7.8	3,353
2.6	467	4.4	1,466	6.2	2,465		

Estimated monthly discharge of Swiftcurrent Creek at Henkel's ranch near St. Mary, Mont.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April *a*			109	6,485	1.08	1.20
May	1,966	156	989	60,811	9.79	11.30
June	1,799	245	880	52,360	8.71	9.71
July	2,909	301	836	51,404	8.28	9.55
August	412	190	276	16,971	2.73	3.15
September	412	108	168	9,996	1.66	1.85
October	128	78	106	6,517	1.05	1.21
November	78	58	66	3,927	.65	.73

a Discharges from 1st to 7th estimated.

ST. MARY RIVER AT DAM SITE NEAR ST. MARY, MONT.

This station was established April 9, 1902, by J. S. Baker. It is located on Henry Henkel's ranch, about 1 mile east of his house, and is 35 miles northwest of Browning, Mont. It is also about 4,500 feet below Lower St. Mary Lake. The gage, which is located about 1,000 feet above the cable from which the measurements are made, is of the usual wire type. It is supported upon a horizontal arm which extends over the river and is fastened to a cottonwood stump. The scale board is graduated to feet and tenths. The length of the wire from the bottom of the weight to the marker is 11.40 feet. The observer is Henry Henkel, who lives about 1 mile west of the gage. The channel is straight both above and below the station and the banks are high. The stream has a moderate velocity and the banks have gentle slopes. The bed of the stream is composed of gravel and bowlders. The initial point for soundings is on the left bank at the middle of the cottonwood tree to which the cable is fastened. Bench mark No. 1 is a spike in the foot of a cottonwood tree 30 feet north of the gage. It is marked B. M. 9.24. Its elevation above the zero of the gage is 9.24 feet. Bench mark No. 2 is a wire spike in the rear post of the gage. It is marked B. M. 6.97 feet. Its elevation above the zero of the gage is 6.97 feet.

Discharge measurements of St. Mary River at dam site near St. Mary, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 9	J. S. Baker	1.50	94
April 9	do	1.50	97
July 31	W. W. Schlecht	3.55	1,179
August 5	W. B. Freeman	3.20	993
August 12	do	3.05	897
August 23	do	2.73	626
September 2	do	2.47	487
September 22	C. T. Prall	2.00	355
September 29	W. B. Freeman	1.92	267
October 8	do	1.85	232
October 24	A. M. Gilbert	1.73	205
October 30	C. T. Prall	1.65	182

Daily gage height, in feet, of St. Mary River at dam site near St. Mary, Mont.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1	.....	1.70	6.10	4.20	3.50	2.50	1.90	1.70	1.50
2	.....	1.80	6.00	4.40	3.40	2.40	1.90	1.70	1.50
3	.....	2.00	6.00	4.90	3.30	2.40	1.90	1.70	1.50
4	.....	2.00	5.30	6.50	3.30	2.40	1.90	1.70	1.50
5	.....	2.00	5.00	6.60	3.20	2.30	1.80	1.60	1.50
6	.....	2.00	4.60	6.40	3.20	2.30	1.80	1.60	1.50
7	.....	2.00	4.10	6.00	3.10	2.30	1.80	1.60	(a)
8	.....	2.00	4.10	5.80	3.10	2.30	1.80	1.60	.....
9	1.50	2.20	4.30	5.50	3.10	2.20	1.80	1.60	.....
10	1.50	2.20	4.30	5.20	3.10	2.20	1.80	1.60	.....
11	1.50	2.20	4.40	5.00	2.90	2.10	1.80	1.60	.....
12	1.50	2.20	4.30	5.00	3.00	2.10	1.80	1.60	.....
13	1.50	2.20	4.30	4.60	3.00	2.10	1.80	1.60	.....
14	1.50	2.30	4.10	4.60	3.00	2.10	1.80	1.60	.....
15	1.60	3.00	4.40	4.20	3.00	2.00	1.80	1.60	.....
16	1.60	3.20	4.30	4.20	3.00	2.10	1.80	1.60	.....
17	1.60	4.30	4.20	4.20	2.90	2.10	1.80	1.60	.....
18	1.60	4.30	4.00	4.10	2.90	2.00	1.80	1.60	.....
19	1.60	4.70	4.00	4.10	2.90	2.00	1.80	1.60	.....
20	1.50	5.60	4.00	4.00	2.90	2.00	1.80	1.60	.....
21	1.50	6.00	3.80	4.00	2.90	2.00	1.80	1.60	.....
22	1.60	6.00	3.60	4.00	2.80	2.00	1.80	1.60	.....
23	1.70	6.00	3.50	3.90	2.80	2.00	1.80	1.60	.....
24	1.80	6.30	3.20	4.00	2.70	2.00	1.80	1.60	.....
25	1.80	6.10	3.20	4.00	2.70	1.90	1.80	1.50	.....
26	1.60	6.00	3.80	4.10	2.70	1.90	1.70	1.50	1.70
27	1.60	6.00	3.70	3.90	2.70	1.90	1.70	1.50	1.80
28	1.60	5.00	4.00	3.90	2.70	1.90	1.70	1.50	1.70
29	1.60	5.10	4.00	3.80	2.60	1.90	1.70	1.50	1.70
30	1.70	6.00	3.80	3.60	2.60	1.90	1.70	1.50	1.60
31	.....	6.00	.....	3.50	2.60	.....	1.70	.....	1.60

(a) River frozen.

Rating table for St. Mary River at dam site near St. Mary, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	27	2.6	600	4.2	1,560	5.8	2,520
1.2	37	2.8	720	4.4	1,680	6.0	2,640
1.4	67	3.0	840	4.6	1,800	6.2	2,760
1.6	140	3.2	960	4.8	1,920	6.4	2,880
1.8	225	3.4	1,080	5.0	2,040	6.6	3,000
2.0	310	3.6	1,200	5.2	2,160	6.8	3,120
2.2	395	3.8	1,320	5.4	2,280		
2.4	480	4.0	1,440	5.6	2,400		

Estimated monthly discharge of St. Mary River at dam site near St. Mary, Mont.

[Drainage area, 177 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 9–30	----------	----------	136	5,931	0.77	0.63
May	2,820	310	1,359	83,561	7.68	8.85
June	2,700	960	1,608	95,682	9.09	10.14
July	3,000	1,140	1,792	110,186	10.12	11.67
August	1,140	600	813	49,989	4.59	5.29
September	540	267	357	21,243	2.02	2.25
October	267	182	222	13,656	1.25	1.44
November	182	97	137	8,152	.77	.86
December 1–6 and 26–31	----------	----------	136	3,237	.77	.38

RED RIVER AT EMERSON, MANITOBA.

This station was established by C. M. Hall, July 26, 1900, and is located at the Emerson railway and traffic bridge one-half mile north of the international boundary line at Emerson, Manitoba. It consists of a board 1 by 6 inches, painted white, grooved, graduated to feet and tenths, and attached to the east side of the breakwater for the center stone pier of the bridge. The zero of the gage is 46.5 feet below a steel beam of the bridge directly over the gage, and its elevation is 747.915 feet above sea level. The bed and the banks of the stream consist of clay. Measurements are usually made from a rowboat. The observer for 1902 is Robert Rossall, Emerson.

This station now replaces the station at Pembina, N. Dak. The readings here were not kept up in 1901 while the gage was maintained at Pembina station, but were resumed when the ice broke up in 1902, the Pembina station having been discontinued.

The following measurement was made by C. M. Hall in 1902:

April 26: Gage height, 12.70 feet; discharge, 7,646 second-feet.

Daily gage height, in feet, of Red River at Emerson, Manitoba.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	.....	30.45	14.20	15.35	9.65	5.70	4.40	3.70	5.00
2	.....	31.35	15.90	14.75	9.30	5.55	4.40	3.70	5.45
3	.....	31.90	18.15	14.20	8.95	5.45	4.35	3.75	5.85
4	.....	32.10	20.15	13.60	8.70	5.30	4.30	3.80	6.05
5	.....	31.85	21.50	13.20	8.50	5.20	4.30	3.80	6.10
6	.....	30.95	22.50	12.95	8.40	5.20	4.40	3.80	6.10
7	.....	30.10	23.10	12.80	8.35	5.10	4.40	3.80	6.05
8	.....	28.90	23.10	12.80	8.25	5.10	4.40	3.80	5.90
9	.....	27.15	23.05	13.05	8.20	5.05	4.30	3.80	5.80
10	.....	25.40	22.65	13.55	8.20	5.00	4.30	3.70	5.60
11	.....	23.65	21.80	14.05	8.35	5.00	4.30	3.70	5.10
12	.....	22.15	21.00	14.50	8.55	4.95	4.35	3.70	4.90
13	.....	20.45	20.20	14.65	8.70	4.80	4.40	3.70	4.90
14	.....	19.15	19.45	14.75	8.50	4.65	4.30	3.65	4.90
15	.....	17.95	18.65	14.70	8.25	4.55	4.25	3.60	4.70
16	.....	17.05	17.90	14.60	8.15	4.45	4.15	3.60	4.60
17	.....	16.40	17.30	14.40	7.90	4.40	4.10	3.60	4.50
18	.....	15.95	16.75	14.15	7.55	4.30	4.10	3.55	4.50
19	.....	15.65	16.20	13.90	7.35	4.30	4.00	3.50	4.80
20	.....	15.20	15.90	13.65	7.25	4.30	3.90	3.50	5.00
21	.....	14.85	15.90	13.45	6.95	4.45	3.80	3.50	5.40
22	.....	14.45	16.05	13.05	6.65	4.70	3.75	3.50	5.70
23	.....	14.05	16.35	12.80	6.50	4.90	3.70	3.50	6.00
24	.....	13.45	16.95	12.55	6.45	4.90	3.70	3.50	6.30
25	.....	13.10	17.35	12.10	6.25	4.85	3.70	3.55	6.30
26	.....	12.70	17.55	11.75	6.05	4.65	3.60	3.60	6.30
27	18.20	12.30	17.60	11.30	5.85	4.45	3.60	3.65	.....
28	21.90	12.00	17.35	10.90	5.70	4.40	3.60	3.75	.....
29	25.10	12.30	17.00	10.45	6.00	4.40	3.60	3.90	.....
30	27.50	13.25	16.40	10.00	5.95	4.40	3.60	4.05	.....
31	29.35	.....	15.95	.....	5.75	4.40	.....	4.55	.....

RED LAKE RIVER AT CROOKSTON, MINN.

This station was established by C. M. Hall, May 19, 1901. It is located at the bridge connecting Robert street and St. Paul street, which is known as the Sampson addition bridge. The gage consists of a weight attached to a woven steel-wire rope which plays over a pulley attached to the center of the single-span bridge. Readings are made on a board 1 by 6 inches, painted white, graduated to feet and tenths, and attached to the east railing of the bridge. A similar gage board nailed to one of the south piers of the bridge is used for reading high-

water stages. The zero of the gage is 820.07 feet above sea level and 9.8 feet below the bench mark, which is marked by one 20-penny and three 8-penny nails driven into the east end of the breakwater under the north end of the bridge:

During 1902 the following discharge measurements were made by C. M. Hall:

May 3: Gage height, 9.95 feet; discharge 5.009 second-feet.
May 30: Gage height, 7.85 feet; discharge, 3,154 second-feet.
July 31: Gage height, 5.35 feet; discharge, 1,472 second-feet.

Daily gage height, in feet, of Red Lake River at Crookston, Minn.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	.....	8.05	8.15	8.10	6.60	4.75	5.10	5.10	5.18
2	.....	7.75	8.75	7.90	6.70	5.30	5.05	5.25	5.15
3	.....	7.15	9.95	8.30	6.75	5.30	4.95	5.20	5.20
4	.....	7.05	9.65	9.10	6.85	5.40	4.95	5.40	5.18
5	.....	7.35	9.55	9.16	6.93	5.45	4.98	5.07	5.22
6	.....	7.25	9.05	9.10	7.00	5.70	5.00	5.00	5.40
7	.....	6.75	8.90	9.20	6.95	5.60	5.00	4.90	5.45
8	.....	7.25	8.60	9.60	6.93	5.00	4.90	4.95	5.30
9	.....	6.70	8.40	9.80	.....	4.30	4.85	5.01	5.35
10	.....	6.55	8.50	9.70	.....	5.30	4.88	5.04	5.40
11	.....	6.05	8.60	9.60	.....	4.90	4.90	5.02	5.45
12	.....	6.15	8.70	9.60	6.60	5.00	4.95	5.00	5.50
13	.....	[a]7.40	5.85	8.70	9.50	6.50	4.70	4.93	4.98	5.53
14	.....	7.38	5.80	8.80	9.70	6.60	4.50	4.85	4.95	5.50
15	.....	7.42	6.55	8.60	9.30	6.55	4.80	4.83	4.97	5.45
16	.....	.....	6.25	8.50	9.10	6.40	5.30	4.70	4.99	5.50
17	.....	7.63	6.05	8.60	9.00	6.35	4.50	4.70	5.01	5.51
18	.....	7.68	6.25	8.80	9.00	6.30	5.00	4.64	5.04	5.58
19	.....	7.70	5.60	9.10	9.00	6.30	5.60	4.64	5.05	5.60
20	.....	7.85	6.15	9.60	9.00	6.28	5.40	4.65	5.03	5.57
21	.....	7.65	5.15	10.00	8.60	6.25	5.20	4.70	5.03	5.55
22	.....	7.60	5.85	9.80	8.50	6.23	5.10	4.75	5.00	5.53
23	.....	7.95	5.85	9.75	8.50	6.20	4.90	4.74	5.05	5.50
24	.....	8.10	5.85	9.00	8.30	5.95	4.95	4.80	5.10	4.98
25	.....	8.55	5.15	8.98	8.00	5.84	5.00	4.83	5.20	4.96
26	.....	8.81	5.95	8.75	7.40	5.20	5.05	4.86	5.40	4.99
27	.....	9.25	7.75	8.60	7.05	5.15	5.10	4.85	5.34	5.52
28	.....	9.85	7.65	8.60	7.00	4.85	5.10	4.87	5.40	5.54
29	.....	9.60	7.95	8.52	6.90	4.60	5.15	4.90	5.37	5.56
30	.....	9.55	8.00	8.40	6.70	4.92	5.20	4.96	5.35	.....
31	.....	9.00	.....	8.40	.....	4.90	5.10	.....	5.30	.....

[a] Frozen during the winter. Elevation of surface of the ice 7.25 to 7.40 feet on gage. Ice 18 inches thick.

RED RIVER AT GRAND FORKS, N. DAK.

This station was established by C. M. Hall May 26, 1901, and is located at the Northern Pacific Railway bridge crossing the river at Grand Forks, N. Dak. The gage consists of a 1 by 8 inch board, painted white, graduated to feet and tenths in black, and attached to the north end of the breakwater for the center pier of the bridge.

The zero of the gage was placed 5 feet below the zero of the United States engineers' gage attached to the same breakwater, and is 779.9 feet above sea level according to leveling done by the Corps of Engineers, United States Army. The danger line is at 40 feet. The channel is straight above the station. The bed of the river is composed of mud and fine sand and is changeable; the water is usually heavily laden with sediment from Red Lake River, which enters one-half of a mile above the station. Measurements are made from a rowboat about 150 yards below the gage. The observer is John F. Hayes.

During 1902 the following discharge measurements were made by C. M. Hall:

May 17: Gage height, 15.10 feet; discharge, 6,613 second-feet.[a]
May 30: Gage height, 15.70 feet; discharge, 7,136 second-feet.[a]

Daily gage height, in feet, of Red River at Grand Forks, N. Dak.[b]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.					1902.					1902.				
1	2.30	1.18	3.65		12	1.95	1.35	1.35		23	1.55	1.15	3.80	
2	1.95	1.38	3.85		13	1.75	1.22	1.70		24	1.30	1.28	3.50	
3	2.25	1.62	3.70		14	1.65	1.15	2.70		25	1.28	1.48	3.45	
4	2.30	1.58	3.58		15	1.80	1.08	3.30		26	1.50	1.70	3.20	
5	1.95	1.58	3.45		16	1.50	1.62	3.00		27	1.62	1.70	3.50	
6	2.15	1.52	3.30		17	1.45	1.50	3.75		28	1.60	2.55	3.20	
7	2.05	1.35	3.10		18	1.52	1.38	4.00		29	1.60	2.92	3.00	
8	2.25	1.52	3.20		19	1.30	1.30	4.10		30	1.68	3.52		
9	2.10	1.53	3.18		20	1.35	1.35	4.20		31		3.50		
10	2.05	1.35	2.60		21	1.50	1.22	4.22						
11	2.05	1.55	2.05		22	1.30	1.00	3.85						

SHEYENNE RIVER AT HAGGART, N. DAK.

This station was established March 22, 1902, by Charles M. Hall. It is located near the way station of Haggart, on the Northern Pacific Railroad, 5 miles west of Fargo, N. Dak. The gage is a plain staff graduated to feet and tenths attached to the bridge. It is read daily by James Haggart, jr., who lives about half a mile from the bridge. The channel is straight both above and below the river. The bed of the stream is of clay and slightly shifting.

During 1902 the following discharge measurements were made by C. M. Hall:

April 30: Gage height, 7.90 feet; discharge, 643 second-feet.
May 31: Gage height, 5.50 feet; discharge, 346 second-feet.
September 30: Gage height, 3.70 feet; discharge, 49 second-feet.

[a] Gage height read on Geological Survey gage.
[b] Daily gage heights read on engineers' gage: add 5.00 feet to reduce to U. S. Geol. Survey gage datum.

Daily gage height, in feet, of Sheyenne River at Haggart, N. Dak.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	.....	13.00	8.00	5.50	4.10	3.80	3.80	3.70	3.90
2	.....	14.80	8.10	5.60	4.20	3.80	3.80	3.90	3.90
3	.....	15.90	8.10	5.70	4.50	4.00	3.80	3.90	3.90
4	.....	16.20	8.00	5.50	4.40	4.10	3.80	4.00	3.90
5	.....	16.50	8.10	5.50	4.30	4.00	3.80	3.90	3.90
6	.....	17.00	8.00	5.40	4.20	3.90	3.80	3.80	4.00
7	.....	17.20	7.90	5.40	4.20	3.70	3.80	3.70	4.00
8	.....	17.40	7.80	5.40	4.10	3.80	3.80	4.00	4.00
9	.....	18.00	7.60	5.70	4.00	3.80	3.80	4.00	.....
10	.....	18.00	7.60	6.10	4.30	3.70	3.80	4.10	.....
11	.....	18.00	7.50	6.50	4.20	3.70	3.80	3.90	.....
12	.....	17.00	7.50	6.70	4.20	3.60	3.70	3.70	.....
13	.....	16.40	7.60	6.60	4.00	3.60	3.70	3.70	.....
14	.....	16.00	7.40	6.20	3.80	3.80	3.70	3.70	.....
15	.....	15.80	7.20	5.70	3.80	3.80	3.70	3.60	.....
16	.....	15.50	7.00	5.30	3.70	3.60	3.60	3.60	.....
17	.....	15.20	7.20	5.20	3.90	3.50	3.60	3.70	.....
18	.....	15.00	7.00	5.10	4.00	3.40	3.80	3.80	.....
19	.....	14.80	7.10	5.00	4.00	3.40	3.90	3.90	.....
20	.....	14.80	7.20	5.00	3.80	3.60	3.80	4.00	.....
21	.....	14.20	7.20	4.90	3.70	3.70	3.90	3.90	.....
22	.....	12.30	7.30	4.80	3.80	3.60	3.80	3.80	.....
23	.....	11.60	7.30	4.70	3.80	3.80	3.70	3.40	.....
24	.....	10.40	7.40	4.80	3.90	3.80	3.60	3.70	.....
25	.....	10.20	7.30	4.80	4.00	4.00	3.80	4.20	.....
26	.....	9.80	7.20	4.60	3.80	4.10	4.00	4.40	.....
27	.....	9.20	6.90	4.40	4.00	4.00	4.10	4.20	.....
28	.....	8.60	6.60	4.50	4.50	4.00	4.00	4.00	.....
29	9.50	8.00	6.30	4.40	4.00	3.80	4.00	4.10	.....
30	10.20	7.90	6.00	4.20	3.60	3.70	3.80	4.00	.....
31	12.10	.....	5.60	.....	3.80	3.60	.....	4.00	.....

RED RIVER AT FARGO, N. DAK.

This station was established by C. M. Hall May 27, 1901, and is located at the bridge connecting Front street, Fargo, N. Dak., and Main street, Moorhead, Minn. The gage consists of a 1 by 8 inch board, painted white, graduated to feet and tenths in black, and attached to the east side of the breakwater for the center pier of the bridge. The zero of the gage is 44.45 feet below the top of the plank walk of the bridge over the gage and is 860.9 feet above sea level, the elevation having been determined by leveling from top of rail of Northern Pacific station, Moorhead, Minn. The danger line is at 26.5 feet. Above the station the river curves to the west. The west bank is high and steep; the east bank low and subject to overflow at times of high water. Measurements are made from the bridge. The river bed consists of soft mud. The observer is H. W. Grasse, United States Weather Bureau, Moorhead, Minn.

During 1902 the following discharge measurements were made by C. M. Hall:

May 2: Gage height, 8.15 feet; discharge, 555 second-feet.
May 20: Gage height, 9.87 feet; discharge, 1,240 second-feet.

Daily gage height, in feet, of Red River at Fargo, N. Dak.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.											
1		8.70	9.00	8.10	9.20	9.30	8.20	7.70	7.30	7.50	6.80
2		8.70	8.90	8.00	9.10	9.20	8.20	7.70	7.30	7.50	6.80
3		8.70	8.60	8.10	9.10	9.20	8.30	7.70	7.30	7.40	
4		8.70	8.30	8.10	9.20	9.30	8.40	7.70	7.30	7.40	
5		8.70	8.10	8.00	9.50	9.40	8.50	7.70	7.30	7.30	
6		8.70	8.00	8.10	9.60	9.40	8.50	7.70	7.30	7.30	
7		8.70	8.00	8.30	9.80	9.50	8.40	7.70	7.30	7.20	
8		8.70	8.00	8.50	9.90	9.50	8.30	7.60	7.30	7.20	
9		8.50	8.00	8.60	10.00	9.40	8.30	7.60	7.20	7.00	
10		8.30	8.30	8.80	10.10	9.30	8.20	7.60	7.20	6.90	
11		8.30	8.20	8.80	10.10	9.10	8.20	7.50	7.20	6.80	
12		8.40	8.30	8.80	10.10	9.10	8.20	7.50	7.20	6.80	
13		8.70	8.20	8.80	10.00	9.10	8.20	7.50	7.10	6.70	
14		8.80	8.20	8.80	10.00	9.10	8.20	7.50	7.10	6.70	
15		9.00	8.20	8.70	9.90	9.10	8.20	7.50	7.10	7.00	
16		9.80	8.20	8.20	9.80	9.10	8.20	7.50	7.00	7.30	
17		10.30	8.20	8.50	9.70	9.00	8.10	7.50	7.00	7.50	
18		10.30	8.10	9.00	9.70	8.90	8.00	7.40	7.00	7.80	
19		9.50	8.00	9.30	9.70	8.80	7.90	7.40	7.00	7.80	
20		9.10	7.90	9.80	9.70	8.70	8.00	7.40	7.00	7.80	
21		9.00	7.80	10.00	9.70	8.70	8.00	7.40	7.00	7.80	
22		9.10	7.80	10.40	9.70	8.60	7.90	7.40	6.90	7.80	
23		9.20	7.80	10.50	9.70	8.60	7.90	7.40	7.00	7.80	
24		9.30	7.80	10.30	9.70	8.50	7.90	7.40	7.10	7.80	
25	7.60	9.40	7.90	10.30	9.70	8.50	7.90	7.40	7.30	7.80	
26	8.20	9.50	7.90	10.40	9.70	8.40	7.80	7.40	7.50	7.70	
27	8.40	9.80	8.00	10.00	9.60	8.30	7.80	7.40	7.70	7.60	
28	8.70	9.80	8.00	9.60	9.50	8.20	7.80	7.40	7.80	7.40	
29		10.00	7.90	9.60	9.50	8.10	7.90	7.40	7.80	7.10	
30		9.50	7.90	9.40	9.40	8.20	7.80	7.30	7.70	6.80	
31		9.10		9.20		8.20	7.70		7.50		

DEVILS LAKE AT DEVILS LAKE, N. DAK.

This station was established by C. M. Hall, June 8, 1901, and is located at the boat landing at the Chautauqua grounds, 6 miles southwest of Devils Lake station, North Dakota. The object of maintaining a gage record on Devils Lake is to ascertain the fluctuations in its water level, which, during past years, has been steadily falling, the drop in the last nineteen years amounting to as much as 10 or 12 feet. The lake has no regular outlets and its waters are salt. It is hoped that a study of such records will lead to important conclusions relating to evaporation from the lake surface. The gage consists of a 2 by 8 inch plank, painted white, grooved, and graduated to feet and tenths, and

attached to the middle of the north row of piles of the Chautauqua boat landing.

A United States Geological Survey bench mark is placed on the shore of the lake 3 rods west of the Chautauqua gate, which opens to the boat landing. It corresponds to the height of the lake in June, 1879, which was preserved by a hard-wood post driven level with the water by Capt. E. E. Heerman. The bench mark is 1,439.08 feet above sea level. The zero of the gage is 22.90 feet below the bench mark. The observer is Capt. E. E. Heerman.

The following gage readings were taken during 1902:

Gage heights of Devils Lake in 1902.

April 23	Lake opened	June 23	13.97
April 25	13.55	June 27	13.95
April 29	13.60	July 15	13.70
April 30	13.60	August 7	13.50
May 5	13.80	August 23	13.70
May 7	13.85	September 13	13.20
May 24	13.95	September 28	13.20
June 5	14.00	October 12	13.10
June 10	13.95	October 22	13.05
June 13	14.10	November 15	13.00
June 22	14.00	November 15	Lake closed

The following table, furnished by E. E. Heerman of Devils Lake, N. Dak., gives the dates for the past twenty years of the opening and closing of Devils Lake, between Devils Lake and Fort Totten, N. Dak. This part of the lake is larger and deeper; consequently freezes over later than other parts of the lake, and opens later on account of the greater body of ice. It has been known to freeze 44 inches thick at this point.

Date of opening and closing of Devils Lake, N. Dak.

Year.	Opened.	Closed.	Year.	Opened.	Closed.
1882		November 19 or 20.	1893	May 14	November 11.
1883	May 2	November 18.	1894	May 3	November 15.
1884	May 11	November 16.	1895	April 17	November 7.
1885	May 12	November 14.	1896	May 3	Do.
1886	April 26	November 11.	1897	do	Do.
1887	May 7	November 19.	1898	April 28	November 13.
1888	April 25	November 15.	1899	May 10	December 2.
1889	April 16	November 14.	1900	April 23	November 12.
1890	April 30	November 30.	1901	April 24	November 14.
1891	April 28	Lost (late November).	1902	April 23	November 15.
1892	May 7	November 7.			

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O

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Author.

Newell, F[rederick] H[aynes].

. . . Report of progress of stream measurements for the calendar year 1902, by F. H. Newell; pt. IV—Interior basin, Pacific coast, and Hudson Bay drainage. Washington, Gov't print. off., 1903.

250 p., 1 l. fig. 23½cm. (U. S. Geological survey. Water-supply and irrigation paper no. 85.)

Subject series P, Hydrographic progress reports, 23.

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Newell, F[rederick] H[aynes].

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Series.

U. S. Geological survey.

Water-supply and irrigation papers

no. 85. Newell, F. H. Report of progress of stream measurements for . . . 1902; pt. 4. 1903.

Reference.

U. S. Dept. of the Interior.

see also

U. S. Geological survey.

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WS 76. Observations on flow of rivers in the vicinity of New York City, by H. A. Pressey. 1903. 108 pp., 13 pls.
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WS 81. California hydrography, by J. B. Lippincott. 1903. 488 pp., 1 pl.

SERIES N—WATER POWER.

WS 24. Water resources of State of New York, Pt. I, by G. W. Rafter. 1899. 92 pp., 13 pls.
WS 25. Water resources of State of New York, Pt. II, by G. W. Rafter. 1899. 100–200 pp., 12 pls.
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WS 63. Hydrography of the Southern Appalachian Mountain region, Pt. II, by H. A. Pressey. 1902. 96–190 pp., 26–44 pls.
WS 69. Water powers of the State of Maine, by H. A. Pressey. 1902. 124 pp., 14 pls.

SERIES O—UNDERGROUND WATERS.

WS 4. A reconnaissance in southeastern Washington, by Israel C. Russell. 1897. 96 pp., 7 pls.
WS 6. Underground waters of southwestern Kansas, by Erasmus Haworth. 1897. 65 pp., 12 pls.
WS 7. Seepage waters of northern Utah, by Samuel Fortier. 1897. 50 pp., 3 pls.
WS 12. Underground waters of southeastern Nebraska, by N. H. Darton. 1898. 56 pp., 21 pls.
WS 21. Wells of northern Indiana, by Frank Leverett. 1899. 82 pp., 2 pls.
WS 26. Wells of southern Indiana (continuation of No. 21), by Frank Leverett. 1899. 64 pp.
WS 30. Water resources of the lower peninsula of Michigan, by A. C. Lane. 1899. 97 pp., 7 pls.
WS 31. Lower Michigan mineral waters, by A. C. Lane. 1899. 97 pp., 4 pls.
WS 34. Geology and water resources of a portion of southeastern South Dakota, by J. E. Todd. 1900. 34 pp., 19 pls.
WS 53. Geology and water resources of Nez Perces County, Idaho, Pt. I, by I. C. Russell. 1901. 86 pp., 10 pls.
WS 54. Geology and water resources of Nez Perces County, Idaho, Pt. II, by I. C. Russell. 1901. 87–141 pp.
WS 55. Geology and water resources of a portion of Yakima County, Wash., by G. O. Smith. 1901. 68 pp., 7 pls.
WS 57. Preliminary list of deep borings in United States, Pt. I, by N. H. Darton. 1902. 60 pp.
WS 59. Development and application of water in southern California, Pt. I, by J. B. Lippincott. 1902. 95 pp., 11 pls.
WS 60. Development and application of water in southern California, Pt. II, by J. B. Lippincott. 1902. 96–140 pp.
WS 61. Preliminary list of deep borings in United States, Pt. II, by N. H. Darton. 1902. 67 pp.
WS 67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls.
B 199. Geology and water resources of the Snake River Plains of Idaho, by I. C. Russell. 1902. 192 pp., 25 pls.
WS 77. Water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls.
WS 78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls.

The following papers also relate to this subject: Underground waters of Arkansas Valley in eastern Colorado, by G. K. Gilbert, in Seventeenth Annual, Part II; Preliminary report on artesian waters of a portion of the Dakotas, by N. H. Darton, in Seventeenth Annual, Part II; Water resources of Illinois, by Frank Leverett, in Seventeenth Annual, Part II; Water resources of Indiana and Ohio, by Frank Leverett, in Eighteenth Annual, Part IV; New developments in well boring and irrigation in eastern South Dakota, by N. H. Darton, in Eighteenth Annual, Part IV; Rock waters of Ohio, by Edward Orton, in Nineteenth Annual, Part IV; Artesian well prospects in the Atlantic Coastal Plain region, by N. H. Darton, Bulletin No. 138.

SERIES P—HYDROGRAPHIC PROGRESS REPORTS.

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PAPERS RELATING ESPECIALLY TO HYDROGRAPHIC PROGRESS REPORTS.

SERIES P—HYDROGRAPHIC PROGRESS REPORTS.

WS 11. River heights for 1896, by A. P. Davis. 1897. 100 pp.
WS 15. Operations at river stations, 1897, Part I. 1898. 100 pp.
WS 16. Operations at river stations, 1897, Part II. 1898. 101–200 pp.
WS 27. Operations at river stations, 1898, Part I. 1899. 100 pp.
WS 28. Operations at river stations, 1898, Part II. 1899. 101–200 pp.
WS 35. Operations at river stations, 1899, Part I. 1900. 100 pp.
WS 36. Operations at river stations, 1899, Part II. 1900. 101–198 pp.
WS 37. Operations at river stations, 1899, Part III. 1900. 199–298 pp.
WS 38. Operations at river stations, 1899, Part IV. 1900. 299–396 pp.
WS 39. Operations at river stations, 1899, Part V. 1900. 397–471 pp.
WS 47. Operations at river stations, 1900, Part I. 1901. 100 pp.
WS 48. Operations at river stations, 1900, Part II. 1901. 101–196 pp.
WS 49. Operations at river stations, 1900, Part III. 1901. 197–292 pp.
WS 50. Operations at river stations, 1900, Part IV. 1901. 293–388 pp.
WS 51. Operations at river stations, 1900, Part V. 1901. 389–488 pp.
WS 52. Operations at river stations, 1900, Part VI. 1901. 489–575 pp
WS 65. Operations at river stations, 1901, Part I. 1902. 334 pp.
WS 66. Operations at river stations, 1901, Part II. 1902. 188 pp.
WS 75. Report of progress of stream measurements for 1901, by F. H. Newell. 1903. 246 pp., 13 pls.
WS 82. Report of progress of stream measurements for 1902, Part I, by F. H. Newell. 1903. 199 pp.
WS 83. Report of progress of stream measurements for 1902, Part II, by F. H. Newell. 1903. 304 pp.
WS 84. Report of progress of stream measurements for 1902, Part III, by F. H. Newell. 1903. 200 pp.
WS 85. Report of progress of stream measurements for 1902, Part IV, by F. H. Newell. 1903. — pp.

Progress reports may also be found in the following publications: Tenth Annual, Part II; Eleventh Annual, Part II; Twelfth Annual, Part II; Thirteenth Annual, Part III; Eighteenth Annual, Part IV; Nineteenth Annual, Part IV; Twentieth Annual, Part IV; Twenty-first Annual, Part IV; Twenty-second Annual, Part IV; Bulletin No. 131; Bulletin No. 140.

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