DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

WATER-SUPPLY PAPER 402

SURFACE WATER SUPPLY OF THE UNITED STATES

1915

PART II. SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS

NATHAN C. GROVER, Chief Hydraulic Engineer
GUY C. STEVENS and WARREN E. HALL, District Engineers

WASHINGTON
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ILLUSTRATIONS.

SURFACE WATER SUPPLY OF THE SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS, 1915.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1915.

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

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

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

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

Annual appropriations for the fiscal years ending June 30, 1895–1916.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1916, inclusive	150,000

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

Measurements of stream flow have been made at about 3,800 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1915, 1,350 gaging stations were being maintained by the Survey and the cooperating organizations. Many

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

DEFINITION OF TERMS.

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

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 7).

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

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

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

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms not in common use are here defined:

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

"Control," "controlling section," and "point of control," terms used to designate the section or sections of the stream below the gage which determine the discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

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

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge in second-feet per square mile.	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	0.03719	1.041	1.079	1.116	1.153
2.....	.07438	2.083	2.157	2.231	2.306
3.....	.11157	3.124	3.236	3.347	3.459
4.....	.14876	4.165	4.314	4.463	4.612
5.....	.18595	5.207	5.393	5.578	5.764
6.....	.22314	6.248	6.471	6.694	6.917
7.....	.26033	7.289	7.550	7.810	8.070
8.....	.29752	8.331	8.628	8.926	9.223
9.....	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge in second-feet.	Run-off in acre-feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	1.983	55.54	57.52	59.50	61.49
2.....	3.967	111.1	115.0	119.0	123.0
3.....	5.950	166.6	172.6	178.5	184.5
4.....	7.934	222.1	230.1	238.0	246.0
5.....	9.917	277.7	287.6	297.5	307.4
6.....	11.90	333.2	345.1	357.0	368.9
7.....	13.88	388.8	402.6	416.5	430.4
8.....	15.87	444.3	460.2	476.0	491.9
9.....	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off in millions of cubic feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	0.0864	2.419	2.506	2.592	2.678
2.....	.1728	4.838	5.012	5.184	5.356
3.....	.2592	7.257	7.518	7.776	8.034
4.....	.3456	9.676	10.02	10.37	10.71
5.....	.4320	12.10	12.53	12.96	13.39
6.....	.5184	14.51	15.04	15.55	16.07
7.....	.6048	16.93	17.54	18.14	18.75
8.....	.6912	19.35	20.05	20.74	21.42
9.....	.7776	21.77	22.55	23.33	24.10

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off in millions of gallons.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	0.6463	18.10	18.74	19.39	20.04
2.....	1.293	36.20	37.48	38.78	40.08
3.....	1.939	54.30	56.22	58.17	60.12
4.....	2.585	72.40	74.96	77.56	80.16
5.....	3.232	90.50	93.70	96.95	100.2
6.....	3.878	108.6	112.4	116.3	120.2
7.....	4.524	126.7	131.2	135.7	140.3
8.....	5.171	144.8	149.9	155.1	160.3
9.....	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0.....	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1.....	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2.....	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3.....	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4.....	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5.....	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6.....	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7.....	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8.....	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9.....	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0.....	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1.....	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2.....	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3.....	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4.....	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5.....	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6.....	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7.....	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8.....	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9.....	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

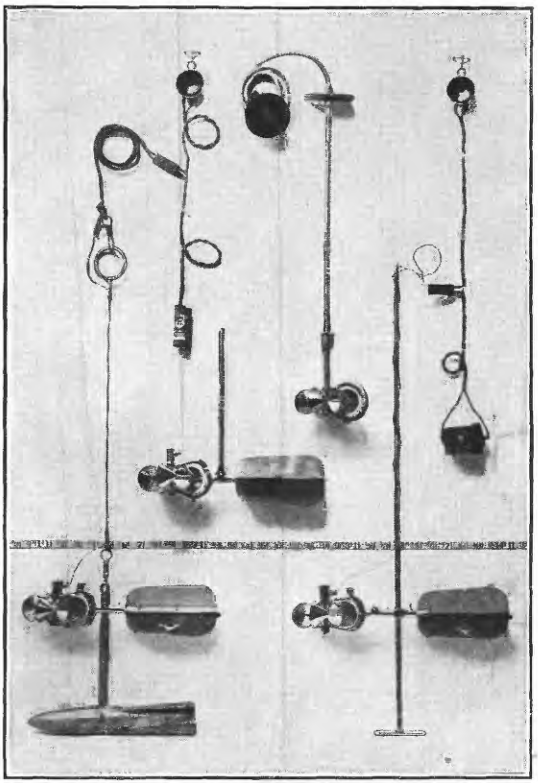
1 second-foot for one year (365 days) covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

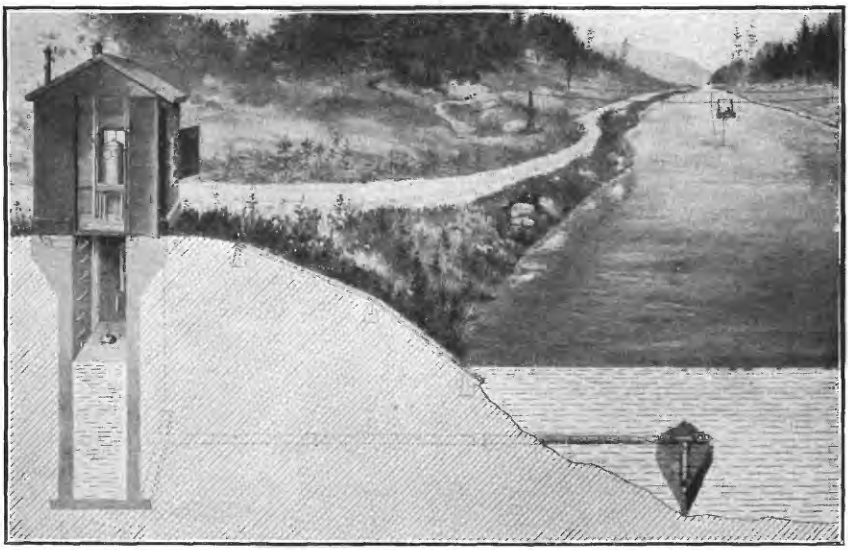
1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one year (365 days) equals 724 acre-feet.

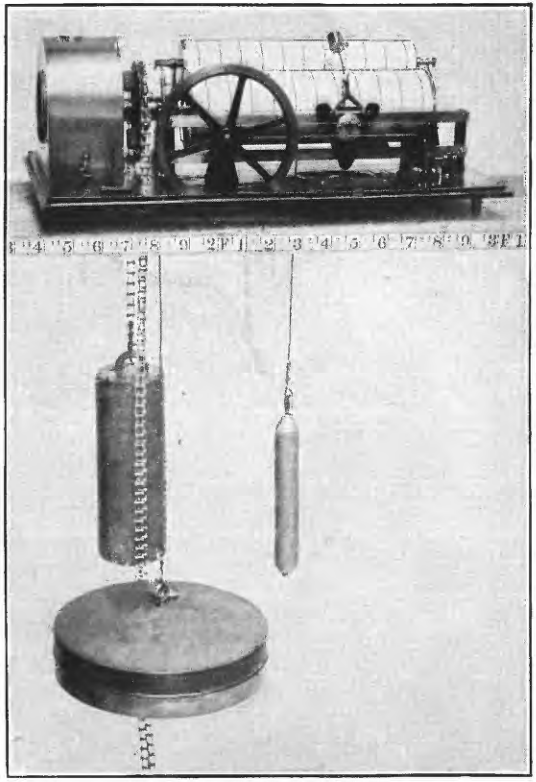
1 second-foot for one day covers 1 square mile 0.03719 inch deep.



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.



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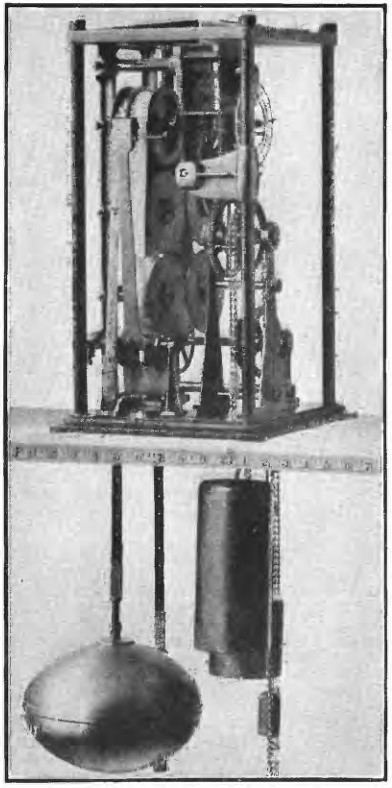
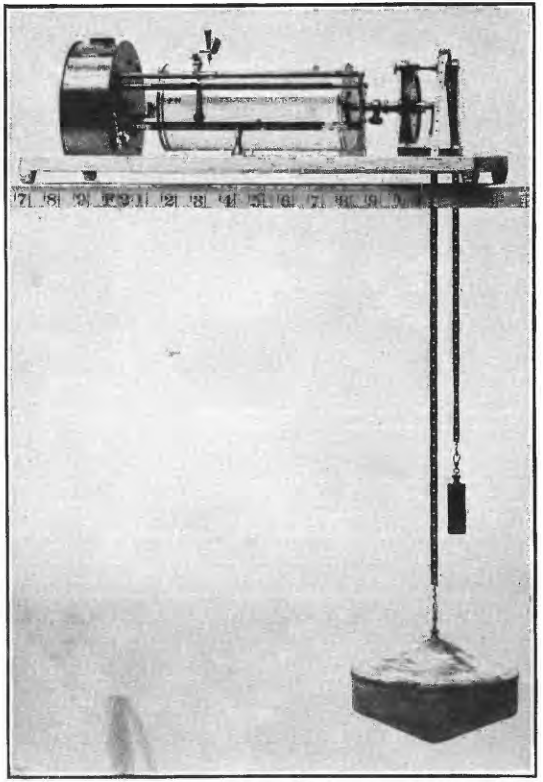


B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Second-feet} \times \text{fall in feet}}{11}$ = net horsepower on water-wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1914, and ending September 30, 1915. At the first of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up; at the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations (Pl. I, *B*) consist of records of stage, measurements of discharge, and general information

used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder (Pl. II) that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. The general methods are outlined in standard text books on the measurement of river discharge.

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

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

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

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

The table of daily discharge gives the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the true mean daily discharge may be obtained by averaging the discharge for regular intervals during the day or by use of the discharge integrator.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 6, are based.

The deficiency table presented for some of the gaging stations shows the number of days in each year on which the mean daily discharge was less than the discharge given in the table. By subtraction the table gives the number of days each year that the mean daily discharge was between the discharge given in the table, and, also by subtraction, the number of days that the mean daily discharge was equal to or greater than the discharge given. If one discharge rating table was used throughout the period covered by the deficiency table, gage heights that correspond to the discharge are also given. For convenience the theoretical horsepower per foot fall corresponding to the discharge is given in the table on page 8. In using the table for studies of power, allowance should be made for the various losses, the most important being wheel loss and head loss.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

Footnotes added to the daily discharge tables give information regarding the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables, "well defined" indicates in general that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate" within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The letter in the column headed "Accuracy" in the monthly discharge table, rates the accuracy of the monthly mean and not that of the estimate of maximum or minimum discharge or the discharge for any one day. The rating is determined by considering the accuracy of the rating curve, the probable reliability of the observer, the number of gage readings per day, the range of the fluctuation in stage, and local conditions. In this column A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the

river above the station. "Second-feet per square mile" and "run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

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

COOPERATION.

Special acknowledgments are due for financial assistance rendered by the following corporations and individuals: Virginia Railway & Power Co., Alabama Geological Survey, Division of Drainage Investigations of the United States Department of Agriculture, Southern Aluminium Co., Central Georgia Power Co., Columbus Power Co., Northern Contracting Co., J. M. Middlebrooks, sr., and Georgia Railway & Power Co.

DIVISION OF WORK.

The data for stations in the James and Roanoke drainage basins were collected and prepared for publication under the direction of G. C. Stevens, assisted by H. J. Dean, J. G. Mathers, M. I. Walters, James E. Stewart, J. H. Morgan, and H. W. Fear.

The data for all drainage basins south of Roanoke River were collected and prepared for publication under the direction of Warren E. Hall, assisted by M. R. Hall, B. M. Hall, jr., B. J. Peterson, Frank Lederle, and Miss E. M. Tiller.

GAGING-STATION RECORDS.

JAMES RIVER BASIN.

JAMES RIVER AT BUCHANAN, VA.

Location.—At highway bridge near Chesapeake & Ohio Railway depot at Buchanan, Botetourt County.

Drainage area.—2,060 square miles.

Records available.—August 18, 1895, to September 30, 1915.

Gage.—Chain gage attached to the highway bridge, installed November 21, 1903, to replace original wire gage read from August 18, 1895, to that date; read once daily by D. D. Booze for United States Weather Bureau. Datum of gage lowered 2 feet April 3, 1897, to avoid negative readings. A span of the bridge and the gage were destroyed by flood on the night of March 27, 1913. A temporary gage was used from April 22 to September 15, 1913, when a new chain gage was installed.

Discharge measurements.—Made from downstream side of two-span highway bridge.

Channel and control.—Bed of river under bridge composed of rock overlain with a thick deposit of mud; banks high and do not overflow except in extreme floods. Rock control several hundred feet below station; discharge relation not constant.

Extremes of discharge.—Maximum stage recorded during year: 17.25 feet February 3; discharge, 56,100 second-feet. Minimum stage recorded: 2.2 feet on several days in July and August; discharge, 340 second-feet.

Maximum stage recorded 1895–1915: 31.0 feet during the night of March 27, 1913 (determined by levels from flood marks October 2, 1914); discharge not computed. Minimum stage recorded: 1.2 feet (present gage datum), April 17 and May 2, 1896; discharge, 260 second-feet.

Winter flow.—Discharge relation occasionally affected by ice for short periods.

Accuracy.—Depends on frequency of discharge measurements to determine changes in rating curve. Results for 1915 considered fair.

Cooperation.—Since July 15, 1906, gage-height records have been furnished by United States Weather Bureau.

Discharge measurements of James River at Buchanan, Va., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	Mathers and Morgan...	1.98	334	June 25	H. J. Dean.....	2.76	861
2	.....do.....	1.98	336				

Daily discharge, in second-feet, of James River at Buchanan, Va., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	430	515	6,020	8,100	4,340	3,970	1,390	900	2,460	500	500	1,130
2	430	515	5,780	6,600	35,800	3,970	1,390	900	3,230	500	500	1,130
3	430	515	4,450	5,670	56,100	3,970	1,260	900	9,340	500	420	1,130
4	430	515	4,450	5,220	18,900	3,970	1,260	900	7,420	500	420	1,530
5	515	515	13,800	4,780	12,500	3,970	1,260	900	4,980	500	420	4,750
6	515	515	16,500	4,340	9,200	3,760	1,260	900	3,440	500	420	7,960
7	430	515	14,800	44,600	7,560	3,760	1,130	900	2,830	500	420	2,640
8	430	515	6,250	45,700	6,780	3,760	1,130	900	2,460	500	340	1,390
9	430	515	5,100	13,900	6,280	3,760	1,130	900	2,290	420	340	1,130
10	430	515	4,240	9,160	5,800	3,540	1,130	900	2,290	420	340	1,010
11	430	515	3,610	9,160	5,100	3,970	1,130	900	2,120	420	340	900
12	430	515	3,210	9,710	4,640	3,760	1,130	900	2,120	420	420	900
13	430	515	3,020	14,600	4,410	3,540	1,130	1,010	2,120	420	1,960	790
14	430	515	3,020	12,100	4,190	3,340	1,130	1,010	1,960	340	1,130	790
15	1,040	1,040	4,020	9,160	3,970	3,130	1,130	1,010	1,960	340	1,010	690
16	5,100	1,670	4,020	7,590	3,970	2,930	1,130	900	2,830	340	900	590
17	3,820	1,530	3,820	6,600	3,970	2,740	1,130	900	2,460	340	900	590
18	1,960	1,280	3,610	6,600	3,970	2,550	1,130	900	1,960	340	790	590
19	1,400	1,040	3,410	21,700	3,970	2,380	1,130	790	1,670	340	790	500
20	1,040	1,040	4,020	12,100	3,970	2,200	1,130	790	1,390	340	690	500
21	930	930	4,450	9,440	3,760	2,040	1,130	790	1,260	590	690	500
22	820	930	4,450	7,090	3,760	1,880	1,010	790	1,130	590	590	500
23	715	820	4,450	5,670	3,760	1,880	1,010	790	1,010	900	500	500
24	610	715	4,450	5,220	3,970	1,740	1,010	690	900	900	500	500
25	610	715	4,450	5,220	18,900	1,740	1,010	690	790	790	420	420
26	610	610	4,450	5,220	11,900	1,740	1,010	690	790	790	420	420
27	610	610	4,880	5,000	6,520	1,740	1,010	690	790	690	340	420
28	610	610	4,880	4,780	5,100	1,740	900	690	690	590	340	420
29	610	515	4,880	4,560	.....	1,600	900	690	590	500	1,130	420
30	610	515	5,330	4,340	.....	1,600	900	3,860	500	500	2,290	420
31	515	.....	9,030	4,340	.....	1,600	.....	2,830	.....	500	1,130	.....

NOTE.—Discharge determined as follows: Oct. 1 to Feb. 3, from a rating curve fairly well defined below 20,000 second-feet; Feb. 4 to Sept. 30, from a rating curve fairly well defined below 3,000 second-feet.

Monthly discharge of James River at Buchanan, Va., for the year ending Sept. 30, 1915.

[Drainage area, 2,060 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	5,100	430	897	0.435	0.50	A.
November	1,670	515	726	.352	.39	A.
December	16,500	3,020	5,580	2.71	3.12	B.
January	45,700	4,340	10,300	5.00	5.76	C.
February	56,100	3,760	9,400	4.56	4.75	C.
March	3,970	1,600	2,850	1.38	1.59	B.
April	1,390	900	1,120	.544	.61	B.
May	3,860	690	1,010	.490	.56	B.
June	9,340	500	2,330	1.13	1.26	B.
July	900	340	510	.248	.29	B.
August	2,290	340	690	.335	.39	B.
September	7,960	420	1,170	.568	.63	B.
The year	56,100	340	3,010	1.46	19.85	

Days of deficiency in discharge of James River at Buchanan, Va., for the year ending Sept. 30, 1915.

Discharge in second-feet.	Days of deficiency in discharge.	Discharge in second-feet.	Days of deficiency in discharge.	Discharge in second-feet.	Days of deficiency in discharge.
300	.....	1,200	201	8,000	340
350	13	1,400	211	10,000	349
400	13	1,600	214	15,000	357
450	44	1,800	224	20,000	360
500	44	2,000	231	25,000	361
550	85	2,500	243	30,000	361
600	93	3,000	250	40,000	362
700	114	4,000	286	50,000	364
800	131	5,000	313	70,000	365
1,000	161	6,000	327		

JAMES RIVER AT HOLCOMB ROCK, VA.

Location.—At works of the Virginia Electrolytic Co., at Holcomb Rock, Bedford County.

Drainage area.—Not measured.

Records available.—Gage heights January 1, 1900, to September 30, 1915.

Gage.—A copper float inclosed in a stilling box, with a vertical rod extending up through power-house floor; read twice daily to tenths by employees of the Virginia Electrolytic Co.

Discharge measurements.—None made at this station.

Extremes of stage.—Maximum stage recorded during year: 17.8 feet at 8 a. m. January 8. Minimum stage recorded: −0.7 foot, October 2.

Maximum stage recorded, 1900–1915: 26.8 feet at 8 a. m., March 28, 1913. Minimum stage recorded: −0.9 foot, September 14, 1913.

Cooperation.—Gage heights furnished by the Virginia Electrolytic Co.

Daily gage height, in feet, of James River at Holcomb Rock, Va., for the year ending Sept. 30, 1915.

[R. D. Damson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−0.6	−0.4	2.7	3.8	2.45	3.25	0.9	0.9	0.7	0.15	0.15	1.05
2	− .7	− .4	3.05	2.75	16.1	2.65	.9	.4	3.4	.1	.55	.7
3	− .65	− .5	2.25	2.55	9.2	2.35	.9	.8	5.9	.1	.5	1.15
4	− .65	− .35	1.7	1.9	6.5	2.1	.7	.7	6.0	−.2	.7	1.4
5	− .4	− .4	8.65	1.6	5.75	1.9	.85	.7	4.2	.15	.6	1.75
6	− .3	− .4	8.65	1.5	5.7	1.9	.7	.6	4.3	.4	.35	4.35
7	− .3	− .55	5.3	9.05	5.7	2.05	.6	.4	4.9	.2	.3	3.35
8	− .35	− .3	3.45	15.15	5.15	2.3	.8	.8	5.2	.05	.0	2.1
9	− .35	− .4	2.7	7.35	4.25	2.4	.8	.9	1.6	.15	.25	1.65
10	− .1	− .5	2.2	5.35	3.4	2.3	.9	.7	1.3	.05	.1	1.25
11	− .3	− .55	2.05	4.0	2.95	2.3	.7	.6	1.1	−.25	.2	1.0
12	− .3	− .4	1.85	5.65	2.45	2.45	1.2	.8	.9	−.05	1.1	.6
13	− .45	− .55	1.65	7.5	2.3	2.4	1.0	.7	.9	.0	1.7	.75
14	− .2	− .4	1.6	5.8	2.15	2.2	1.2	.8	.9	.3	.85	.45
15	− .25	.55	1.35	4.6	2.0	2.1	1.1	.7	1.05	.2	.4	.4
16	1.65	1.2	1.0	4.2	2.4	2.0	1.0	.6	1.55	−.2	.3	.4
17	2.4	.9	.6	3.9	2.9	1.9	1.1	.6	1.9	−.05	.95	.1
18	1.1	.55	.75	5.1	2.65	1.95	.7	.8	1.35	−.3	.5	.15
19	.55	.4	.8	7.55	2.4	1.8	.7	.6	2.05	.2	.3	.25
20	.25	.2	1.35	7.9	2.1	1.7	1.0	.3	1.2	.45	.1	.25
21	.1	.1	2.9	5.55	1.9	1.6	.8	.7	1.05	1.3	.45	.3
22	.1	.0	4.4	4.15	1.7	1.55	.8	.7	.9	.6	.25	.3
23	− .05	− .1	4.4	3.2	1.6	1.4	.8	.4	.9	.75	.3	.15
24	− .1	− .05	3.05	2.9	4.75	1.3	.7	.9	.6	.7	.1	.15
25	− .2	− .15	2.4	3.0	9.1	1.2	.6	.4	.7	.25	.2	.1
26	− .1	− .15	2.0	3.0	6.3	1.2	.8	.6	.35	.45	.15	.0
27	− .25	− .2	1.5	3.5	4.75	1.2	.7	.7	.1	.1	.0	.2
28	− .3	− .3	1.3	2.75	3.75	1.0	.9	.5	.45	.2	.2	.0
29	− .3	− .3	1.25	2.5	.....	1.0	.7	.5	.1	.1	.15	.0
30	− .3	− .1	2.25	2.25	.....	.95	.9	1.2	.1	.1	1.05	.2
31	− .3	.....	4.6	2.1	.....	1.0	.....	.7	.....	.1	1.4	.....

JAMES RIVER AT CARTERSVILLE, VA.

Location.—At highway bridge between Pemberton and Cartersville, Cumberland County, about 50 miles above Richmond. Willis River enters from the south about a mile above station, and Rivanna River from the north about 7 miles above.

Drainage area.—6,230 square miles.

Records available.—January 1, 1899, to September 30, 1915.

Gage.—Chain on downstream side and near Cartersville end of bridge; read twice daily by B. W. Palmore. Wire gage used previous to July 24, 1903.

Discharge measurements.—Made from bridge.

Channel and control.—Both banks high; left bank overflows at a stage of about 20 feet. Bed of stream composed of rocks and sand; changes somewhat during floods.

Extremes of discharge.—Maximum stage recorded during year: 20.6 feet at 8.30 a. m. February 4; discharge, 69,300 second-feet. Minimum stage recorded: 0.5 foot at 9.20 a. m. October 3; discharge, 800 second-feet.

Maximum stage recorded 1899–1915: 26.7 feet at 6 p. m. December 30, 1901; discharge approximately 106,000 second-feet. Minimum stage observed: 0.5 foot, October 3, 1914; discharge, 800 second-feet. A discharge of 603 second-feet (gage height 0.42 foot) was measured September 8, 1897, but gage height corresponding to this measurement is probably subject to error.

Winter flow.—Ice forms only during severe winters, but discharge relation is seldom affected thereby.

Accuracy.—Records good, except when changes in discharge relation, caused by shifting channel, have not been well determined by discharge measurements. Estimates at extremely high stages may be subject to considerable error, as discharge above point of overflow has not been accurately determined.

Discharge measurements of James River at Cartersville, Va., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 1	Mathers and Morgan	0.62	1,050
June 26	H. J. Dean	1.61	2,630

Daily discharge, in second-feet, of James River at Cartersville, Va., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	980	1,740	2,270	15,000	9,530	14,700	4,880	3,030	3,830	2,270	1,740	5,750
2	830	1,660	2,640	13,800	38,600	12,200	4,670	3,030	8,780	2,000	2,360	5,530
3	815	1,660	9,030	12,200	61,700	10,800	4,670	3,030	31,400	1,740	2,450	6,880
4	890	1,660	8,300	8,780	67,300	10,000	4,880	3,030	24,400	1,660	6,420	7,580
5	1,080	1,540	7,340	8,060	38,200	8,780	5,090	3,230	23,700	2,640	7,820	7,110
6	1,470	1,510	22,000	6,880	28,200	10,000	4,670	3,030	20,600	6,420	6,420	7,340
7	1,570	1,430	32,200	38,200	25,800	10,300	4,880	2,830	11,600	4,040	4,880	14,400
8	1,510	1,430	20,000	62,200	20,900	12,200	4,670	2,830	9,280	2,640	3,830	12,400
9	1,300	1,490	13,800	59,000	18,300	11,100	4,670	2,830	7,820	2,270	2,450	9,280
10	1,740	1,570	10,800	26,100	15,300	10,600	4,250	2,830	7,110	2,090	2,270	7,110
11	1,570	1,570	9,280	19,300	13,800	10,000	4,250	2,640	6,650	2,000	2,000	5,750
12	1,510	1,740	8,540	20,300	11,600	9,530	5,090	2,830	5,970	1,910	2,090	5,310
13	1,470	1,540	7,820	52,000	10,300	9,530	4,880	3,230	5,530	1,820	14,100	4,880
14	1,470	1,510	9,280	35,900	22,000	9,280	4,670	3,230	4,670	1,570	5,970	3,430
15	3,630	2,640	8,300	25,000	9,280	8,780	4,460	3,230	4,460	1,570	5,090	3,430
16	4,670	11,900	6,420	20,300	9,780	8,300	4,250	3,230	4,460	1,740	4,250	2,830
17	13,500	8,300	5,310	19,000	10,300	8,060	4,250	2,830	4,460	1,740	3,030	2,640
18	9,780	6,190	4,880	18,300	10,300	7,820	4,250	2,640	4,460	2,270	2,830	2,450
19	8,060	4,670	4,880	29,300	10,000	7,580	4,040	2,450	4,670	1,910	5,090	5,750
20	4,460	4,040	7,340	33,300	11,600	7,340	3,830	2,450	4,460	1,910	3,030	3,830
21	4,040	3,430	11,100	30,000	8,540	7,340	3,830	2,270	4,880	5,530	2,450	2,640
22	2,830	3,030	16,200	20,600	7,820	7,110	3,830	2,270	4,430	4,250	2,830	3,430
23	2,270	2,450	16,500	15,600	7,340	6,420	3,830	2,180	3,980	5,310	3,830	2,640
24	2,180	2,450	15,600	14,100	7,580	6,190	3,630	2,180	3,540	3,230	3,030	2,640
25	2,180	2,270	11,400	12,200	37,400	5,970	3,630	2,270	3,090	3,030	2,640	2,450
26	2,090	2,180	10,600	14,100	36,700	5,530	3,630	2,360	2,640	2,830	2,450	2,180
27	2,090	2,090	8,780	12,400	26,400	5,310	3,430	2,450	2,450	2,270	2,090	1,910
28	1,740	2,000	6,650	11,600	22,600	5,310	3,430	2,640	2,090	2,000	2,270	1,910
29	1,740	2,090	7,110	10,800	.....	5,090	3,230	2,180	2,000	2,090	3,030	2,090
30	1,740	2,000	9,280	8,780	.....	4,880	3,230	2,830	1,910	1,910	5,310	2,090
31	1,740	.....	13,000	9,030	.....	4,880	.....	3,430	.....	1,820	6,190	.....

NOTE.—Discharge determined from a rating curve well defined below 10,000 second-feet and fairly well defined between 10,000 and 40,000.

Monthly discharge of James River at Cartersville, Va., for the year ending Sept. 30, 1915.

[Drainage area, 6,230 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	13,500	815	2,800	0.449	0.52	B.
November	11,900	1,430	2,790	.448	.50	B.
December	32,200	2,270	10,500	1.69	1.95	A.
January	62,200	6,880	22,000	3.53	4.07	B.
February	67,300	7,340	21,300	3.42	3.56	B.
March	14,700	4,880	8,420	1.35	1.56	A.
April	5,090	3,230	4,230	.679	.76	A.
May	3,430	2,180	2,760	.443	.51	A.
June	31,400	1,910	7,640	1.23	1.37	A.
July	6,420	1,570	2,600	.417	.48	A.
August	14,100	1,740	4,010	.644	.74	A.
September	14,400	1,910	4,920	.790	.88	A.
The year	67,300	815	7,760	1.25	16.90	

Days of deficiency in discharge of James River at Cartersville, Va., for the year ending Sept. 30, 1915.

Discharge in second-feet.	Days of deficiency in discharge.	Discharge in second-feet.	Days of deficiency in discharge.
840	2	5,000	205
900	3	6,000	226
1,000	4	7,000	238
1,100	5	8,000	257
1,200	5	10,000	290
1,400	6	12,000	308
1,600	24	15,000	324
1,800	39	20,000	333
2,000	53	25,000	345
2,200	73	30,000	351
2,500	99	40,000	360
3,000	124	50,000	360
3,500	151	60,000	362
4,000	165	80,000	365
4,500	184		

ROANOKE RIVER BASIN.

ROANOKE RIVER AT ROANOKE, VA.

Location.—At Walnut Street highway bridge in Roanoke, Roanoke County.

Drainage area.—388 square miles.

Gage.—Chain on downstream side of Walnut Street bridge; read once daily by employees of Roanoke Railway & Electric Co. Wire gage used previous to November 28, 1903.

Records available.—July 10, 1896, to July 15, 1906; May 7, 1907, to September 30, 1915.

Discharge measurements.—Made from downstream side of Walnut Street bridge or from Jefferson Street bridge about one-third mile above. Measurement of overflow from Crystal Spring, which enters river between the two bridges, added when discharge measurements are made at Jefferson Street bridge.

Channel and control.—Bed composed of coarse gravel and small bowlders. Both banks may overflow at extreme flood stages. Control, loose bowlders; shifts slightly.

Extremes of discharge.—Maximum stage recorded during year: 9.3 feet at 8.30 a. m., December 5; discharge, 10,200 second-feet. Minimum stage recorded: 0.6 foot, October 1–4; discharge, 65 second-feet. Maximum stage recorded 1896–1915: 14.34 feet, August 6, 1901; discharge, 16,900 second-feet. Minimum stage recorded, 0.0 on gage, morning of December 23, 1909, when flow was retarded by freezing; reported that practically no water was flowing.

Winter flow.—Ice seldom forms at station but flow is sometimes retarded by freezing of headwaters.

Accuracy.—Frequent measurements necessary to adequately define rating curve at low stages. Rating curves at high stages not well defined and estimates of discharge only fair except for periods during which frequent measurements were made.

Cooperation.—Gage-height records furnished by Roanoke Railway & Electric Co., J. W. Hancock, general manager.

Daily discharge measurements of Roanoke River at Roanoke, Va., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	J. G. Mathers	0.60	63	June 24	H. J. Dean	0.88	144
3	do	.62	71				

Daily discharge, in second-feet, of Roanoke River at Roanoke, Va., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	65	89	1,130	950	512	578	290	211	338	85	104	290
2	65	89	1,330	793	5,880	512	290	211	1,050	140	117	211
3	65	89	770	578	2,670	512	290	211	1,250	123	90	719
4	65	89	550	578	1,690	450	290	248	793	132	146	1,690
5	143	89	10,200	512	1,250	450	290	248	578	140	146	2,290
6	173	89	2,520	450	1,150	647	290	211	450	248	123	1,930
7	115	89	1,540	8,300	870	793	290	211	338	146	90	870
8	89	89	1,130	2,670	793	719	290	211	290	132	85	578
9	115	89	770	1,580	719	647	290	211	248	132	85	450
10	115	89	690	1,050	647	647	290	177	248	140	85	338
11	89	89	690	793	647	719	290	177	211	117	90	290
12	89	89	550	1,810	578	647	290	211	211	112	381	248
13	89	89	490	2,050	512	578	290	290	211	117	230	211
14	115	89	550	1,360	512	578	290	211	177	117	146	870
15	143	490	375	1,050	450	512	290	177	647	117	132	392
16	1,330	206	326	870	647	512	290	177	338	132	104	290
17	620	375	326	793	578	578	290	177	338	140	146	230
18	326	242	326	1,250	512	578	290	177	248	112	132	211
19	242	206	282	1,360	512	578	248	177	211	112	132	211
20	206	173	690	1,050	450	512	248	177	211	117	85	211
21	173	173	940	870	450	512	248	177	177	132	177	211
22	143	143	1,540	647	450	450	248	146	177	132	211	211
23	143	173	940	578	392	450	248	146	146	146	132	177
24	115	143	690	578	793	392	248	177	146	211	95	146
25	143	115	620	578	1,810	392	248	177	140	152	90	146
26	115	115	550	719	1,050	338	348	146	123	117	85	146
27	115	115	490	578	870	338	248	146	123	104	70	146
28	115	115	490	578	647	338	211	146	123	95	314	177
29	115	115	490	578	.....	338	211	146	85	90	314	177
30	115	206	1,130	578	.....	290	211	512	85	85	248	177
31	89	.....	1,330	512	.....	290	.....	481	.....	90	248	.....

NOTE.—Discharge determined from two fairly well-defined rating curves, applicable Oct. 1 to Dec. 31, and Jan. 1 to Sept. 30. Discharge interpolated Apr. 12 and June 27.

Monthly discharge of Roanoke River at Roanoke, Va., for the year ending Sept. 30, 1915.

[Drainage area, 388 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,330	65	182	0.469	0.54	A.
November	490	89	145	.374	.42	A.
December	10,200	282	1,110	2.86	3.30	B.
January	8,300	450	1,180	3.04	3.51	B.
February	5,880	392	1,000	2.58	2.69	B.
March	793	290	512	1.32	1.52	B.
April	290	211	269	.693	.77	B.
May	512	146	210	.541	.62	B.
June	1,250	85	324	.835	.93	A.
July	248	85	128	.330	.38	A.
August	381	70	149	.384	.44	A.
September	2,290	146	475	1.22	1.36	B.
The year	10,200	65	472	1.22	16.48	

ROANOKE RIVER AT OLD GASTON, N. C.

Location.—At bridge of Roanoke Railway Co., at Old Gaston, Northampton County, about three-fourths mile below mouth of Indian Creek, 1¼ miles north of Thelma, N. C., and 2½ miles above mouth of Deep Creek.

Drainage area.—8,350 square miles.

Records available.—December 7, 1911, to September 30, 1915.

Gage.—Chain gage attached to outside of guard timber on downstream side of second span from right end of deck-plate girder railroad bridge of Roanoke Railway Co.; read once daily by R. A. Howell.

Discharge measurements.—Made from downstream side of bridge to which gage is attached. Measuring section broken by 11 bridge piers.

Channel and control.—Channel fairly permanent; point of control, about 1 mile below gage, is of rock and probably permanent. Left bank overflows in extreme floods, but a fair determination can be made of the overflow discharge around the bridge.

Extremes of discharge.—Maximum stage recorded during year: 10.7 feet, January 10; discharge, 72,300 second-feet. Minimum stage recorded: 0.95 foot, October 1; discharge, 790 second-feet.

Maximum stage recorded 1911–1915: 16.6 feet at 7 a. m., March 18, 1912; discharge, 210,000 second-feet. Minimum stage recorded: 0.95 foot at 6 a. m., October 1, 1914; discharge, 790 second-feet.

Flood of 1877 highest known in this locality. No definite marks preserved at Old Gaston, but from authentic information regarding the crest height as observed in 1877, the approximate height has been determined as about 19 feet, referred to present gage datum. The corresponding discharge is about 275,000 second-feet.

Winter flow.—Ice sometimes forms to considerable thickness at this station, but the discharge relation is seldom affected thereby.

Regulation.—Persons engaged in the operation of power plants at Roanoke Rapids and Weldon have observed on Tuesday or Wednesday during periods of low water a trough probably due to the weekly shutdown of large power plants farther upstream.

Accuracy.—Rating curve believed to be reliable and results excellent.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Roanoke River at Old Gaston, N. C., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	790	2,360	2,160	27,400	9,060	11,900	5,500	4,260	5,140	2,620	3,410	17,900
2	915	2,160	2,020	20,600	15,300	9,960	5,870	4,430	11,400	2,310	3,250	13,000
3	1,130	1,370	6,240	14,700	56,400	9,060	6,620	4,780	53,300	2,160	2,770	11,900
4	900	1,250	10,900	10,900	57,500	8,210	8,630	4,080	60,800	2,620	11,900	9,060
5	915	2,160	8,210	9,960	38,800	8,210	11,900	4,430	60,800	2,770	14,700	28,200
6	915	2,160	8,210	9,060	21,400	8,210	13,000	4,780	17,900	3,410	9,960	16,600
7	1,130	2,020	40,600	9,960	15,900	15,900	11,900	4,260	13,000	3,910	11,400	26,600
8	5,140	2,360	35,100	41,600	14,200	13,600	10,900	4,780	5,140	6,240	5,870	20,600
9	3,090	1,880	15,300	57,500	11,900	17,900	9,960	5,140	4,430	5,500	4,430	12,500
10	2,620	2,360	10,900	72,300	10,900	15,300	8,210	6,240	6,620	4,780	3,090	10,900
11	2,460	2,360	9,060	38,800	9,960	12,500	5,870	5,870	5,870	3,410	2,160	7,400
12	2,020	2,460	8,210	14,700	9,060	10,900	7,010	6,240	4,780	2,770	3,740	6,620
13	1,250	2,360	8,210	46,400	9,060	9,500	9,960	5,140	4,960	2,460	26,600	6,240
14	1,500	2,360	9,060	53,300	8,210	9,060	9,960	5,320	4,080	3,090	38,800	4,260
15	915	2,620	14,700	35,100	4,780	8,630	9,060	5,870	3,740	2,770	10,400	5,320
16	5,870	6,620	11,900	20,600	9,060	7,800	8,210	4,780	5,500	3,410	7,400	4,260
17	8,210	9,960	9,500	14,700	10,900	8,630	6,620	4,260	4,430	3,250	5,870	3,740
18	21,400	11,900	8,210	11,900	10,900	9,960	8,210	4,780	4,780	2,460	5,140	4,260
19	10,900	10,900	7,400	30,700	9,960	8,210	7,400	3,740	5,870	2,310	8,630	2,620
20	6,620	5,870	5,870	36,000	8,630	9,060	4,960	3,580	4,430	3,250	6,620	3,250
21	5,140	3,740	6,620	26,600	8,210	7,400	4,430	900	3,740	3,090	5,870	2,930
22	3,410	3,410	11,400	17,900	7,400	8,210	5,140	3,580	3,740	3,740	7,400	3,580
23	2,460	2,930	13,000	13,600	7,400	6,620	4,780	2,620	3,580	5,320	14,200	3,250
24	2,620	2,460	13,000	9,960	7,400	7,800	4,430	3,580	3,410	5,140	9,960	3,090
25	2,310	2,310	11,900	10,900	13,600	7,400	5,500	3,250	2,930	4,080	7,010	2,770
26	2,160	2,930	19,200	13,600	33,300	6,620	4,780	3,580	2,770	3,090	5,140	2,160
27	2,460	2,770	28,200	14,200	27,400	4,780	4,600	3,410	2,620	2,930	3,250	2,770
28	2,930	2,770	20,600	13,000	15,300	6,620	5,320	1,020	2,460	2,460	2,620	2,930
29	2,770	2,770	14,200	10,900	.....	4,780	4,600	3,740	2,310	2,460	22,800	2,620
30	2,460	2,620	19,900	9,960	.....	4,080	4,600	6,620	1,750	2,310	35,100	2,160
31	2,360	.....	34,200	9,060	.....	6,620	.....	7,400	.....	2,020	26,600	.....

NOTE.—Discharge determined from a rating curve well defined below 33,300 second-feet, and fairly well defined up to 181,000 second-feet.

Monthly discharge of Roanoke River at Old Gaston, N. C., for the year ending Sept. 30, 1915.

[Drainage area, 8,350 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	21,400	790	3,540	0.424	0.49	A.
November	11,900	1,250	3,540	.424	.47	A.
December	40,600	2,020	13,700	1.64	1.89	A.
January	72,300	9,060	23,400	2.80	3.23	A.
February	57,500	4,780	16,500	1.98	2.06	A.
March	17,900	4,080	9,140	1.09	1.26	A.
April	13,000	4,430	7,260	.870	.97	A.
May	7,400	900	4,400	.527	.61	A.
June	60,800	1,750	10,500	1.26	1.41	A.
July	6,240	2,020	3,300	.395	.46	A.
August	38,800	2,160	10,500	1.26	1.45	A.
September	28,200	2,160	8,120	.973	1.09	A.
The year	72,300	790	9,460	1.13	15.39	

PEEDEE RIVER BASIN.

YADKIN RIVER AT DONNAHA, N. C.

Location.—At toll bridge in Donnaha on road between Donnaha and East Bend, N. C., about a quarter of a mile west of Donnaha railway station, and about 6 miles downstream from mouth of Ararat River, which enters from the left; about 60 miles upstream from gaging station at Salisbury, N. C.

Drainage area.—1,600 square miles.

Records available.—April 11, 1913, to September 30, 1915.

Gage.—Vertical gage in four sections on left bank 150 feet downstream from left end of toll bridge; read twice daily by J. F. Goolsby.

Discharge measurements.—Made from three-span toll bridge with two piers in stream and two on banks. Bridge has steel trestle approaches at both ends. Flood water confined under bridge except during extreme floods above about 28 feet.

Channel and control.—Channel sand and bedrock; probably permanent. Current slightly obstructed by two old steel trusses lying about 150 and 400 feet, respectively, below bridge; obstructions probably permanent. Control, a rock ledge extending across river and forming a shoal about 450 feet below gage.

Extremes of discharge.—Maximum stage recorded during year: 20.4 feet at 7 a. m. January 7; discharge, approximately 26,700 second-feet, based on extension of rating curve. Minimum stage recorded: 4.7 feet at 6 p. m. October 1, 8 a. m. and 6 p. m. October 2 and 3, 8 a. m. October 10 and 12, and 6 p. m. October 14; discharge, 720 second-feet.

Maximum stage recorded 1913–1915: 20.4 feet at 7 a. m. January 7, 1915; discharge, approximately 26,700 second-feet. Minimum stage recorded: 4.65 feet at 4 p. m. September 30, 1914; discharge, 678 second-feet.

Winter flow.—Discharge relation not affected by ice.

Regulation.—None except a few small mill dams on tributaries.

Accuracy.—Results good for medium and ordinary low stages.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Yadkin River at Donnaha, N. C., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	815	1,050	11,000	2,470	2,770	3,070	2,170	1,880	2,770	1,460	1,050	2,030
2	720	1,050	11,200	2,470	2,770	3,070	2,170	1,880	6,950	1,460	1,180	1,600
3	720	1,050	6,950	2,470	3,370	2,920	2,170	1,880	3,370	1,460	2,030	1,600
4	6,270	1,050	6,610	2,470	6,270	2,920	2,170	2,030	1,600	1,460	1,320	1,600
5	5,290	1,050	20,200	2,170	5,290	2,770	2,170	2,030	1,600	1,600	1,180	5,290
6	1,600	1,050	6,440	4,960	4,000	2,770	2,170	1,880	2,170	1,600	1,050	4,640
7	1,320	1,050	4,800	17,800	3,680	3,680	2,170	1,880	1,880	1,600	1,050	2,030
8	1,050	925	4,640	7,120	3,370	3,680	2,170	2,170	1,880	1,600	1,050	1,600
9	815	1,050	4,320	4,160	3,370	3,370	2,170	2,170	1,740	1,600	1,050	1,600
10	815	1,050	4,160	2,470	3,220	3,070	2,030	2,030	1,740	1,600	1,050	1,320
11	815	1,050	3,680	3,370	3,070	2,920	2,170	1,880	1,600	1,600	1,050	1,320
12	815	1,050	3,070	7,970	2,920	2,770	2,770	2,170	1,600	1,600	3,680	1,320
13	1,050	1,050	2,920	4,640	2,770	2,770	2,320	2,170	1,600	1,460	3,370	1,320
14	815	1,050	2,770	4,000	2,770	2,770	2,170	1,880	1,460	1,320	3,220	1,320
15	1,050	2,470	2,770	3,370	2,920	2,620	2,170	1,880	1,460	1,320	3,070	1,180
16	12,700	4,960	4,800	3,370	4,320	2,620	2,170	1,880	1,460	1,320	2,770	1,050
17	4,320	2,470	5,290	4,000	3,680	2,620	2,170	1,880	1,600	1,320	2,470	1,050
18	2,770	1,880	7,630	5,450	3,370	2,620	2,170	1,740	1,740	1,320	2,170	1,050
19	1,880	1,740	5,940	8,480	3,370	2,470	2,030	1,740	1,880	1,320	1,740	1,050
20	1,050	1,600	3,680	4,320	3,220	2,470	2,030	1,740	1,740	1,320	1,880	1,180
21	1,320	1,600	2,770	3,370	3,220	2,320	2,030	1,740	1,740	1,320	4,960	1,600
22	1,320	1,460	3,070	3,070	3,370	2,320	2,030	1,880	1,600	1,180	2,770	1,460
23	1,180	1,320	2,770	2,920	3,370	2,320	2,030	1,880	1,600	1,180	2,170	1,320
24	1,050	1,320	3,070	2,770	4,160	2,320	2,030	2,620	1,460	1,050	1,880	1,320
25	1,050	1,320	3,370	2,770	6,780	2,320	2,030	1,880	1,460	1,050	1,600	1,320
26	1,050	1,320	3,370	2,770	4,800	2,320	2,030	1,880	1,460	1,050	1,460	1,320
27	925	1,180	3,070	6,440	4,000	2,320	2,030	1,880	1,320	1,050	4,000	1,320
28	1,050	1,180	2,770	6,950	3,370	2,320	2,030	1,880	1,320	1,050	4,000	1,320
29	1,050	1,600	2,770	4,320	.....	2,320	2,030	1,880	1,320	1,050	2,770	1,320
30	1,050	2,920	2,770	4,000	.....	2,320	2,170	2,170	1,320	1,050	4,800	1,320
31	1,050	.....	2,770	3,070	.....	2,170	.....	2,470	.....	1,050	3,070	.....

NOTE.—Daily discharge determined from a rating curve well defined between 1,000 and 4,000 second-feet; below 1,000 second-feet the curve is based on a fairly accurate determination of the point of zero flow; above 5,000 second-feet it is approximate, and discharge estimates should be used with caution.

Monthly discharge of Yadkin River at Donnaha, N. C., for the year ending Sept. 30, 1915.

[Drainage area, 1,600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	12,700	720	1,900	1.19	1.37	B.
November	4,960	925	1,500	.938	1.05	A.
December	20,200	2,770	5,010	3.13	3.61	C.
January	17,800	2,170	4,520	2.82	3.25	B.
February	6,780	2,770	3,700	2.31	2.40	B.
March	3,680	2,170	2,690	1.68	1.94	A.
April	2,770	2,030	2,140	1.34	1.50	A.
May	2,620	1,740	1,970	1 23	1.42	A.
June	6,950	1,320	1,880	1.18	1.32	A.
July	1,600	1,050	1,340	.838	.97	A.
August	4,960	1,050	2,290	1.43	1.65	B.
September	5,290	1,050	1,630	1.02	1.14	A.
The year	20,200	720	2,540	1.59	21.62	

YADKIN RIVER NEAR SALISBURY, N. C.

Location.—At highway bridge known as the Piedmont Toll Bridge, 1,000 feet above Southern Railway bridge, 6 miles east of Salisbury, and about 5 miles below mouth of South Yadkin River.

Drainage area.—3,400 square miles.

Records available.—September 24, 1895, to December 31, 1909; September 1, 1911, to September 30, 1915.

Gage.—Standard chain gage attached to highway bridge; read twice daily by J. T. Yarbrough. From the date of establishment to May 31, 1899, the gage was at the Southern Railway bridge, and from the latter date it was at the highway bridge until moved back to the railroad bridge early in 1903, where it remained until the end of 1905. Since January 1, 1906, the gage has been at the highway bridge at the datum originally established there in 1899. The last gage at the railroad bridge read the same as the gage at the highway bridge at gage height 3.2 feet, but not for higher and lower stages. Datum of the original gage at the railroad bridge somewhat uncertain.

Discharge measurements.—Made from highway bridge. During the time that gage was at railroad bridge most of the measurements were made from that bridge.

Channel and control.—Channel wide and rather rough; control, a rock ledge about 500 feet below bridge, extending entirely across river.

Extremes of discharge.—Maximum stage recorded during year: 12.8 feet at 7 a. m. January 8; discharge, 58,600 second-feet. Minimum stage recorded: 1.65 feet at 7 a. m. October 1 and 2; discharge, 1,080 second-feet.

Maximum stage recorded 1895–1915: 18.8 feet, March 20, 1899; discharge, 115,000 second-feet. Minimum stage recorded: 1.2 feet, September 20, October 5, November 22 and 26, 1897; discharge, 900 second-feet.

Winter flow.—Discharge relation little, if at all, affected by ice.

Regulation.—Flow during low stages may be slightly affected by developed powers on the river and tributaries above.

Accuracy.—Owing to fact that station has an excellent natural control, the rating curve for low and medium stages is good.

The following discharge measurement was made by Warren E. Hall:
September 23, 1915: Gage height, 2.21 feet; discharge, 2,260 second-feet.

Daily discharge, in second-feet, of Yadkin River near Salisbury, N.C., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,250	1,940	9,580	7,210	5,050	5,740	4,090	3,210	14,400	2,170	1,690	8,770
2	1,300	2,170	18,700	5,740	19,200	5,390	4,400	3,070	32,800	2,540	3,640	6,460
3	1,250	1,940	15,800	5,050	23,200	5,050	4,400	3,500	23,800	2,660	3,640	4,240
4	1,380	1,940	11,300	4,400	12,200	5,050	5,050	3,500	9,990	2,290	5,390	3,940
5	13,000	1,840	35,300	4,240	8,370	5,050	4,240	3,500	6,460	3,360	5,050	11,700
6	7,980	1,730	50,200	4,720	7,210	8,770	4,090	3,070	4,400	4,400	3,070	22,700
7	3,790	1,730	22,200	39,300	7,210	9,580	4,090	4,090	4,400	3,790	2,060	12,600
8	2,410	1,730	10,400	54,400	6,460	7,590	4,090	8,370	3,940	3,070	1,840	6,460
9	1,940	2,170	7,210	18,200	5,740	6,460	4,090	7,210	4,400	3,640	1,840	4,720
10	1,730	2,060	7,210	8,770	5,390	5,740	3,790	4,400	3,500	3,210	1,730	3,940
11	1,730	1,840	6,830	7,210	5,050	5,390	3,500	3,500	3,210	3,070	1,730	3,360
12	2,800	1,730	5,390	12,200	5,050	5,050	5,050	3,500	2,660	2,290	2,800	3,360
13	2,930	1,940	5,050	20,700	4,720	5,050	5,050	4,240	3,640	2,290	5,390	3,640
14	3,500	1,690	9,170	12,200	4,720	4,400	4,090	4,090	3,500	2,540	3,790	3,070
15	5,740	2,930	7,590	7,980	4,720	4,720	3,640	3,070	3,070	2,540	6,830	3,070
16	14,400	7,210	5,050	6,460	6,100	4,400	3,640	2,930	3,360	2,060	5,390	2,800
17	26,400	6,460	3,790	6,100	7,210	4,720	3,640	3,210	5,050	1,840	3,210	2,410
18	8,770	3,790	3,940	13,500	5,740	5,050	3,500	2,930	4,720	2,170	3,790	2,540
19	4,240	2,930	3,790	23,800	5,050	4,400	3,790	2,930	3,640	2,290	2,930	2,290
20	3,210	2,660	3,790	18,700	5,050	4,400	3,210	2,800	2,800	2,290	2,930	2,540
21	2,930	2,410	4,720	10,400	4,400	4,240	3,500	3,070	2,800	3,070	10,800	2,290
22	2,540	2,410	5,390	7,590	4,400	4,400	3,210	2,930	2,540	3,070	18,200	2,170
23	2,410	2,660	4,720	6,830	4,400	4,400	3,500	2,930	2,410	3,070	7,210	2,060
24	2,170	2,410	4,240	6,100	7,210	4,090	3,360	5,740	2,410	2,540	3,500	1,940
25	2,930	2,290	9,580	6,100	24,800	4,090	3,360	5,740	2,060	2,060	2,800	1,940
27	3,210	2,170	31,600	6,100	14,400	4,090	3,360	3,790	2,060	2,060	2,410	1,940
28	3,210	1,940	24,800	5,740	8,770	3,790	3,210	3,500	2,170	1,630	8,770	2,170
28	2,930	1,940	9,580	5,390	6,830	3,790	3,210	3,500	2,290	1,690	32,800	1,940
29	2,290	2,170	7,980	5,050	.....	4,090	3,070	4,720	2,060	1,630	19,200	2,170
30	2,170	2,410	14,900	5,050	.....	4,090	3,070	4,720	2,170	1,630	11,700	2,410
31	2,060	.....	11,700	4,720	.....	3,940	.....	5,050	.....	1,630	10,400	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 22,000 second-feet.

Monthly discharge of Yadkin River near Salisbury, N. C., for the year ending Sept. 30, 1915.

[Drainage area, 3,400 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	26,400	1,250	4,470	1.31	1.51	B.
November	7,210	1,690	2,510	.738	.82	A.
December	50,200	3,790	12,000	3.53	4.07	B.
January	54,400	4,240	11,300	3.32	3.83	B.
February	24,800	4,400	8,170	2.40	2.50	B.
March	9,580	3,790	5,060	1.49	1.72	A.
April	5,050	3,070	3,810	1.12	1.25	A.
May	8,370	2,800	3,960	1.16	1.34	A.
June	32,800	2,060	5,560	1.64	1.83	B.
July	4,400	1,630	2,540	.747	.86	A.
August	32,800	1,690	6,340	1.86	2.14	B.
September	22,700	1,940	4,520	1.33	1.48	A.
The year	54,400	1,250	5,850	1.72	23.35	

Days of deficiency in discharge of Yadkin River near Salisbury, N. C., for the year ending Sept. 30, 1915.

Discharge in second-feet.	Days of deficient discharge.	Discharge in second-feet.	Days of deficient discharge.	Discharge in second-feet.	Days of deficient discharge.
1,400	4	3,500	145	9,000	318
1,600	4	3,800	182	11,000	328
1,800	19	4,200	200	15,000	342
2,000	35	4,600	224	20,000	349
2,300	68	5,000	237	25,000	357
2,600	87	5,500	268	30,000	358
2,900	98	6,000	277	40,000	363
3,200	126	7,000	293	60,000	365

EDISTO RIVER BASIN.

FOUR HOLE CREEK NEAR RIDGEVILLE, S. C.

Location.—At Horseford's bridge, about 3½ miles west of Ridgeville, and about 5 miles upstream from mouth of creek.

Drainage area.—600 square miles.

Records available.—November 16, 1914, to September 30, 1915.

Gages.—Gage No. 1, which is the upper gage, is a Gurley printing water-stage recorder on left bank about 200 feet downstream from Horseford's bridge. Gage No. 2 is a Stevens water-stage recorder about 150 feet downstream from Harley's bridge and about 5 miles below gage No. 1; both gages set at same datum. See "Determination of flow."

Discharge measurements.—Made from Horseford's bridge during medium and high stages; low-water measurements made by wading.

Channel and control.—Bottom hard; both banks low and flat, overgrown with dense brush and trees. Low-water flow confined to one channel at gage No. 1. For stages above gage height about 13 feet (gage No. 1) the water flows in three channels and when the stage exceeds gage height about 17 feet the stream spreads over the swamps beyond both banks. No flow past gage No. 1 when the stage at that gage falls below 9.8 feet.

During the greater part of the year the discharge relation at gage No. 1, as determined by the natural control below this gage, is affected by backwater from Edisto River, to which Four Hole Creek is tributary.

Determination of flow.—Estimates of flow computed according to the method outlined in Water-Supply Paper 345–E.[1] Individual discharge measurements, unless proper corrections are made for the slope in the water surface at the time of each measurement, plot very discordantly. These measurements, however, develop a well-defined rating curve called the "normal curve" when the discharge is corrected to correspond to that which would occur for a normal slope. This normal rating curve has been used in the determination of estimates of daily flow, the discharge for any given day as determined from this curve being corrected to correspond to the slope in the water surface as obtained from the gage heights at gages Nos. 1 and 2. This method of computing the daily flow takes into proper account any variation in backwater caused by Edisto River. It should be noted that, since the point of zero flow for gage No. 1 is at 9.8 feet, the discharge relation for this gage as determined by its natural control is not affected by backwater when the stage falls below about 10 feet at gage No. 2.

[1] Hall, M. R., Hall, W. E., and Pierce, C. H., A method of determining the daily discharge of rivers of variable slope: U. S. Geol. Survey Water-Supply Paper 345, pp. 53–65, 1915.

Extremes of discharge.—Maximum stage during year (water-stage recorder): 22.12 feet (gage No. 1) at 4 p. m. January 24; discharge, 9,450 second-feet. Minimum stage recorded: 10.01 feet (gage No. 1) from 8. p. m. July 31 to 2 a. m. August 3; discharge, 5.1 second-feet.

Accuracy.—Records good for periods when both water-stage recorders were running. Estimates for periods when gage No. 1 was not running are considered fair.

Discharge measurements of Four Hole Creek near Ridgeville, S. C., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height,[a] in feet.		Discharge.	Date.	Made by—	Gage height,[a] in feet.		Discharge.
		Gage No. 1.	Gage No. 2.				Gage No. 1.	Gage No. 2.	
				Sec.-ft.					*Sec.-ft.*
Nov. 12	Hall and Eason	11.03	.....	39.6	Mar. 12	F. G. Eason	15.96	12.95	529
16	do	15.57	.....	457	18	do	15.88	12.26	541
28	Eason and Varner	14.54	.....	321	27	do	13.60	10.60	217
Dec. 9	do	13.52	.....	198	May 15	W. E. Hall and Eason	19.96	17.44	2,510
Jan. 7	M. R. Hall and Eason	16.68	.....	656	29	F. G. Eason	16.44	11.53	656
9	do	17.58	14.64	919	July 19	W. E. Hall and Eason	10.27	8.13	10.5
14	Eason and Varner	18.38	16.03	1,240	28	F. G. Eason	10.06	7.85	6.7
20	do	20.78	19.20	3,360	Aug. 26	do	13.70	11.25	220
Feb. 26	Warren E. Hall	17.58	14.22	940	Sept. 30	M. R. Hall and Eason	10.28	7.59	12.1
27	Hall and Eason	17.59	14.11	971					

[a] See "Gage" in station description.

Daily discharge, in second-feet, of Four Hole Creek near Ridgeville, S. C., for the year ending Sept. 30, 1915.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	308	465	2,030	890	228	73	1,080	86	5.1	535
2	.....	296	467	2,090	829	240	60	1,810	86	5.1	552
3	.....	277	468	2,250	763	315	52	2,110	86	6.6	481
4	.....	255	477	2,110	692	400	46	2,320	110	15	427
5	.....	241	488	1,970	648	460	39	2,210	183	29	393
6	.....	232	513	1,950	639	490	34	1,960	285	34	357
7	.....	225	628	1,960	616	526	30	1,670	349	26	299
8	.....	218	860	1,940	637	560	32	1,370	369	20	249
9	.....	214	927	1,940	588	582	36	1,150	352	18	202
10	.....	212	856	1,940	566	594	37	969	328	7.3	165
11	.....	213	796	1,860	536	588	54	807	267	9.1	170
12	.....	217	884	1,670	511	586	624	684	195	13	255
13	.....	228	1,180	1,560	503	594	1,590	595	124	35	308
14	.....	257	1,340	1,360	509	596	2,520	562	72	178	337
15	.....	279	1,320	1,150	512	566	2,770	552	49	298	340
16	457	290	1,470	1,040	566	526	3,900	542	32	534	299
17	416	293	1,610	1,010	538	479	5,990	512	22	785	234
18	375	285	1,960	977	552	426	5,270	480	14	919	176
19	356	274	2,910	896	518	399	3,990	326	12	926	131
20	354	266	3,460	810	477	347	3,130	248	11	822	100
21	348	260	4,880	749	431	310	2,790	190	12	664	77
22	327	253	7,030	725	372	264	2,430	154	10	525	62
23	298	246	8,500	729	340	227	2,070	140	8.7	450	42
24	279	240	9,210	766	301	194	1,700	108	8.3	353	30
25	287	243	8,990	844	267	166	1,350	86	7.9	275	22
26	308	283	7,490	964	240	145	1,120	83	7.8	220	17
27	325	310	5,780	1,020	225	124	887	81	7.5	202	14
28	325	336	4,330	950	213	108	735	76	7.4	258	11
29	316	358	3,170	.....	202	93	738	79	10	334	9.6
30	315	401	2,410	.....	191	81	792	82	8.8	379	9.8
31	.....	443	2,220	.....	203	.....	919	.....	6.1	475	.....

NOTE.—Daily discharge determined from a rating curve well defined between 5 and 5,000 second-feet except for periods noted below when gage No. 1 was not running, and determinations were made from records for gage No. 2: Feb. 6–11; Fed. 28 to Mar. 5; Mar. 15–17 and 19–21; Apr. 1–4, 6–11, 13–17, 22, 23, and 25–30; May 1–14 and 31; June 1, 24–30; July 1–18, 20–27; Aug. 20 and 21; Sept. 3 and 4. See "Determination of flow."

Monthly discharge of Four Hole Creek near Ridgeville, S. C., for the year ending Sept. 30, 1915.

[Drainage area, 600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
November 16–30	457	279	339	0.565	0.32	B.
December	443	212	273	.455	.52	B.
January	9,210	465	2,810	4.68	5.40	B.
February	2,250	725	1,400	2.33	2.43	B.
March	890	191	486	.810	.93	B.
April	596	81	374	.623	.70	C.
May	5,990	30	1,480	2.47	2.85	B.
June	2,320	76	768	1.28	1.43	B.
July	369	6.1	101	.168	.19	C.
August	926	5.1	285	.475	.55	B.
September	552	9.6	210	.350	.39	B.

SAVANNAH RIVER BASIN.

TALLULAH RIVER AT MATHIS, GA.

Location.—About a quarter of a mile southeast of Lakemont (formerly called Mathis) station on the Tallulah Falls Railway, about 900 feet below mouth of Tiger Creek, about 1 mile below the Rabun (formerly called Mathis) storage dam of the Georgia Railway & Power Co., and about 5 miles upstream from Tallulah Falls, Ga., where a station was formerly located.

Drainage area.—186 square miles.

Records available.—October 31, 1912, to September 30, 1915.

Gage.—Vertical staff in eight sections on left bank, 900 feet below mouth of Tiger Creek, installed March 27, 1913, to replace original gage, 400 feet upstream, washed out March 16, 1913; read twice daily by Miles Phillips. Low-water stages hard to read because of silt which collects around lower sections of gage.

Discharge measurements.—Made from a rough railroad trestle 400 feet upstream. A good cable is soon to be erected about 700 feet upstream.

Channel and control.—Channel composed of sand, gravel, and bowlders. A good control which has remained permanent is formed by a gravel and bowlder shoal 150 feet downstream from gage.

Extremes of discharge.—Maximum stage recorded during year: 5.0 feet at 6 p. m. January 6; discharge, 2,790 second-feet. Minimum stage recorded: 0.1 foot at several times during July, August, and September; discharge, approximately 38 second-feet.

Maximum stage recorded 1913–1915: 8.5 feet about 4 a. m. March 27, 1913; discharge, 8,970 second-feet. Minimum stage recorded: 0.1 foot at several times during July, August, and September, 1915; discharge, approximately 38 second-feet. This low stage was caused by shutting off of stream flow by Rabun dam.

Winter flow.—Discharge relation not affected by ice.

Regulation.—Since January 1, 1915, considerable diurnal fluctuation has been caused by the Rabum (first called Mathis) Dam, which was put in formal operation May 12, 1915. Operation of small mills on Tiger Creek also causes slight fluctuation.

Accuracy.—Gage heights from October 1 to December 5 represent mean of two readings daily. From December 6 to August 20 the mean gage records were obtained from five readings daily, as follows: 6 a. m., 7 a. m., noon, 6 p. m., and 7 p. m. After August 20 an additional reading was taken at midnight, and the accuracy of the records was greatly increased. Rating curve excellent. No discharge measurements were made during the year.

Daily discharge, in second-feet, of Tallulah River at Mathis, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	98	98	820	930	2,300	449	408	193	1,050	660	98	318
2	61	72	930	660	2,050	1,170	408	89	765	560	610	377
3	492	98	1,240	560	1,970	1,170	408	182	765	449	470	585
4	233	164	2,480	560	1,810	1,170	277	515	377	449	300	245
5	61	164	2,130	560	1,730	1,240	204	515	239	710	388	85
6	57	204	1,970	1,810	1,050	1,170	204	515	470	710	270	307
7	224	122	1,890	538	875	1,170	204	361	428	449	227	321
8	218	164	990	350	1,050	1,110	182	142	515	470	85	660
9	129	164	930	1,170	990	1,110	118	110	408	470	332	560
10	129	350	610	1,050	820	1,050	118	150	380	428	538	449
11	159	264	280	1,660	820	377	118	221	365	470	254	267
12	129	89	560	2,050	875	388	127	470	346	820	339	85
13	118	98	1,380	1,970	875	408	185	515	354	538	358	1,170
14	152	169	1,240	1,730	1,050	428	274	710	354	660	193	311
15	2,050	248	560	710	1,110	449	267	660	515	449	57	354
16	1,660	129	560	1,110	1,450	1,170	287	492	408	408	207	343
17	1,450	118	428	1,380	1,050	610	164	492	388	174	242	990
18	233	248	280	1,970	875	428	108	470	408	108	274	408
19	80	297	560	2,050	875	875	108	388	332	765	277	75
20	350	118	710	1,730	610	325	470	538	157	610	145	930
21	1,450	118	660	710	280	1,110	492	449	248	765	118	820
22	204	64	428	373	820	820	449	449	361	610	102	990
23	449	190	492	765	1,450	408	377	449	820	538	314	1,170
24	280	118	492	1,660	1,970	408	339	428	820	212	318	765
25	98	177	470	1,890	1,310	388	112	428	492	82	201	515
26	314	169	270	1,450	1,050	388	201	428	388	875	185	314
27	428	264	182	1,310	610	408	294	408	147	710	207	1,110
28	492	264	157	930	449	408	492	408	610	930	122	1,590
29	145	710	218	765	.....	428	585	428	538	820	114	1,240
30	72	1,520	196	710	.....	875	710	388	990	710	287	990
31	314	.....	177	710	.....	875	.....	428	.....	332	261	.....

NOTE.—Daily discharge determined from rating curve well defined above and approximate below 150 second-feet. Seven discharge measurements made subsequent to September 30, 1915, check the rating curve.

Monthly discharge of Tallulah River at Mathis, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 186 square miles.][a]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	2,050	57	397	C.
November	1,520	64	232	C.
December	2,480	157	784	B.
January	2,050	350	1,160	B.
February	2,300	280	1,150	B.
March	1,240	325	735	B.
April	710	108	290	B.
May	710	89	401	B.
June	1,050	147	481	B.
July	930	82	546	B.
August	610	57	255	B.
September	1,590	75	611	A.
The year	2,480	57	584	

[a] "Second-feet per square mile" and "Run-off (depth in inches)" not published because the regulation caused by the Rabun storage dam a mile upstream would render such figures misleading.

ALTAMAHA RIVER BASIN.

OCMULGEE RIVER NEAR JACKSON, GA.

Location.—At Pittmans Ferry, 1½ miles below dam and power plant of Central Georgia Power Co., and 8 miles southeast of Jackson, half a mile above mouth of Yellow Water Creek, and a short distance below Heards Creek.

Drainage area.—1,400 square miles.

Records available.—May 18, 1906, to September 30, 1915.

Gage.—Vertical staff in three sections on right bank at upstream side of ferry landing; read by C. A. Pittman twice daily to half-tenths.

Discharge measurements.—Made at ferry, either from ferry or from a small boat held in place by ferry cable.

Channel and control.—Bed of river sandy; shifts considerably. Shifting has little if any effect upon discharge relation, as control is a rocky ledge about 400 feet below gage. Point of zero flow is at gage height about 2.75 feet.

Extremes of discharge.—Maximum stage recorded during year: 11.1 feet at 4 p. m., December 5; discharge, 14,300 second-feet. Minimum stage recorded: 3.9 feet at 5 a. m., August 15; discharge, 320 second-feet.

Maximum stage recorded 1906–1915: 20.75 feet at 6 p. m., March 16, 1912; discharge, 34,700 second-feet. Minimum stage recorded: 2.78 feet, November 20, 1910; discharge, 18 second-feet; this low stage was due to cutting off of water at the dam about 1½ miles upstream.

Regulation.—Flow at low stages since 1911 greatly affected by operation of power plant of Central Georgia Power Co.

Accuracy.—On account of diurnal fluctuations in the stage caused by operation of power plant estimates of flow as determined from the mean daily gage height obtained from two readings per day may be considerably in error.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Ocmulgee River near Jackson, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,330	858	8,380	3,870	2,840	3,260	1,080	518	6,740	618	430	1,080
2	1,620	1,080	5,510	2,840	4,690	2,640	925	470	5,510	1,080	858	1,000
3	1,240	790	4,280	2,230	4,690	2,540	790	766	4,280	925	925	1,000
4	390	790	9,200	2,020	4,080	2,540	565	670	2,540	925	858	858
5	858	925	14,200	2,020	3,460	3,460	1,240	730	925	4,280	925	565
6	1,000	1,080	11,700	2,230	3,460	3,460	1,160	766	565	5,100	670	925
7	858	730	7,150	2,540	3,050	4,690	1,160	898	1,330	3,460	649	1,000
8	858	565	4,690	3,660	3,460	4,280	1,520	7,760	3,260	1,240	430	858
9	925	1,240	3,460	3,050	2,840	3,660	1,620	7,560	2,330	858	730	790
10	518	1,080	2,640	2,230	3,050	3,050	1,240	4,690	1,080	925	790	790
11	430	1,240	2,230	3,050	2,540	2,540	1,000	3,050	670	1,820	670	925
12	790	1,240	2,230	3,660	2,540	2,540	1,520	5,100	565	1,820	858	518
13	1,000	1,160	1,720	3,870	2,130	2,230	1,720	8,180	565	1,420	858	1,080
14	1,330	1,080	2,640	3,460	1,520	2,230	1,520	7,360	1,720	1,330	670	1,080
15	2,440	790	2,540	3,050	3,050	2,330	1,420	4,900	2,230	1,080	390	925
16	1,920	9,000	2,440	2,640	3,460	2,230	1,420	3,460	2,020	730	790	858
17	565	5,920	2,330	2,330	3,660	2,440	1,420	2,840	1,720	925	858	925
18	390	3,260	2,130	6,330	3,460	1,920	858	1,330	1,720	518	1,080	618
19	1,420	2,020	1,080	6,330	2,840	1,820	1,620	1,240	565	790	925	430
20	1,420	1,520	670	4,690	2,440	1,820	565	1,240	518	858	4,480	925
21	1,330	1,160	1,820	4,080	1,820	1,330	565	1,720	1,000	1,420	3,050	925
22	1,080	858	1,820	3,050	2,440	2,020	518	649	618	790	2,230	790
23	1,080	1,000	1,720	2,440	2,540	2,130	1,000	618	670	670	1,620	1,080
24	730	1,420	1,720	2,230	2,740	1,920	565	817	694	649	1,000	1,330
25	925	1,420	1,240	6,940	4,480	1,920	565	1,080	858	430	1,000	858
26	858	858	1,080	6,330	5,100	1,820	790	858	858	670	1,000	390
27	925	1,000	2,230	4,690	3,460	1,420	858	858	470	1,160	1,330	730
28	925	1,160	3,260	3,870	2,840	1,330	790	858	730	730	470	1,080
29	1,000	730	3,050	3,460	.....	1,720	790	565	790	730	730	1,080
30	790	9,200	6,330	2,740	.....	1,330	518	858	670	1,000	925	1,160
31	618	.....	5,100	2,440	.....	925	.....	817	.....	518	858	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 10,000 second-feet.

Monthly discharge of Ocmulgee River near Jackson, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 1,400 square miles.[a]]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	2,440	390	1,020	C.
November	9,200	565	1,840	C.
December	14,200	670	3,890	C.
January	6,940	2,020	3,500	B.
February	5,100	1,520	3,170	B.
March	4,690	925	2,370	B.
April	1,720	518	1,040	C.
May	8,180	470	2,360	C.
June	6,740	470	1,610	C.
July	5,100	430	1,270	C.
August	4,480	390	1,100	C.
September	1,330	390	886	C.
The year	14,200	390	2,000	

[a] "Second-feet per square mile" and "run-off (depth in inches)" are not published for this drainage area because the regulation due to the operation of the power plant of Central Georgia Power Co. make such figures misleading.

OCONEE RIVER NEAR GREENSBORO, GA.

Location.—At highway bridge 5 miles west of Greensboro on the road to Madison, Ga., about 4 miles above the mouth of Apalachee River, and 1½ miles below Town Creek.

Drainage area.—1,100 square miles.

Records available.—July 25, 1903, to September 30, 1915.

Gage.—Standard chain gage attached to the bridge; read twice daily by F. M. Chambers.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Bed composed chiefly of sand; slightly shifting. Control section not known.

Extremes of stage.—Maximum stage recorded during the year: 19.7 feet at 8 a. m. October 17. Minimum stage recorded: 0.9 foot at 8 a. m. and 5 p. m. August 2.

Maximum stage recorded 1903–1915: 35.4 feet, August 26, 1908; discharge, approximately 28,000 second-feet. Minimum mean daily stage recorded: 0.35 foot, September 18 and October 8, 1911; discharge, 172 second-feet.

Regulation.—Flow affected by operation of power plants above station.

Accuracy.—Gage-height record not good because of difficulty of securing good observer. A discharge measurement made December 10, 1914, indicates that there has been a decided change in the discharge relation as expressed by the 1913 rating curve. Estimates of discharge are therefore withheld until additional data are obtained for developing a new rating curve.

The following discharge measurement was made by M. R. Hall:

December 10, 1914: Gage height, 4.60 feet; discharge, 1,460 second-feet.

Daily gage height, in feet, of Oconee River near Greensboro, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.9	2.4	13.7	9.2	6.1	5.3	3.6	2.5	4.8	4.4	1.1	2.0
2	2.1	2.5	14.4	8.0	10.4	5.0	3.6	2.5	5.4	3.8	.9	1.8
3	7.3	2.3	12.1	6.0	9.5	4.6	3.6	2.6	5.2	3.0	1.7	1.6
4	9.2	2.1	10.1	4.1	7.0	4.8	3.6	2.6	4.6	3.0	2.8	1.8
5	8.3	2.1	15.5	4.8	6.1	7.2	3.6	2.6	3.5	5.6	2.1	1.6
6	5.9	2.1	16.5	7.6	6.0	10.0	3.5	2.6	3.2	6.2	1.9	1.6
7	4.3	2.1	16.3	9.6	5.5	9.2	3.6	3.8	3.0	4.6	1.6	1.8
8	3.5	2.3	11.5	8.8	5.4	8.0	3.4	10.4	3.4	3.6	1.4	1.8
9	3.0	3.3	6.9	7.1	5.0	6.1	3.2	8.2	5.4	3.2	1.4	1.8
10	2.6	3.9	5.4	5.8	4.8	5.6	3.2	5.8	4.0	4.0	2.2	1.8
11	2.3	3.6	4.4	5.4	4.5	5.0	3.2	4.8	3.4	3.9	3.4	1.7
12	2.1	3.3	4.0	7.9	4.2	4.6	3.2	7.6	3.2	3.4	4.4	1.6
13	2.0	2.8	4.2	7.0	4.2	4.5	3.2	10.2	3.0	2.7	3.2	1.6
14	2.3	3.1	4.8	6.2	4.2	4.4	3.2	12.4	2.8	2.3	2.4	1.8
15	5.3	7.4	4.8	5.0	4.4	4.3	3.0	10.8	2.6	2.4	4.2	2.7
16	15.0	11.5	4.3	4.6	4.2	4.2	3.0	6.6	2.8	3.4	6.0	1.8
17	19.5	10.4	3.8	5.4	4.2	4.1	3.0	5.4	3.2	2.7	6.7	1.7
18	16.3	7.3	3.7	10.3	4.0	4.0	3.0	4.4	2.6	2.1	5.0	1.6
19	7.7	6.1	3.6	14.2	4.1	4.1	2.9	4.0	2.6	1.8	3.9	1.6
20	4.7	5.5	3.4	12.1	4.0	4.0	2.9	3.5	2.6	1.7	3.4	1.7
21	3.9	5.0	3.8	7.9	4.2	3.9	2.9	3.3	2.4	1.8	4.8	1.8
22	3.3	4.1	4.2	5.6	4.2	3.8	2.8	3.1	2.4	1.6	4.0	1.8
23	3.0	3.6	4.2	5.2	4.3	3.6	2.8	3.0	2.4	1.8	3.0	1.6
24	2.9	3.2	3.8	5.8	6.1	3.6	2.8	3.2	2.2	2.0	2.4	1.7
25	2.9	2.8	4.8	8.2	8.5	3.6	2.7	4.0	2.0	1.8	2.1	1.6
26	2.7	2.7	7.6	8.4	7.3	3.6	2.7	3.8	2.1	1.8	1.8	1.5
27	2.5	2.8	9.2	7.4	5.9	3.5	2.7	3.2	2.0	2.0	1.8	1.5
28	2.3	2.9	8.2	6.1	5.6	3.6	2.6	3.1	2.0	2.0	1.9	1.4
29	2.3	4.6	8.2	5.1	.....	3.6	2.6	3.1	2.2	1.9	1.8	1.6
30	2.3	11.9	10.3	4.6	.....	3.5	2.5	3.2	2.6	1.8	2.6	1.8
31	2.3	.....	9.6	4.2	.....	3.6	.....	4.0	.....	1.4	2.1	.....

OCONEE RIVER AT FRALEYS FERRY, NEAR MILLEDGEVILLE, GA.

Location.—At Fraleys Ferry, about 4 miles below mouth of Little River, and 6 miles above Milledgeville.

Drainage area.—2,840 square miles.

Records available.—May 23, 1906, to December 31, 1908; October 6, 1909, to September 30, 1915.

Gage.—A combination sloping and vertical rod gage in four sections. Section 0 to 8 feet is the old sloping gage bolted to solid rock on left bank above Fraleys Ferry. November 13–14, 1913, vertical sections were added up to 20 feet; gage read twice daily by H. A. Taylor.

Discharge measurements.—Made from ferryboat.

Channel and control.—Sandy and shifting at measuring section; excellent rock control below. Top of control approximately 3 feet above zero of gage. The point of zero flow is therefore at about gage height 3 feet.

Extremes of discharge.—Maximum stage recorded during year: 14.6 feet at 7 a. m. January 19; discharge, 21,700 second-feet. Minimum stage recorded: 4.4 feet at 6 a. m. and 6 p. m. September 28; discharge, 570 second-feet.

Maximum stage recorded May 23, 1906, to December 31, 1908, and October 6, 1909, to September 30, 1915: Approximately 24.6 feet, March 17, 1913; discharge approximately 49,700 second-feet. Minimum stage recorded: 4.1 feet at 6 a. m. September 17, 1914; discharge, 410 second-feet.

Regulation.—None below vicinity of Athens, Ga., where storage may cause at times low daily discharge at this station.

Accuracy.—Station not visited during year ending September 30, 1915. Accuracy of records in the following tables depends on constancy of discharge relation subsequent to November 14, 1913, when the last discharge measurement was made.

Daily discharge, in second-feet, of Oconee River at Fraleys Ferry, near Milledgeville, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	660	1,170	17,200	6,450	4,500	3,080	3,080	2,450	2,760	2,300	830	1,270
2	760	1,270	16,400	4,500	10,700	2,760	3,080	1,610	3,950	2,150	760	1,080
3	4,500	1,270	9,340	4,130	8,910	3,590	2,760	1,610	3,770	1,870	618	910
4	6,650	1,380	6,050	3,770	6,450	3,590	2,760	1,610	3,250	1,870	1,040	950
5	5,850	1,270	8,910	3,420	5,260	7,650	2,600	1,490	2,760	2,920	2,450	1,610
6	4,880	1,170	13,000	4,310	4,880	10,200	2,450	1,490	2,450	5,650	1,490	1,490
7	3,080	1,170	10,900	9,780	4,880	8,490	2,450	1,610	2,450	3,770	1,120	1,270
8	1,870	1,270	8,910	7,650	4,500	6,050	2,450	5,450	2,760	3,080	870	1,170
9	1,610	1,740	5,260	5,650	4,310	4,690	2,450	7,050	3,080	2,450	830	1,080
10	1,320	2,760	3,770	3,590	4,130	4,130	2,300	6,050	3,420	2,760	760	990
11	1,170	2,760	3,250	3,770	3,770	3,770	2,300	3,770	2,450	2,450	1,740	1,270
12	1,040	2,300	2,760	6,450	3,590	2,150	2,300	5,650	1,740	2,150	1,870	830
13	1,080	1,490	3,080	7,050	3,420	3,250	2,300	6,450	1,870	1,610	5,070	830
14	1,120	1,440	3,420	5,260	3,420	3,080	2,300	8,910	2,010	1,610	2,300	690
15	7,250	2,600	3,770	4,500	3,080	3,080	2,150	8,700	2,450	1,490	3,080	1,320
16	14,800	7,250	3,420	4,310	3,770	3,080	2,150	5,650	1,870	1,320	3,770	1,870
17	18,900	6,850	3,080	4,500	4,130	2,920	2,150	3,770	1,870	1,870	3,950	1,380
18	15,300	5,650	2,450	12,000	3,950	2,920	2,010	2,760	2,450	1,270	3,420	1,170
19	9,340	3,770	2,450	20,600	3,770	2,760	2,010	2,450	2,300	1,080	3,950	1,490
20	3,770	2,760	2,760	15,600	3,250	2,760	2,010	2,300	2,010	1,380	3,590	910
21	2,600	2,300	2,920	8,490	2,920	2,760	2,150	2,150	1,610	1,170	3,590	830
22	2,300	1,870	3,080	5,450	2,920	2,760	2,010	2,150	1,380	990	2,760	910
23	2,150	1,870	2,920	4,500	3,080	2,760	2,010	2,010	1,380	1,040	2,600	910
24	1,870	1,870	3,080	5,260	3,950	2,600	1,870	1,870	1,270	990	1,870	870
25	1,740	1,870	3,250	7,250	5,260	2,600	1,870	2,600	1,170	950	1,320	795
26	1,740	1,610	3,950	6,450	6,250	2,450	1,870	2,010	1,080	910	1,120	690
27	1,610	1,490	4,880	5,850	5,450	2,450	1,870	1,740	1,080	990	990	760
28	1,490	1,490	6,050	5,260	4,130	2,450	1,740	2,010	1,170	990	990	570
29	1,380	4,500	6,050	4,690	.....	2,600	1,870	2,010	2,150	950	990	600
30	1,270	17,800	8,490	3,770	.....	2,600	1,740	2,010	1,870	910	1,270	990
31	1,170	.....	7,450	3,420	.....	2,760	.....	2,150	.....	830	1,870	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 6,000 second-feet. Above 7,000 second-feet the curve is approximate. See "Accuracy" in station description.

Monthly discharge of Oconee River at Fraleys Ferry, near Milledgeville, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 2,840 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	18,900	660	4,010	1.41	1.63	B.
November	17,800	1,170	2,930	1.03	1.15	B.
December	17,200	2,450	5,880	2.07	2.39	B.
January	20,600	3,420	6,380	2.25	2.59	B.
February	10,760	2,920	4,590	1.62	1.69	B.
March	10,200	2,150	3,640	1.28	1.48	B.
April	3,080	1,740	2,240	.789	.88	A.
May	8,910	1,490	3,340	1.18	1.36	B.
June	3,950	1,080	2,190	.771	.86	A.
July	5,650	830	1,800	.634	.73	A.
August	5,070	618	2,030	.715	.82	A.
September	1,870	570	1,050	.370	.41	A.
The year	20,600	570	3,340	1.18	15.99	

APALACHICOLA RIVER BASIN.

CHATTAHOOCHEE RIVER NEAR NORCROSS, GA.

Location.—At Medlock's bridge, 4½ miles north of Norcross, 1½ miles above the mouth of John Creek, and about 5 miles above Suwanee Creek.

Drainage area.—1,170 square miles.

Records available.—January 9, 1903, to September 30, 1915.

Gage.—Standard chain gage on the toll bridge; read twice daily by W. O. Medlock. Original gage was a vertical staff attached to oak tree on right bank about 100 feet above bridge. A chain gage, established March 14, 1903, was read in connection with the vertical gage until June 28, 1905, when present gage was installed.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Bed of stream sandy and changeable; right bank is high and overflows only slightly; the left bank will overflow for about 800 feet at a gage height of 16 to 18 feet. A rock shoal about 2½ miles below gage forms part of the control.

Extremes of discharge.—Maximum stage recorded during year: 14.8 feet at 5 p. m. December 5; discharge, 18,400 second-feet. Minimum stage recorded: 1.05 feet at 6 p. m. October 2; discharge, 435 second-feet.

Maximum stage recorded 1903–1915: 19.3 feet at 1.30 p. m. March 16, 1912; discharge, approximately 26,300 second-feet. Minimum mean daily stage recorded: 1.02 feet October 2, 1911; discharge, 294 second-feet.

Regulation.—Dams near Gainesville, Ga., and on Chestatee River interfere with the natural flow. It is thought that the two readings a day give a good mean daily gage height.

Accuracy.—Except for possible error in mean gage heights due to artificial regulation, results excellent, though rating curve must be shifted occasionally.

Discharge measurements of Chattahoochee River near Norcross, Ga., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 28	M. R. Hall	5.22	3,730	Sept. 28	M. R. Hall	1.78	879
28	Hall and Lederle	5.13	3,790				

Daily discharge, in second-feet, of Chattahoochee River near Norcross, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	538	800	10,000	2,830	3,790	3,130	2,020	1,540	3,130	3,790	898	995
2	485	770	3,680	2,460	9,550	2,930	2,020	1,540	3,460	2,020	832	865
3	1,540	770	2,460	2,280	6,080	2,730	2,020	1,400	2,370	1,780	1,190	832
4	3,680	770	11,500	2,100	4,140	2,550	2,020	1,540	1,780	1,330	1,190	800
5	1,470	740	17,500	2,020	4,020	4,260	1,940	1,400	1,700	2,190	1,120	1,190
6	1,060	740	10,200	2,370	4,500	5,280	1,780	1,330	1,780	2,100	1,120	1,330
7	865	770	4,140	7,900	3,790	3,790	1,860	3,350	1,700	1,860	1,060	1,260
8	800	650	3,030	5,020	3,240	3,350	1,860	8,650	1,780	1,940	930	995
9	710	1,620	2,460	3,130	2,930	2,930	1,860	3,680	1,860	1,700	832	930
10	710	1,120	2,190	2,550	2,730	2,640	1,860	2,370	1,540	1,540	865	770
11	832	930	1,940	2,370	2,550	2,640	1,780	2,100	1,400	1,460	995	865
12	680	865	1,780	3,350	2,550	2,550	1,860	3,350	1,330	1,120	1,060	770
13	680	832	1,940	4,500	2,460	2,370	1,860	9,250	1,400	1,400	995	1,060
14	800	832	2,100	2,930	2,550	2,370	1,860	4,500	1,330	1,190	1,330	1,620
15	4,260	2,280	2,020	2,550	3,030	2,370	1,780	2,730	1,400	1,260	2,020	1,620
16	11,100	5,280	1,780	2,460	4,890	2,370	1,700	2,100	1,260	1,620	1,190	1,120
17	5,940	2,460	1,700	3,460	3,460	2,460	1,700	2,020	1,400	1,400	1,120	898
18	1,940	1,620	1,620	7,340	2,930	2,280	1,700	1,860	1,330	1,190	1,190	898
19	1,470	1,260	1,540	9,250	2,730	2,190	1,470	1,620	1,400	1,060	1,700	898
20	1,190	1,120	1,620	5,800	2,550	2,190	1,700	1,700	1,260	1,260	1,400	832
21	1,120	1,060	1,780	3,790	2,550	2,370	1,620	1,700	1,260	1,190	1,400	1,260
22	995	995	2,020	3,130	2,370	2,280	1,700	1,620	1,120	1,060	1,330	1,400
23	995	995	1,940	2,930	2,370	2,190	1,700	1,620	1,120	1,120	1,260	1,060
24	995	995	1,860	5,280	8,350	2,550	1,470	1,700	1,060	1,120	930	898
25	930	930	4,140	8,950	10,500	2,370	1,540	1,620	1,120	1,120	930	832
26	800	832	14,800	6,360	4,760	2,100	1,540	1,620	1,060	832	865	800
27	898	898	9,550	4,260	3,790	2,190	1,620	1,620	1,120	962	898	740
28	832	930	3,790	3,570	3,240	2,020	1,860	1,540	1,190	995	962	770
29	800	1,330	.....	3,130	.....	2,190	1,780	1,470	1,540	865	930	770
30	770	8,350	.....	2,830	.....	1,940	1,620	1,540	2,020	930	898	930
31	832	.....	.....	2,730	.....	1,700	.....	1,780	.....	865	1,120	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge for individual days may be somewhat in error because of fluctuations due to operation of power plants. Discharge Dec. 29–31 estimated at 4,800 second-feet.

Monthly discharge of Chattahoochee River near Norcross, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	11,100	485	1,640	1.40	1.61	B.
November	8,350	740	1,450	1.24	1.38	B.
December	17,500	1,540	4,500	3.85	4.44	B.
January	9,250	2,020	3,990	3.41	3.93	B.
February	10,500	2,370	4,010	3.43	3.57	A.
March	5,280	1,700	2,620	2.24	2.58	A.
April	2,020	1,470	1,770	1.51	1.68	B.
May	9,250	1,330	2,450	2.09	2.41	B.
June	3,460	1,060	1,570	1.34	1.50	B.
July	3,790	832	1,430	1.22	1.41	B.
August	2,020	832	1,110	.949	1.09	B.
September	1,620	740	1,000	.855	.95	B.
The year	17,500	485	2,290	1.96	26.55	

CHATTAHOOCHEE RIVER AT WEST POINT, GA.

Location.—Just below the mouth of Oseligee Creek, about 300 feet east of the West Point waterworks pumping plant, and about 4 miles above Long Cane Creek about a mile upstream from station at Montgomery Street Bridge, West Point, used until October 20, 1912.

Drainage area.—3,300 square miles.

Records available.—July 30, 1896, to September 30, 1915.

Gage.—Staff gage in two sections; the lower section, reading from 0 to 6 feet, is near the right bank; the upper section, reading from 6 to 25 feet, is fastened to a tree on the left bank; datum of staff gage different from that of chain gage used at Montgomery Street Bridge prior to October 21, 1912. Gage read three times a a day by J. H. Miller.

Discharge measurements.—Made from a boat at a section near staff gage or from highway bridge to which chain gage was attached. No tributaries enter between the two sections.

Channel and control.—Bottom rough, rocky, and fairly permanent; banks are overflowed at high stages; control, a rock ledge extending entirely across river just below gage.

Extremes of discharge.—Maximum mean daily stage recorded during year: 11.6 feet, December 6; discharge, 23,500 second-feet. Minimum mean daily stage recorded: 1.9 feet, October 1; discharge, 1,370 second-feet.

Maximum stage recorded 1896–1915: 25 feet (at old gage location) on December 30, 1901; discharge, 88,600 second-feet. Minimum stage recorded: 0.8 foot (at old gage location), September 18–21, 1896; discharge, 780 second-feet.

Regulation.—Operation of power plants at points above causes some diurnal fluctuation. The Langdale dam, 5 miles below station, forms a pond reaching back as far as West Point. This affected the gage heights at the highway bridge. The new gage established in October, 1912, is not affected by backwater.

Accuracy.—Rating curve well developed from fairly low to medium flood stages. No records of discharge at extreme floods have yet been obtained. Diurnal fluctuation caused by hydroelectric plants above will cause some error in records for individual days during low water.

Cooperation.—Gage heights after October 20, 1912, furnished by the Columbus Power Co., Columbus, Ga.

Discharge measurements of Chattahoochee River at West Point, Ga., during the year ending Sept. 30, 1915.

[Made by M. R. Hall.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Feb. 24	7.05	12,000
25	8.56	15,500

Daily discharge, in second-feet, of Chattahoochee River at West Point, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,370	1,660	7,250	9,500	10,800	7,500	5,080	3,340	13,500	4,600	1,770	2,130
2	1,880	1,560	13,200	6,760	18,500	6,760	4,600	3,160	20,200	15,200	1,770	2,130
3	2,130	1,660	10,800	5,560	15,200	6,280	4,600	3,160	10,200	11,800	1,880	1,880
4	1,660	1,660	12,200	4,840	15,200	6,040	4,600	2,680	6,280	6,040	1,880	1,880
5	2,400	1,660	21,000	4,370	10,800	11,500	4,370	3,160	4,840	10,200	1,880	8,000
6	4,150	1,660	23,500	5,320	11,000	14,200	4,150	2,830	3,940	19,800	2,000	6,280
7	2,990	1,660	23,200	12,200	10,200	11,800	4,150	4,150	4,600	13,000	2,000	3,340
8	2,000	1,660	15,500	12,800	8,750	10,000	3,940	15,200	3,530	6,040	2,000	2,680
9	1,770	1,660	7,000	13,000	7,500	8,250	3,940	18,800	3,530	7,250	1,660	2,540
10	1,660	1,880	5,080	8,000	6,520	7,000	3,940	14,500	3,340	15,200	1,770	2,000
11	1,660	2,680	4,840	6,520	6,040	6,520	3,940	7,750	3,340	15,200	3,160	1,880
12	1,460	2,130	4,150	12,000	5,800	6,040	4,150	7,250	3,340	9,250	2,990	1,770
13	1,560	2,260	4,150	10,500	5,800	5,800	3,730	6,520	4,150	3,940	2,830	1,660
14	1,880	1,770	4,840	9,250	5,560	5,560	3,940	9,750	3,940	3,340	2,400	1,880
15	3,940	7,500	4,600	7,750	6,760	5,320	3,940	10,800	3,160	4,150	2,130	2,830
16	14,000	9,250	4,150	6,040	9,000	5,320	3,940	6,040	3,160	4,150	4,370	2,990
17	17,200	9,000	3,730	9,250	8,500	5,320	3,730	4,600	2,990	3,530	3,340	2,990
18	14,800	7,750	3,730	15,000	8,750	5,080	3,730	3,940	3,940	2,990	2,680	2,400
19	6,280	4,370	3,340	16,000	6,760	5,080	3,730	3,940	2,990	2,990	3,730	1,880
20	3,940	2,990	3,730	15,200	6,040	5,080	3,160	3,530	2,680	2,830	3,530	1,660
21	2,830	2,540	3,530	13,800	5,800	4,840	3,730	3,530	2,680	2,680	4,600	1,660
22	2,260	2,540	3,530	9,000	5,320	4,840	3,340	3,340	2,540	2,830	4,150	1,660
23	2,260	2,130	3,730	7,500	5,560	4,840	3,340	2,990	2,400	2,400	3,160	1,560
24	2,000	2,130	3,940	16,500	10,800	4,600	3,530	3,160	2,400	2,400	2,540	1,770
25	2,000	2,000	4,150	20,500	15,800	4,370	3,530	2,830	2,260	2,400	3,160	1,770
26	1,880	2,000	3,940	18,200	16,800	4,600	3,160	3,160	2,260	2,260	2,260	1,660
27	2,000	2,130	14,500	15,500	12,800	4,600	2,830	4,150	2,540	2,130	2,130	1,460
28	1,770	2,130	18,800	10,800	8,500	4,370	3,730	9,000	2,400	2,000	1,880	1,460
29	1,660	4,150	13,500	8,250	.....	4,370	3,530	7,000	2,680	1,770	1,880	1,460
30	1,660	4,840	14,000	7,250	.....	4,370	3,940	4,150	2,540	1,770	2,400	1,660
31	1,660	.....	12,200	6,760	.....	5,080	.....	4,370	.....	1,770	2,260	.....

NOTE.—Daily discharge determined from a rating curve well defined between 2,500 and 18,000 second-feet.

Monthly discharge of Chattahoochee River at West Point, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	17,200	1,370	3,570	1.08	1.24	B.
November	9,250	1,560	3,100	.939	1.05	A.
December	23,500	3,340	8,900	2.70	3.11	A.
January	20,500	4,370	10,400	3.15	3.63	A.
February	18,500	5,320	9,460	2.87	2.99	A.
March	14,200	4,370	6,300	1.91	2.20	A.
April	5,080	2,830	3,870	1.17	1.30	A.
May	18,800	2,680	5,900	1.79	2.06	A.
June	20,200	2,260	4,410	1.34	1.50	A.
July	19,800	1,770	6,000	1.82	2.10	B.
August	4,600	1,660	2,590	.785	.90	A.
September	8,000	1,460	2,360	.715	.80	B.
The year	23,500	1,370	5,570	1.69	22.88	

Days of deficiency in discharge of Chattahoochee River at West Point, Ga., for the year ending Sept. 30, 1915.

Discharge in second-feet.	Days of deficient discharge.	Discharge in second-feet.	Days of deficient discharge.	Discharge in second-feet.	Days of deficient discharge.
1,300	.....	2,900	118	5,500	246
1,500	5	3,100	128	6,000	254
1,700	29	3,400	151	7,000	275
1,900	55	3,700	162	9,000	297
2,100	66	4,000	191	12,000	322
2,300	85	4,300	207	16,000	351
2,500	95	4,600	216	20,000	361
2,700	110	5,000	235	30,000	365

FLINT RIVER NEAR WOODBURY, GA.

Location.—At the Macon & Birmingham Railroad bridge, 3 miles east of Woodbury, about a third of a mile above mouth of Cane Creek, and a quarter of a mile below Elkins Creek.

Drainage area.—1,090 square miles.

Records available.—March 29, 1900, to September 30, 1915.

Gage.—Vertical staff in four sections on left bank about 300 feet above railroad bridge; read twice daily by E. T. Riggins. Datum 660 feet above sea level.

Discharge measurements.—Made from downstream side of railroad bridge, which does not make a right angle with the current.

Channel and control.—Bottom is rough, consisting chiefly of rock; currents irregular. Above gage height 10 feet banks are subject to overflow for a width of about 350 feet, but all water passes beneath the bridge and its approaches. Control formed by a shoal about a mile downstream; shoal somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year: 7.2 feet at 7 a. m. and 5 p. m., December 5; discharge, 10,700 second-feet. Minimum stage recorded: —0.1 foot at 7 a. m. and 5 p. m., September 27; discharge, 170 second-feet.

Maximum stage recorded 1900–1915: 16.2 feet, March 15, 1913; discharge, 35,300 second-feet. Minimum stage recorded: —0.4 foot, October 8 to 10, 1911; discharge, 86 second-feet.

Regulation.—Operation of power plants on tributary streams above the station affects daily flow at low stages.

Accuracy.—Diurnal fluctuation may affect records somewhat. Records not good, due partly to shifting control, effect on discharge relation of the new bridge below gage, and poor equipment for making discharge measurements.

Cooperation.—Since July 1, 1910, morning readings have been furnished by United States Weather Bureau.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Flint River near Woodbury, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	239	279	3,000	2,580	2,720	1,540	1,220	620	3,600	516	279	371
2	323	279	2,580	1,700	3,450	1,360	1,130	620	5,150	870	279	347
3	584	279	2,440	1,360	3,450	1,180	1,130	584	3,300	998	239	323
4	454	279	6,390	1,130	3,600	1,040	1,130	483	2,050	828	301	347
5	371	279	10,700	1,040	3,000	3,300	1,040	424	1,400	2,180	398	620
6	371	279	8,990	1,260	2,440	4,350	870	424	828	6,580	323	828
7	371	279	6,960	2,180	2,180	3,900	870	1,400	742	4,050	301	742
8	347	279	3,900	2,310	1,930	3,150	785	6,770	620	3,000	239	483
9	323	454	2,050	2,310	1,590	2,180	785	4,500	584	1,810	239	398
10	323	785	1,360	1,930	1,440	1,590	785	3,300	483	2,580	259	323
11	301	660	1,080	1,640	1,260	1,360	785	2,440	483	2,180	398	301
12	301	516	912	3,300	1,080	1,220	785	2,440	483	2,050	454	259
13	301	454	870	3,000	1,080	1,130	700	2,310	1,080	1,080	347	301
14	454	424	1,220	2,580	1,130	1,080	700	2,050	1,040	828	347	700
15	1,440	2,720	1,180	1,930	1,810	1,040	700	1,360	742	912	454	371
16	2,180	4,500	998	1,540	2,720	1,040	700	1,040	785	912	347	371
17	2,720	3,900	912	1,930	2,440	1,040	620	785	955	742	301	398
18	3,150	3,000	828	3,900	1,930	955	620	660	1,080	660	371	347
19	1,930	1,640	785	4,500	1,540	955	620	584	998	483	870	323
20	1,130	1,130	785	3,150	1,360	955	620	548	785	660	1,040	301
21	742	828	828	3,000	1,220	955	620	483	700	870	1,080	259
22	483	700	998	2,180	1,130	955	548	454	516	785	1,080	239
23	424	516	912	1,700	1,180	870	548	424	398	548	785	239
24	371	483	870	3,900	1,590	870	548	424	347	424	548	239
25	347	483	870	5,490	1,700	870	548	371	323	371	548	203
26	371	483	998	6,580	1,930	870	516	371	323	323	454	203
27	323	483	1,310	5,150	1,930	870	483	398	301	323	371	170
28	279	620	1,310	3,300	1,700	870	516	870	323	301	347	203
29	279	1,540	1,930	2,440	.....	870	620	1,130	483	279	323	203
30	279	2,580	3,150	1,930	.....	912	620	870	454	279	371	279
31	279	.....	3,000	1,700	.....	1,180	.....	955	.....	279	454	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 24,000 second-feet. Because of uncertainties due to power regulation and to lack of discharge measurements between discharges of 2,000 and 12,000 second-feet, estimates for individual days should be used with caution.

Monthly discharge of Flint River near Woodbury, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 1,090 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	3,150	239	703	0.645	0.74	C.
November	4,500	279	1,040	.954	1.06	C.
December	10,700	785	2,390	2.19	2.52	C.
January	6,580	1,040	2,670	2.45	2.82	C.
February	3,600	1,080	1,950	1.79	1.86	C.
March	4,350	870	1,430	1.31	1.51	C.
April	1,220	483	739	.678	.76	C.
May	6,770	371	1,290	1.18	1.36	C.
June	5,150	301	1,050	.963	1.07	C.
July	6,580	279	1,250	1.15	1.33	C.
August	1,080	239	456	.418	.48	C.
September	828	170	356	.327	.36	C.
The year	10,700	170	1,280	1.17	15.87	

FLINT RIVER NEAR CULLODEN, GA.

Location.—At Grays Ferry, 1½ miles above the mouth of Auchumpkee Creek, and about 3 miles above old gage near Musella, Ga., read for a short time in 1907; 14 miles southwest of Culloden.

Drainage area.—2,000 square miles.

Records available.—July 1, 1911, to September 30, 1915.

Gage.—Staff in four sections on left bank at ferry landing; read twice daily by F. A. Adams.

Discharge measurements.—Made from the ferryboat. Measurements above gage height 5 feet can not be made because of danger in operating ferry.

Channel and control.—Bed sandy; likely to shift; control, rock ledge half a mile below; probably permanent.

Extremes of discharge.—Maximum stage recorded during year: 12.0 feet at 5 p. m. January 18; discharge 18,200 second-feet. Minimum stage recorded: 1.3 feet at 6 a. m. and 6 p. m. September 28 and 6 a. m. September 29; discharge, 307 second-feet.

Maximum stage recorded 1911–1915: 30.5 feet, March 16, 1913. This stage, which is the crest of the March flood as shown by watermarks, was determined by levels by an engineer of the Survey; discharge not known. Minimum mean daily stage recorded: 1.0 foot, October 8, 1911; discharge, 165 second-feet.

Accuracy.—Results good for low and medium stages.

No discharge measurements were made during the year ending September 30, 1915.

Daily discharge, in second-feet, of Flint River near Culloden, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	473	598	6,240	4,400	4,570	2,850	2,320	1,120	5,100	875	534	696
2	730	566	5,100	3,430	8,200	2,580	2,080	1,040	15,800	1,560	566	630
3	1,460	534	3,750	2,580	7,200	2,320	1,960	955	8,600	2,850	566	598
4	1,080	534	6,240	2,200	6,240	2,080	1,960	875	4,400	1,620	630	566
5	838	534	11,600	1,840	4,570	6,620	1,840	838	2,850	1,720	663	730
6	765	534	12,400	1,960	4,400	8,200	1,620	800	1,840	8,400	696	998
7	730	534	10,600	3,430	3,750	6,620	1,510	1,120	1,510	9,000	534	1,170
8	696	534	7,400	3,750	3,430	5,480	1,460	8,800	1,360	5,480	504	998
9	630	534	4,070	3,750	2,990	4,070	1,410	8,000	1,220	3,430	473	765
10	598	663	2,580	2,990	2,580	3,130	1,410	5,100	1,080	6,620	598	630
11	566	1,220	1,840	2,580	2,320	2,580	1,410	4,230	998	3,750	663	566
12	696	1,040	1,620	4,400	2,320	2,320	1,310	5,100	955	2,580	765	504
13	598	765	1,620	5,100	2,080	2,080	1,310	4,400	1,410	1,960	730	444
14	663	800	2,080	4,400	2,080	2,080	1,310	3,750	1,620	1,560	630	875
15	1,840	3,430	2,080	3,590	2,080	1,960	1,220	2,710	1,460	1,310	598	875
16	3,130	6,620	1,840	2,850	4,570	1,840	1,220	1,960	1,260	1,410	730	696
17	3,130	5,670	1,560	3,430	4,070	1,840	1,170	1,510	1,720	1,310	566	630
18	4,230	5,100	1,410	14,200	3,750	1,840	1,120	1,260	1,720	1,120	696	630
19	3,280	3,130	1,410	15,400	2,990	1,840	1,120	1,080	1,620	955	1,080	598
20	2,080	1,960	1,410	8,600	2,580	1,720	1,120	955	1,410	1,170	1,360	504
21	1,360	1,510	1,510	5,860	2,320	1,720	1,120	955	1,170	1,220	1,360	473
22	955	1,170	1,620	4,070	2,080	1,720	1,040	875	955	1,460	1,840	444
23	765	998	1,510	3,280	2,200	1,620	1,040	875	765	1,220	1,310	415
24	730	955	1,460	9,800	3,430	1,620	1,040	875	730	875	955	388
25	730	875	1,510	11,800	3,430	1,560	1,040	838	663	800	765	360
26	663	875	2,080	10,200	3,280	1,510	955	800	663	663	838	360
27	663	875	2,080	8,600	3,430	1,510	955	800	630	663	800	360
28	598	915	2,080	6,620	3,130	1,510	955	1,560	630	598	730	307
29	598	7,400	2,850	4,740	.....	1,510	1,040	2,080	730	598	663	696
30	598	10,600	6,240	3,430	.....	1,510	1,120	1,840	915	534	598	998
31	598	.....	5,100	2,850	.....	1,960	.....	1,560	.....	534	696	.....

NOTE.—Daily discharge determined from a rating curve well defined below 4,400 second-feet. Above 4,400 second-feet the rating curve is simply an extension and estimates above 7,000 second-feet are only approximate.

Monthly discharge of Flint River near Culloden, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 2,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	4,230	473	1,180	0.590	0.68	A.
November	10,600	534	2,050	1.02	1.14	B.
December	12,400	1,410	3,710	1.86	2.14	B.
January	15,400	1,840	5,360	2.68	3.09	B.
February	8,200	2,080	3,570	1.78	1.85	B.
March	8,200	1,510	2,640	1.32	1.52	A.
April	2,320	955	1,340	.670	.75	A.
May	8,800	800	2,210	1.10	1.27	A.
June	15,800	630	2,190	1.10	1.23	B.
July	9,000	534	2,190	1.10	1.27	A.
August	1,840	473	779	.390	.45	A.
September	1,170	307	630	.315	.35	A.
The year	15,800	307	2,320	1.16	15.74	

FLINT RIVER AT ALBANY, GA.

Location.—At the Dougherty County highway bridge in the city of Albany, 700 feet below the Atlantic Coast Line Railroad bridge.

Drainage area.—5,000 square miles.

Records available.—April 10, 1893, to September 30, 1915 (United States Weather Bureau gage heights). Discharge measurements were begun by the Geological Survey in 1901, and estimates of daily discharge have been made from January 1, 1902, to September 30, 1915.

Gage.—Standard chain gage, installed at the bridge April 20, 1904; read once daily by D. W. Brosnan. The original staff gage was washed out in 1898. It was again injured in 1902 and on June 18 of that year a new gage was installed by the United States Weather Bureau at a datum 0.75 foot lower than that of the former gage. All gage heights for 1902 published by the United States Weather Bureau and the United States Geological Survey refer to the new datum. Present gage conforms with the United States Weather Bureau gage.

Discharge measurements.—Fairly accurate measurements can be made at the section at the Atlantic Coast Line bridge, although it is very rough and train switching in the yard interferes with the work. The section at the Georgia Northern Railway bridge, 1 mile above, at which measurements are sometimes made, is considered better, especially for medium and low stages.

Channel and control.—Channel at and below gage may shift slightly, but control is such that conditions of flow are practically permanent. The river overflows both banks but only under the approaches to the bridge.

Extremes of discharge.—Maximum stage recorded during year: 16.6 feet at 7 a. m. January 25; discharge, 22,800 second-feet. Minimum stage recorded: —0.7 foot at 7 a. m. September 27; discharge, 1,340 second-feet.

Maximum stage recorded 1902–1915: 30.3 feet at 7 a. m. March 21, 1913; discharge, 53,700 second-feet. Minimum stage recorded: —1.1 feet, October 9 to 12, 1911; discharge, 1,110 second-feet.

Regulation.—Power developments on Muckalee Creek, which joins Flint River about 2 miles above the station, cause considerable diurnal fluctuation, especially at low stages. It is probable that the flow is also affected by other power plants farther up the river.

Accuracy.—As records are based on one gage reading daily, at 7 a. m., it is probable that the estimates of daily discharge are somewhat in error, especially at low stages. The actual daily discharge is probably greater than that indicated by the reading at 7 a. m.

Cooperation.—Gage heights furnished by the United States Weather Bureau.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Flint River at Albany, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,290	2,500	9,920	8,920	16,200	10,400	6,360	3,380	5,780	2,420	1,780	2,010
2	3,200	2,500	12,400	9,800	16,200	9,670	6,700	3,290	5,440	2,670	1,700	2,090
3	3,380	2,330	14,200	10,200	16,000	9,170	6,940	3,380	5,320	2,930	1,700	1,930
4	3,980	2,250	14,700	10,400	15,900	8,670	6,820	3,200	7,060	3,480	1,550	1,850
5	5,440	2,330	16,300	9,920	15,500	8,420	6,700	3,020	8,300	4,750	2,010	1,780
6	5,780	2,250	15,600	8,670	15,800	9,170	6,130	3,020	9,800	5,900	2,420	1,620
7	5,320	2,250	14,300	7,920	15,600	10,300	6,020	2,840	10,900	5,210	2,580	1,620
8	4,520	2,330	12,300	8,040	15,500	11,200	5,670	5,210	11,500	5,210	2,670	1,850
9	4,190	2,580	11,500	8,800	14,300	11,800	5,210	8,670	10,000	5,900	2,760	2,090
10	3,570	2,250	11,300	9,300	12,800	12,500	4,860	10,400	4,980	7,060	2,330	2,330
11	3,200	2,170	12,400	9,420	11,300	13,000	4,520	11,300	3,770	8,800	2,090	2,250
12	3,020	2,330	13,700	9,300	10,200	12,700	4,750	13,000	3,380	9,670	2,250	1,850
13	3,020	2,330	12,800	9,170	9,170	11,000	4,410	15,200	3,290	9,420	2,170	1,620
14	3,020	2,500	10,500	8,920	8,670	9,300	4,300	15,900	3,020	9,170	2,090	1,780
15	3,020	2,930	7,540	8,920	7,920	8,040	4,300	15,800	3,020	8,170	2,090	1,700
16	4,300	3,380	6,820	9,300	7,920	7,420	4,080	14,400	3,200	5,900	2,170	1,700
17	5,670	3,670	6,590	9,920	8,300	6,480	3,770	12,500	3,670	3,980	2,250	1,850
18	6,820	5,100	6,240	12,000	9,300	6,480	3,770	10,400	4,080	3,670	2,500	2,010
19	7,670	5,780	6,240	14,700	10,000	6,480	3,570	7,060	3,770	3,200	2,670	1,850
20	6,820	6,700	6,360	17,000	10,400	6,240	3,670	5,560	3,670	3,020	1,780	1,700
21	6,360	6,590	6,360	17,400	10,300	6,130	3,670	4,860	3,980	2,760	2,170	1,700
22	6,020	6,480	5,210	18,800	9,540	5,900	3,480	4,300	3,380	2,760	2,840	1,850
23	5,210	5,900	4,980	21,300	8,540	5,670	3,380	3,980	3,200	2,760	3,290	2,010
24	3,670	4,520	4,980	22,300	8,040	5,670	3,380	3,670	2,760	2,840	3,110	1,700
25	3,380	3,480	4,980	22,800	8,540	5,440	3,380	3,570	2,670	2,760	3,110	1,620
26	3,200	3,020	5,100	21,000	9,540	5,440	3,290	3,480	2,330	2,670	2,930	1,410
27	3,110	2,840	5,100	17,700	10,400	5,320	3,200	3,110	2,420	2,420	2,580	1,340
28	3,290	2,840	5,560	15,100	10,700	5,560	3,200	3,110	2,330	2,250	2,250	1,480
29	3,020	3,980	5,780	15,200	.....	5,440	3,110	3,290	2,420	2,090	2,090	1,480
30	2,670	6,700	7,060	15,900	.....	5,320	3,380	4,190	2,330	2,010	1,850	1,480
31	2,580	.....	7,800	16,200	.....	6,020	.....	5,560	.....	1,930	2,010	.....

NOTE.—Daily discharge determined from a rating curve well defined between 2,500 and 48,000 second-feet.

Monthly discharge of Flint River at Albany, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 5,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	7,670	2,580	4,250	0.850	0.98	A.
November	6,700	2,170	3,560	.712	.79	B.
December	16,300	4,980	9,180	1.84	2.12	A.
January	22,800	7,920	13,000	2.60	3.00	B.
February	16,200	7,920	11,500	2.30	2.40	A.
March	13,000	5,320	8,080	1.62	1.87	A.
April	6,940	3,110	4,530	.906	1.01	A.
May	15,900	2,840	6,800	1.36	1.57	A.
June	11,500	2,330	4,730	.946	1.06	A.
July	9,670	1,930	4,440	.888	1.02	B.
August	3,290	1,550	2,320	.464	.53	B.
September	2,330	1,340	1,780	.356	.40	C.
The year	22,800	1,340	6,170	1.23	16.75	

TOBLER CREEK NEAR YATESVILLE, GA.

Location.—At Tobler Mills, about 1 mile downstream from Macon & Birmingham Railroad bridge, about 2 miles north of Yatesville, and about 15 miles from Flint River.

Drainage area.—Not measured.

Records available.—November 4, 1914, to September 30, 1915.

Gage.—Vertical staff on right bank just below penstock of Tobler Mills; read by J. K. Sanders once daily to hundredths.

Discharge measurements.—Made from steel highway bridge across mill pond about 600 feet above gage during medium and high stages; by wading during low stages.

Channel and control.—Channel consists of bowlders and solid rock. Control formed by solid rock shoal; permanent.

Extremes of discharge.—Maximum stage recorded during year: 2.6 feet at 7.10 a. m. November 30 and at 7 a. m. January 18. Minimum stage recorded: 0.3 foot at 6 a. m. September 29.

Regulation.—Tobler Mill causes large fluctuations in stage. Gage is read in the morning before operation of mill in order to obtain readings which more nearly represent the normal stage.

Accuracy.—Gage-height record reliable.

Data insufficient for estimates of discharge.

Discharge measurements of Tobler Creek near Yatesville, Ga., during the year ending Sept. 30, 1915.

[Made by Warren E. Hall.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-feet.*		*Feet.*	*Sec.-feet.*
Nov. 4	0.52	6.61	June 2	1.65	165
4	.52	6.71			

Daily gage height, in feet, of Tobler Creek near Yatesville, Ga., for the year ending Sept. 30, 1915.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.3	0.90	0.90	0.90	0.90	0.70	1.4	0.50	0.52	0.52
2	.....	.95	.85	1.3	.80	.85	.70	1.9	.85	.52	.50
3	.....	.90	.85	1.3	.80	.85	.65	1.0	.70	.50	.50
4	0.52	.90	.80	1.0	.75	.80	.62	.80	.72	.52	.50
5	.50	.90	.80	.95	1.4	.80	.62	.80	.85	.52	.52
6	.50	.85	.88	1.0	1.4	.75	.62	.78	1.7	.55	.52
7	.52	.85	1.1	.92	.95	.75	.60	.75	.90	.50	.50
8	.50	.80	.90	.90	.90	.75	1.55	.70	.70	.50	.50
9	.58	.80	.88	.85	.90	.75	.90	.70	1.2	.50	.50
10	.60	.80	.85	.80	.85	.65	.80	.60	.90	.52	.50
11	.52	.80	.85	.80	.85	.65	.80	.60	.75	.50	.50
12	.58	.75	1.1	.80	.80	.75	1.3	.65	.70	.52	.50
13	.58	.85	.9	.75	.75	.75	.95	.65	.70	.50	.50
14	.58	.90	.9	.75	.80	.70	.85	.65	.72	.50	.50
15	2.1	.90	.85	.85	.80	.70	.78	.60	.75	.52	.60
16	1.6	.90	.85	1.1	.80	.72	.70	.55	.60	.50	.50
17	.88	.65	1.1	.90	.82	.72	.70	.60	.60	.50	.50
18	.78	.65	2.6	.75	.80	.70	.70	.62	.55	.52	.50
19	.75	.65	2.1	.80	.80	.70	.68	.60	.55	1.1	.45
20	.65	.75	1.2	.80	.80	.72	.65	.55	.70	.70	.50
21	.68	.80	1.05	.85	.80	.72	.65	.55	.80	.60	.50
22	.68	.80	1.0	.85	.80	.72	.65	.50	.65	.60	.45
23	.65	.70	.95	.85	.80	.68	.60	.50	.65	.60	.50
24	.65	.75	1.55	1.1	.80	.62	.60	.50	.60	.60	.40
25	.65	.75	1.5	.90	.75	.60	.68	.52	.60	55	.40
26	.65	.90	1.1	.80	.75	.60	.65	.50	.60	.50	.40
27	.65	.80	1.05	.80	.75	.62	.60	.50	.62	.50	.40
28	.65	.80	1.0	.90	.80	.62	.75	.80	.60	.55	.40
29	1.55	.98	.95	.....	.80	.80	.70	.80	.60	.50	.30
30	2.6	1.4	.92	.....	.80	.70	.70	.82	.52	.52	.40
31	.....	1.0	1.2	.....	.85	.....	.75	.....	.52	.50	.....

ESCAMBIA RIVER BASIN.

CONECUH RIVER AT BECK, ALA.

Location.—At Simmons Bridge at Beck, 8 miles west of Andalusia, Ala., a station on the Central of Georgia and Louisville & Nashville railroads, and about 12 miles below the mouth of Patsaliga Creek.

Drainage area.—1,290 square miles.

Records available.—August 24, 1904, to September 30, 1915.

Gage.—Standard chain gage attached to upstream side of wagon bridge; read by S. T. Dillard once daily to half-tenths.

Discharge measurements.—Made from the wagon bridge.

Channel and control.—In soft bedrock; practically permanent; both banks subject to overflow at high stages.

Extremes of discharge.—Maximum stage recorded during year: 15.6 feet at 9 a. m. January 25. Minimum stage recorded: 1.3 feet at 8.30 a. m. August 2 and 3.

Maximum mean daily discharge, 1904–1915: 26,000 second-feet, March 18, 1913, (estimated by comparison with Pea River at Pera, Ala). Minimum stage recorded: 0.7 foot, October 4, 1904; discharge, 187 second-feet.

Regulation.—The flow at times may be affected by logging operations.

Accuracy.—Station not visited since October 18, 1911; gage readings may be considerably in error, owing to elongation of the gage chain, and are therefore withheld from publication.

MOBILE RIVER BASIN.

OOSTANAULA RIVER AT RESACA, GA.

Location.—At Western & Atlantic Railroad bridge in Resaca, 3 miles below junction of Conasauga and Coosawattee rivers, and 1 mile above the mouth of Camp Creek.

Drainge area.—1,610 square miles.

Records available.—1891 to 1898 (gage heights by the United States Weather Bureau and discharge measurements and gage heights by the United States Geological Survey); 1899 to 1904 partial records of gage heights; continuous records, January 1, 1905, to September 30, 1915.

Gage.—Heavy vertical timber attached to downstream side of bridge pier in middle of river. Gage is in poor condition; read once daily.

Discharge measurements.—Usually made from downstream side of railroad bridge, but at times from a boat at the ferry about 200 feet above, where the section is somewhat better. A new steel highway bridge about 500 feet downstream now affords better equipment from which measurements can be made.

Channel and control.—Slightly shifting at and below station. Left bank low and overflows during high water for 480 feet.

Extremes of discharge.—Maximum stage recorded during year: 21.5 feet, February 3; discharge, 18,100 second-feet. Minimum stage recorded: 1.2 feet, September 24; discharge, 275 second-feet.

Maximum stage recorded 1896–1915:[1] 31.7 feet, March 15, 1909; discharge, 39,200 second-feet. Minimum stage recorded: 0.95 foot, during discharge measurement September 26, 1904; discharge, 273 second-feet.

Regulation.—Except on the smaller tributaries there are very few mill dams, and these have little or no effect on flow at station. Channel sometimes obstructed by logs under left span of bridge.

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[1] No gage-height records were collected during the following periods: May 1 to July 31, 1896; May 1 to Oct. 31, 1899; July 1 to Oct. 31, 1900; May 1 to Nov. 12, 1901, and Jan. 1, 1902, to Dec. 31, 1904.

Accuracy.—Slight change in rating curve owing to shift in control. Discharge estimates for low stages should be used with caution, owing to difficulty in obtaining accurate readings because of poor condition of lower end of gage.

No discharge measurements were made during the year, but a measurement made on November 1, 1915 (discharge, 986 fecond-feet) checks the rating curve.

Daily discharge, in second-feet, of Oostanaula River at Resaca, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	380	500	730	6,050	7,730	3,270	2,490	1,750	1,750	1,110	500	1,110
2	380	460	1,750	4,110	17,000	3,040	2,490	1,470	1,610	1,230	500	1,110
3	420	460	1,540	3,430	18,100	2,800	2,190	1,350	1,470	2,190	1,110	880
4	420	460	8,690	3,110	14,600	2,650	2,110	1,230	1,470	2,190	990	830
5	380	460	13,600	2,880	10,300	3,430	2,110	1,170	1,350	3,270	780	3,270
6	380	460	10,800	2,490	6,870	6,140	2,110	1,110	1,350	3,770	680	4,980
7	380	460	8,690	9,370	4,630	5,160	1,960	1,110	1,470	2,490	590	3,270
8	380	460	5,160	6,780	4,110	4,450	1,960	2,720	1,610	2,650	500	1,820
9	380	500	4,110	4,110	3,680	4,110	1,750	10,100	1,750	2,190	500	1,110
10	345	590	1,410	3,270	3,270	3,270	1,750	6,870	1,750	2,040	990	990
11	420	590	1,230	2,650	3,040	2,960	1,750	2,800	1,470	2,040	680	830
12	420	500	1,110	4,110	2,720	2,800	1,890	2,490	1,470	1,750	1,110	780
13	420	500	1,110	6,230	2,720	2,800	1,960	2,110	1,750	1,610	2,490	780
14	420	500	1,750	4,630	2,720	2,650	2,040	3,270	2,190	1,750	1,350	730
15	2,650	680	1,110	4,110	4,540	2,490	2,040	2,490	2,340	1,610	1,350	780
16	7,540	590	990	5,330	7,730	2,490	1,890	2,490	2,490	1,610	1,750	780
17	4,110	500	830	4,110	4,720	2,960	1,750	2,110	2,800	1,890	1,610	680
18	1,350	500	730	3,680	3,850	2,960	1,610	1,890	2,960	1,750	780	635
19	1,230	500	730	5,870	3,430	2,960	1,610	1,750	2,490	1,610	780	500
20	1,110	500	880	4,980	2,880	2,960	1,540	1,610	1,470	1,350	1,170	420
21	880	500	1,110	3,940	4,980	2,570	1,470	1,470	1,230	1,110	2,800	345
22	730	500	1,350	3,270	2,490	2,650	1,470	1,410	1,170	1,750	1,610	310
23	590	460	1,750	3,040	2,340	2,490	1,470	1,350	1,110	1,470	1,290	310
24	590	460	1,890	4,110	8,210	2,490	1,470	1,350	990	1,230	1,290	275
25	590	460	6,780	7,920	7,160	2,340	1,470	1,350	830	1,110	1,110	880
26	590	460	15,400	8,500	4,630	2,340	1,470	1,610	780	1,110	990	590
27	500	460	16,600	6,500	3,940	2,340	1,410	2,110	780	990	990	500
28	500	460	14,600	4,280	3,270	2,190	1,410	2,040	830	780	830	500
29	500	460	12,600	3,770	.....	2,490	1,610	1,470	990	680	2,490	460
30	500	730	12,000	3,600	.....	2,490	2,040	1,350	990	590	1,610	590
31	500	.....	9,460	3,510	.....	2,490	.....	1,350	.....	545	1,110	.....

NOTE.—Daily discharge determined from a rating curve well defined below 7,000 second-feet.

Monthly discharge of Oostanaula River at Resaca, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 1,610 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	7,540	345	967	0.601	0.69	B.
November	730	460	504	.313	.35	B.
December	16,600	730	5,180	3.22	3.71	B.
January	9,370	2,490	4,640	2.88	3.32	A.
February	18,100	2,340	5,920	3.68	3.83	B.
March	6,140	2,190	3,010	1.87	2.16	A.
April	2,490	1,410	1,810	1.12	1.25	A.
May	10,100	1,110	2,220	1.38	1.59	A.
June	2,960	780	1,560	.969	1.08	B.
July	3,770	545	1,660	1.03	1.19	A.
August	2,800	500	1,170	.727	.84	B.
September	4,980	275	1,030	.640	.71	B.
The year	18,100	275	2,460	1.53	20.72	

COOSA RIVER AT RIVERSIDE, ALA.

Location.—At the Southern Railway bridge at Riverside, 1 mile above mouth of Blue Eye Creek, and about 7 miles above Choccolocco Creek.

Drainage area.—7,060 square miles.

Records available.—September 25, 1896, to September 30, 1915.

Gage.—Standard chain gage attached to right-bank end of downstream side of railroad bridge; read twice daily by J. E. Whitehead. The original wire gage was located on the downstream side of bridge near middle of river.

Discharge measurements.—Made from downstream side of railroad bridge.

Channel and control.—Bed of stream rocky and permanent. For a part of the width the current is broken by a ledge above. Both banks high and do not overflow. Control permanent.

Extremes of discharge.—Maximum stage recorded during year: 18.0 feet at 6 a. m., December 29; discharge, 68,100 second-feet. Minimum stage recorded: 0.7 foot at 6 a. m. and 6 p. m., October 4 to 7; discharge, 1,760 second-feet.

Maximum stage recorded 1896–1915: 19.8 feet, March 20, 1906; discharge, 75,800 second-feet. Minimum stage recorded: 0.35 foot, October 20 to November 1, 1904; discharge, 1,220 second-feet.

Regulation.—Flow not noticeably affected by artificial regulation at the comparatively few dams above. Four navigation locks have been constructed, the nearest of which is lock 4, about 4 miles above the station. Lock 5, several miles downstream, will soon be completed and discharge relation will then be affected by backwater from the dam.

Accuracy.—Rating curve good and probably permanent. Records should, however, be used with caution, as no discharge measurements have been made since 1911.

Daily discharge, in second-feet, of Coosa River at Riverside, Ala., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,080	1,920	3,430	40,400	22,700	17,500	8,380	4,380	5,700	6,840	2,620	3,890
2	1,920	1,920	5,420	32,400	42,600	14,900	8,380	4,380	5,420	7,140	2,620	3,890
3	1,920	1,920	7,440	19,800	50,200	13,400	8,380	3,890	4,900	7,750	2,810	3,890
4	1,760	1,920	9,980	14,500	51,500	12,000	8,380	3,890	4,900	11,700	3,010	4,130
5	1,760	1,920	16,000	12,000	51,100	19,800	8,060	3,890	4,900	16,000	3,010	9,980
6	1,760	1,920	25,600	13,100	51,100	23,100	7,750	3,890	4,900	17,900	3,010	19,400
7	1,760	1,920	31,500	24,300	46,000	27,700	7,140	12,400	4,900	18,300	2,810	22,300
8	2,000	1,920	31,100	29,000	40,900	26,000	7,140	33,600	5,160	17,100	2,810	16,800
9	2,080	1,920	23,900	31,900	29,800	23,100	6,540	35,800	4,900	13,400	2,810	13,400
10	2,440	2,000	16,000	29,400	21,400	19,800	6,540	34,100	4,900	12,400	2,810	7,440
11	3,430	2,440	11,300	24,800	17,500	16,800	5,970	29,000	4,640	9,980	2,810	5,420
12	3,890	3,220	7,140	21,000	15,300	14,200	5,970	23,900	4,380	9,020	2,810	4,130
13	3,430	3,010	6,840	19,000	12,700	11,700	5,970	17,500	4,380	8,380	2,810	3,430
14	3,430	2,620	8,700	19,000	12,400	11,700	5,700	13,400	4,900	8,380	4,130	3,010
15	3,890	2,620	9,660	19,400	14,500	11,300	5,420	12,000	6,540	6,840	4,130	3,010
16	4,380	3,220	9,020	18,300	17,500	10,600	5,420	11,000	7,750	6,840	4,900	3,010
17	12,000	4,640	8,380	17,900	19,400	10,300	5,420	9,340	6,840	6,540	4,900	3,430
18	17,100	5,700	6,840	19,800	21,400	9,660	5,420	8,700	6,540	6,540	5,420	3,220
19	14,900	5,970	5,700	21,800	20,200	9,020	5,160	7,750	6,540	5,420	6,250	3,010
20	9,980	4,640	5,160	24,300	15,300	9,020	5,160	6,250	5,970	4,640	7,140	3,010
21	5,970	3,890	5,420	25,200	13,800	9,980	5,160	5,420	5,420	3,890	9,340	2,810
22	4,130	3,430	5,700	23,100	12,000	11,000	5,160	5,160	4,380	3,890	9,980	2,620
23	3,430	3,010	6,250	19,000	11,000	9,340	5,160	4,900	3,890	3,430	9,020	2,620
24	3,010	2,620	8,060	16,000	14,900	8,700	4,900	4,900	3,430	3,010	7,750	3,010
25	2,810	2,260	12,400	17,900	18,300	8,380	4,640	4,380	3,430	3,010	5,420	3,010
26	2,620	2,170	21,000	23,100	23,500	8,380	4,640	4,380	3,220	3,010	4,380	3,010
27	2,260	2,080	38,300	26,900	21,000	8,380	4,640	4,380	3,220	2,810	4,380	3,010
28	2,260	2,080	40,900	24,800	19,400	8,060	4,380	5,420	3,220	2,810	4,380	2,620
29	2,260	2,810	56,200	21,800	.....	8,380	4,380	7,440	3,890	2,810	4,130	2,260
30	2,000	4,130	46,400	18,300	.....	8,700	4,380	7,750	3,890	2,620	3,890	2,260
31	1,920	.....	44,700	17,900	.....	8,700	.....	6,250	.....	2,620	3,890	.....

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Coosa River at Riverside, Ala., for the year ending Sept. 30, 1915.

[Drainage area, 7,060 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	17,100	1,760	4,150	0.588	0.68	B.
November	5,970	1,920	2,860	.405	.45	B.
December	56,200	3,430	17,200	2.44	2.81	B.
January	40,400	12,000	22,100	3.13	3.61	B.
February	51,500	11,000	25,300	3.58	3.73	B.
March	27,700	8,060	13,200	1.87	2.16	B.
April	8,380	4,380	5,990	.848	.95	B.
May	35,800	3,890	10,900	1.54	1.78	B.
June	7,750	3,220	4,900	.694	.77	B.
July	18,300	2,620	7,580	1.07	1.23	B.
August	9,980	2,620	4,520	.640	.74	B.
September	22,300	2,260	5,570	.789	.88	B.
The year	56,200	1,760	10,300	1.46	19.75	

ETOWAH RIVER NEAR BALL GROUND, GA.

Location.—At the iron wagon bridge about 3 miles southeast of Ball Ground and a quarter of a mile below mouth of Longswamp Creek.

Drainage area.—466 square miles.

Records available.—May 16, 1907, to September 30, 1915.

Gage.—A standard chain gage attached to upstream side of bridge, installed August 18, 1908, to replace vertical staff gage, located 75 feet below bridge; read twice daily by Miss Ethel Long. The chain gage was set to read with the vertical staff at low stages and will differ only very slightly at other stages.

Discharge measurements.—Made from upstream side of wagon bridge.

Channel and control.—Left bank does not overflow, but the right bank overflows about 500 feet beyond end of bridge approach at high stages. Current is somewhat broken and is disturbed by rough, rocky bed and curved channel above. Control somewhat shifting but not definitely located.

Extremes of discharge.—Maximum stage recorded during year: 13.2 feet at 6 a. m. December 26; discharge, 8,780 second-feet. Minimum stage recorded: 1.95 feet at 5 p. m. October 1; discharge, 265 second-feet.

Maximum stage recorded 1907–1915: 19.5 feet at 4 p. m. March 15, 1913; discharge, 15,500 second-feet. Minimum stage recorded: 1.4 feet at 6 a. m. July 28, 1914; discharge, 165 second-feet.

Regulation.—Operation of a number of mills above may cause slight variations in flow.

Accuracy.—Discharge relation affected by shifting of the stream bed some distance below station. Results fairly good.

Discharge measurements of Etowah River near Ball Ground, Ga., during the year ending Sept. 30, 1915.

[Made by Frank Lederle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 17	2.80	520	Aug. 20	2.87	554
Jan. 8	5.00	1,770	Sept. 27	2.15	355

Daily discharge, in second-feet, of Etowah River near Ball Ground, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	275	300	2,020	1,200	3,690	1,740	1,080	735	1,490	690	410	380
2	410	325	780	1,080	3,210	1,550	1,080	735	1,200	600	480	350
3	780	312	1,200	980	2,090	1,430	1,080	735	830	600	410	350
4	735	300	7,010	880	1,740	1,430	1,030	690	735	560	645	338
5	645	300	5,590	880	1,810	2,520	980	690	690	930	395	645
6	560	300	1,950	1,740	2,020	2,230	980	645	780	880	365	540
7	480	325	1,310	3,370	1,680	2,020	980	2,090	690	645	312	410
8	365	410	1,080	1,680	1,550	1,740	980	2,970	735	600	445	365
9	275	540	930	1,310	1,430	1,620	980	1,310	690	690	350	350
10	288	410	880	1,140	1,310	1,490	930	980	600	645	1,200	325
11	325	338	780	1,140	1,310	1,430	880	930	600	600	600	325
12	312	300	690	2,160	1,250	1,430	980	1,310	600	540	480	312
13	275	325	880	1,550	1,250	1,310	880	2,370	645	480	480	325
14	325	428	980	1,250	1,200	1,310	880	1,310	690	520	735	350
15	3,930	830	780	1,200	2,820	1,310	880	1,080	690	830	560	338
16	3,130	830	690	1,080	2,230	1,310	830	880	645	560	480	300
17	1,080	445	645	2,520	1,680	1,310	880	830	600	480	410	312
18	600	380	645	2,900	1,490	1,250	880	780	580	445	1,200	312
19	480	410	600	3,370	1,370	1,200	880	780	560	428	690	300
20	395	380	645	2,020	1,310	1,250	880	780	560	380	480	365
21	350	350	830	1,620	1,250	1,250	880	780	520	480	520	735
22	325	338	830	1,310	1,250	1,200	880	780	520	410	445	500
23	325	350	735	1,490	1,620	1,140	830	780	480	380	395	350
24	325	325	735	3,770	5,590	1,140	830	780	480	410	380	325
25	338	325	6,160	3,690	2,820	1,080	780	980	480	410	350	325
26	325	325	7,390	2,230	2,020	1,080	780	1,030	462	380	350	300
27	325	325	2,090	1,810	1,810	1,140	780	780	480	350	365	300
28	300	350	1,490	1,680	1,620	1,140	780	735	520	350	380	300
29	288	600	2,230	1,430	.....	1,080	780	690	560	338	380	275
30	300	3,770	1,880	1,310	.....	1,080	780	690	780	350	428	410
31	275	.....	1,370	1,310	.....	1,200	.....	1,030	.....	350	445	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve.

Monthly discharge of Etowah River near Ball Ground, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 466 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	3,930	275	617	1.32	1.52	B.
November	3,770	300	508	1.09	1.22	A.
December	7,390	600	1,800	3.86	4.45	B.
January	3,770	880	1,780	3.82	4.40	B.
February	5,590	1,200	1,940	4.16	4.33	B.
March	2,520	1,080	1,400	3.00	3.46	B.
April	1,080	780	903	1.94	2.16	A.
May	2,970	645	1,020	2.19	2.52	B.
June	1,490	462	663	1.42	1.58	A.
July	930	338	526	1.13	1.30	B.
August	1,200	312	502	1.08	1.24	A.
September	735	275	370	.794	.89	B.
The year	7,390	275	999	2.14	29.07	

ETOWAH RIVER NEAR ROME, GA.

Location.—At Freemans Ferry, 5 miles above Rome, where Etowah and Oostanaula rivers unite to form Coosa River; 1 mile below mouth of Dikes Creek.

Drainage area.—1,800 square miles.

Records available.—August 17, 1904, to September 30, 1915.

Gage.—Vertical staff in three sections on left bank 250 feet below the ferry; read twice daily by R. M. Patillo.

Discharge measurements.—Made from ferryboat or from small boat held in place by ferry cable. No measurements can be made at high stages.

Channel and control.—Both banks subject to overflow during extreme high water. Control formed by shoal immediately below gage.

Extremes of discharge.—Maximum stage recorded during year: 14.3 feet at 7 a. m. February 2; discharge, 22,500 second-feet. Minimum stage recorded: 1.45 feet at 6 p. m. October 2; discharge, 585 second-feet.

Maximum stage recorded 1905–1915: 23.1 feet at 6 p. m., March 20, 1906; discharge, approximately 60,800 second-feet. Minimum stage recorded: 1.2 feet, October 10 and 24, 1904; discharge, 360 second-feet.

Regulation.—Operation of the few mill dams above will seldom affect the flow.

Accuracy.—Conditions of flow permanent; rating curve excellent for low and medium stages.

No discharge measurements were made during the year, but a measurement made on November 2, 1915, checks the rating curve.

Daily discharge, in second-feet, of Etowah River near Rome, Ga., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	625	800	4,540	3,300	15,700	4,000	2,340	1,600	2,200	3,300	990	990
2	609	800	3,300	2,640	21,300	3,640	2,340	1,600	2,340	2,640	990	942
3	895	755	4,900	2,200	12,500	3,300	2,200	1,600	2,340	2,340	990	895
4	1,200	755	13,000	2,200	6,160	3,130	2,200	1,540	1,920	2,200	895	942
5	1,200	755	15,200	2,060	5,800	4,540	2,200	1,540	1,660	4,360	895	4,720
6	1,090	710	9,220	2,200	6,160	5,260	2,060	1,480	1,540	7,960	895	4,360
7	942	710	3,820	11,600	5,080	5,260	2,060	3,640	1,790	6,340	895	4,000
8	800	668	2,340	7,060	4,540	4,540	2,060	15,200	1,790	3,130	990	2,640
9	710	1,920	2,060	3,820	4,000	4,000	2,060	12,600	1,660	1,920	990	1,300
10	625	1,790	1,790	2,960	3,640	3,640	2,060	8,500	1,540	1,920	895	1,090
11	990	1,420	1,660	2,640	3,300	3,300	2,060	3,820	1,480	2,490	895	990
12	710	1,040	1,540	4,900	3,130	2,960	2,200	2,960	1,420	2,340	1,600	895
13	625	848	1,600	4,360	2,960	2,960	2,060	2,640	2,060	2,060	1,360	895
14	1,540	800	1,480	3,640	2,640	2,960	2,060	2,340	3,640	1,790	1,140	895
15	3,300	1,790	1,360	3,130	4,720	2,800	2,060	2,340	3,640	1,480	990	1,660
16	8,500	1,540	1,300	2,800	6,700	2,640	1,920	2,200	3,640	1,250	895	1,360
17	5,080	990	1,200	3,640	4,720	2,640	1,920	2,060	2,340	1,140	895	990
18	2,060	895	1,090	3,640	4,000	2,640	1,790	2,060	1,790	1,140	2,060	942
19	1,200	895	1,090	3,300	3,640	2,640	1,790	1,920	1,480	1,090	4,000	895
20	1,090	848	1,090	3,130	3,300	2,960	1,790	1,790	1,300	1,090	3,130	1,090
21	990	848	990	2,960	3,130	2,960	1,790	1,790	1,200	1,090	1,600	1,360
22	895	800	990	2,640	2,960	2,640	1,790	1,660	1,090	1,090	1,420	1,140
23	895	800	1,250	4,360	2,960	2,640	1,790	1,660	1,090	990	1,300	1,090
24	895	800	1,540	12,100	6,520	2,490	1,660	1,660	1,090	895	1,200	1,040
25	848	800	6,160	12,100	9,400	2,340	1,660	1,600	990	895	1,090	990
26	848	710	17,000	8,140	7,960	2,340	1,660	1,540	990	895	1,040	990
27	800	668	13,000	5,080	5,080	2,340	1,660	1,600	1,250	895	1,040	942
28	800	710	4,900	4,180	4,000	2,340	1,660	1,790	1,090	895	1,140	895
29	800	895	5,800	3,820	.....	2,340	1,660	1,660	2,060	895	1,090	895
30	800	800	7,240	3,640	.....	2,340	1,660	1,790	4,000	895	1,090	990
31	800	.....	4,720	3,300	.....	2,340	.....	2,060	.....	895	990	.....

NOTE.—Daily discharge determined from a rating curve well defined below 4,000 second-feet. Above 6,000 second-feet rating curve is an extension.

Monthly discharge of Etowah River near Rome, Ga., for the year ending Sept. 30, 1915.

[Drainage area, 1,800 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	8,500	609	1,390	0.772	0.89	B.
November	1,920	668	952	.529	.59	A.
December	17,000	990	4,420	2.46	2.84	C.
January	12,100	2,060	4,440	2.47	2.85	B.
February	21,300	2,640	5,930	3.29	3.43	B.
March	5,260	2,340	3,130	1.74	2.01	A.
April	2,340	1,660	1,940	1.08	1.20	A.
May	15,200	1,480	2,980	1.66	1.91	B.
June	4,000	990	1,880	1.04	1.16	A.
July	7,960	895	2,010	1.12	1.29	A.
August	4,000	895	1,270	.706	.81	A.
September	4,720	895	1,430	.794	.89	A.
The year	21,300	609	2,630	1.46	19.87	

TALLAPOOSA RIVER AT STURDEVANT, ALA.

Location.—At the Central of Georgia Railway bridge, a quarter of a mile west of Sturdevant, and 5 miles below mouth of Hillabee Creek.

Drainage area.—2,460 square miles.

Records available.—July 19, 1900, to September 30, 1915.

Gage.—Vertical staff on right bank about 2,000 feet above bridge; read twice daily by C. J. Stowe. Original gage was a staff in two sections attached to pier of railroad bridge. A standard chain gage installed July 10, 1905, was read until summer of 1906, when present gage was installed. Readings of new staff gage corrected to agree with readings of standard chain gage referred to its original datum at railroad bridge.

Discharge measurements.—Made from a plank walk resting on the lower members of the deck railroad bridge. Some low-water measurements made from boat.

Channel and control.—Rocky and permanent; one side deep and sluggish at low stages. Both banks overflow for about 200 feet at extreme high stages. Control, a rocky ledge across river just below bridge.

Extremes of discharge.—Maximum stage recorded during year: 14.3 feet at 8 a. m. July 6. Minimum stage recorded: 0.55 foot at 6 p. m. September 28 and 29. Maximum stage recorded 1900–1915: 21.6 feet, March 20, 1906; discharge, 59,100 second-feet. Minimum stage recorded: −0.2 foot, October 25 to 29, 1904; discharge, 250 second-feet.

Regulation.—Practically no effect from any of the small dams upstream.

As this station has not been visited since 1911, estimates of discharge have not been prepared.

Daily gage height, in feet, of Tallapoosa River at Sturdevant, Ala., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.95	0.9	3.6	4.1	11.3	3.8	3.5	2.2	2.7	3.7	1.0	1.45
2	2.2	.9	3.0	3.4	12.7	3.6	3.4	2.1	3.1	9.7	.95	1.35
3	2.3	.8	2.9	3.0	9.0	3.6	3.2	2.1	2.8	7.9	1.35	1.05
4	1.7	.8	4.5	2.9	7.8	3.6	3.0	2.0	2.5	5.3	1.7	1.05
5	1.35	.8	6.5	2.7	5.8	6.8	3.0	2.0	2.2	8.0	1.1	13.3
6	1.25	.8	4.5	4.5	5.0	6.3	2.9	2.0	2.1	11.5	1.0	7.0
7	1.35	.8	3.5	7.8	4.6	5.4	2.9	2.3	2.1	4.9	1.0	5.9
8	1.35	.8	3.0	6.2	4.2	4.7	2.8	7.9	2.8	3.8	.9	3.6
9	1.2	.9	2.7	4.7	4.0	4.2	2.8	9.2	2.2	4.9	.9	2.5
10	1.05	.9	2.3	4.1	3.8	4.0	2.8	6.3	1.8	7.2	.9	2.1
11	1.0	.8	2.2	4.0	3.6	3.8	2.7	4.1	1.7	6.7	3.8	1.8
12	.85	.8	2.1	5.0	3.5	3.7	2.6	4.4	1.7	4.3	3.2	1.6
13	1.15	1.0	2.5	4.5	3.4	3.6	2.6	4.0	1.8	3.2	2.4	1.45
14	2.2	1.25	3.0	4.0	3.6	3.5	2.6	3.6	2.0	2.8	2.1	1.45
15	4.1	4.0	3.0	3.5	6.1	3.4	2.5	3.2	2.2	2.5	1.8	1.6
16	4.6	5.7	2.8	3.3	5.9	3.4	2.5	3.0	2.0	3.0	1.6	1.35
17	3.4	4.7	2.5	6.3	5.1	3.4	2.5	2.6	1.8	2.7	1.4	1.7
18	2.7	2.7	2.3	7.8	4.3	3.3	2.5	2.5	2.2	2.3	1.25	1.4
19	2.0	2.2	2.2	7.6	4.0	3.2	2.5	2.3	1.8	2.0	2.0	1.3
20	1.7	1.9	2.2	6.2	3.8	3.2	2.4	2.2	1.7	1.8	3.8	1.25
21	1.45	1.7	2.2	4.9	3.6	3.3	2.4	2.2	1.45	1.8	3.0	1.15
22	1.3	1.45	2.3	4.1	3.5	3.2	2.3	2.1	1.35	1.6	2.6	1.05
23	1.1	1.3	2.3	4.2	3.7	3.2	2.3	2.1	1.15	1.5	2.2	1.0
24	1.05	1.1	2.3	8.1	5.6	3.1	2.3	2.2	1.05	1.5	2.2	.95
25	1.0	1.0	3.1	7.6	6.1	3.0	2.2	2.1	1.05	1.45	3.0	.8
26	1.0	1.05	4.7	6.5	5.4	3.0	2.5	2.1	1.1	1.35	2.5	.7
27	.95	1.3	4.9	5.5	4.5	3.0	2.3	2.6	1.3	1.25	1.6	.6
28	.8	1.7	4.1	4.7	4.0	3.0	2.5	5.2	1.45	1.15	1.4	.6
29	.9	3.4	4.5	4.1	.....	3.0	2.3	4.1	3.6	1.05	1.25	.55
30	.9	4.0	6.1	3.8	.....	3.0	2.2	3.5	2.9	1.0	1.45	2.3
31	.9	.....	5.1	3.6	.....	3.4	.....	2.9	.....	1.0	1.35	.....

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in the eastern Gulf of Mexico basin in the year ending September 30, 1915:

Miscellaneous discharge measurements in the eastern Gulf of Mexico drainage basin during the year ending Sept. 30, 1915.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Nov. 19	Etowah River	Coosa River	Frogtown bridge near Creighton gold mine, about 10 miles from Ball Ground, Ga.	(a)	304
Jan. 9	do	do	do	(b)	913
June 2	Pearl River	Gulf of Mexico	Old U. S. Geological Survey gaging station at Jackson, Miss.	6.19	2,150

a Water surface 17.05 feet below top of downstream side of left bank pier.
b Water surface 14.52 feet below top of downstream side of left bank pier.

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INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES.

PART II. SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below:

Part I. North Atlantic basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific basins in California.
XII. North Pacific basins; in three volumes.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small, and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

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

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., Customhouse.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
St. Paul, Minn., Old Capitol Building.
Austin, Tex., Old Post Office Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Phoenix, Ariz., 417 Fleming Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 416 Couch Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications may be obtained by applying to the Director, United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,800 points in the United States and have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	....do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.
W 401 to 414	do	1915.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives by years and drainage basins the numbers of the papers on surface-water supply published from 1899 to 1915. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data from 1902 to 1915, for any station in the area covered by Part III are published in Water-Supply Papers 83, 98, 128, 169, 205, 243, 263, 283, 303, 323, 353, 383, and 403, which contain records for the Ohio River basin for those years.

Number of water-supply papers containing results of stream measurements, 1899–1915.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific slope basins.		
	North Atlantic slope (St. John River to York River).	South Atlantic and eastern Gulf of Mexico (James River to the Mississippi).	Ohio River	St. Lawrence River and Great Lakes.	Hudson Bay and upper Mississippi River.	Missouri River.	Lower Mississippi River.	Western Gulf of Mexico.	Colorado River.	Great Basin.	Pacific slope in California.	Pacific slope in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope in Oregon.
1899[a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900[g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332–A	332–B	332–C
1913	351	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Estimates for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific slope basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Estimates for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill rivers to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated on page III, and in the records for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

PART II. SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS.

PRINCIPAL STREAMS.

The south Atlantic slope and eastern Gulf of Mexico drainage basins include streams flowing into the Atlantic Ocean and Gulf of Mexico from York River, Va., to Pearl River, Miss., inclusive. The principal streams in this division are James, Roanoke, Cape Fear, Yadkin, Santee, Savannah, Altamaha, Apalachicola, Choctawhatchee, Mobile, and Pearl. The streams drain wholly or in part the States of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. XVII.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained September 30, 1915; period after a date indicates discontinuance. Tributaries are indicated by indention.

JAMES RIVER BASIN.

Jackson River (head of James) at Covington, Va., 1907–8.
James River at Buchanan, Va., 1895–
James River at Holcomb Rock, Va., 1900–
James River at Cartersville, Va., 1899–
  Cowpasture River near Clifton Forge, Va., 1907–8.
  North River near Glasgow, Va., 1895–1905.
  Appomattox River at Mattoax, Va., 1900–1905.

ROANOKE RIVER BASIN.

Roanoke River at Roanoke, Va., 1896–
Roanoke River at Randolph, Va., 1900–1906.
Roanoke River above Dan River, at Clarksville, Va., 1895–1898.
Roanoke River at Old Gaston, N. C., 1912–
Roanoke River near Weldon, N. C., 1912.
Roanoke River at Neal, N. C., 1896–1903.
  Tinker Creek at Roanoke, Va., 1907–8.
  Back Creek near Roanoke, Va., 1907–8.
  Dan River at Madison, N. C., 1903–1908.
  Dan River at South Boston, Va., 1900–1907.
  Dan River at Clarksville, Va., 1895–1898.
    Banister River at Houston, Va., 1904–5.

TAR RIVER BASIN.

Tar River near Tarboro, N. C., 1896–1900.

NEUSE RIVER BASIN.

Neuse River near Selma, N. C., 1896–1900.

CAPE FEAR RIVER BASIN.

Haw River (head of Cape Fear River) near Moncure, N. C., 1898–9.
Cape Fear River near Fayetteville, N. C., 1889–1903.
Deep River near Cumnock, N. C., 1900–1902.
Deep River near Moncure, N. C., 1898–9.
Rockfish Creek near Brunt, N. C., 1902–3.

YADKIN (OR PEEDEE) RIVER BASIN.

Yadkin River (head of Peedee River) at North Wilkesboro, N. C., 1903–1909.
Yadkin River at Siloam, N. C., 1900–1901.
Yadkin River at Donnaha, N. C., 1913–
Yadkin River near Salisbury, N. C., 1895–1909; 1911–
Yadkin River near Norwood, N. C., 1896–1899.
Yadkin River near Peedee, N. C., 1906–1912.
Peedee River at Cheraw, S. C., 1909–1912.

SANTEE RIVER BASIN.

Catawba River (head of Santee River) at Old Fort, N. C., 1907.
Catawba River near Morganton, N. C., 1900; 1903–1909.
Catawba River at Catawba, N. C., 1896–1902.
Catawba River near Catawba, S. C., 1903–1905.
Catawba River near Rock Hill, S. C., 1895–1903.
Wateree River (lower part of Catawba) near Camden, S. C., 1903–1910.
Mill Creek at Old Fort, N. C., 1907.
Linville River at Fonta Flora, N. C., 1907–8.
Linville River near Bridgewater, N. C., 1900.
John River at Collettsville, N. C., 1907.
John River near Morganton, N. C., 1900–1901.
Broad River (of the Carolinas), head of Congaree River, at Uree, N. C., 1907–1909.
Broad River (of the Carolinas) at Dellinger, S. C., 1900–1901.
Broad River (of the Carolinas) near Gaffney, S. C., 1896–1899.
Broad River (of the Carolinas) at Alston, S. C., 1896–1907.
Green River near Saluda, N. C., 1907–1909.
Second Broad River near Logans Store, N. C., 1907–8.
Saluda River near Waterloo, S. C., 1896–1905.
Saluda River near Ninety Six, S. C., 1905.

EDISTO RIVER BASIN.

Four Hole Creek near Ridgeville, S. C., 1914.

SAVANNAH RIVER BASIN.

Chattooga River (head of Savannah River) near Clayton, Ga., 1907–8.
Tugaloo River (continuation of Chattooga River) near Toccoa, Ga., 1907–8.
Tugaloo River near Madison, S. C., 1898–1901; 1903–1910.
Savannah River near Calhoun Falls, S. C., 1896–1903.
Savannah River at Woodlawn, S. C., 1905–1910.
Savannah River at Augusta, Ga., 1899–1906.
Stekoa Creek near Clayton, Ga., 1907–8.
Tallulah River at Mathis, Ga., 1912–

Savannah River tributaries—Continued.
Tallulah River at Tallulah Falls, Ga., 1900–1901; 1904–1912.
Chauga River near Madison, S. C., 1907.
Seneca River near Clemson College, S. C., 1903–1905.
Broad River (of Georgia) near Carlton, Ga., 1897–1913.

OGEECHEE RIVER BASIN.

Ogeechee River near Millen, Ga., 1903.
Williamsons Swamp Creek near Davisboro, Ga., 1903–4.
Canoochee River near Groveland, Ga., 1903–1907.

ALTAMAHA RIVER BASIN.

South River (head of Ocmulgee River, which is head of Altamaha River) near Lithonia, Ga., 1903–4.
Ocmulgee River near Jackson, Ga., 1906–
Ocmulgee River near Flovilla, Ga., 1901–1905.
Ocmulgee River at Macon, Ga., 1893–1913.
Yellow River at Almon, Ga., 1897; 1899–1901.
Alcovy River near Covington, Ga., 1901–1904.
Alcovy River near Stewart, Ga., 1905–6.
Towaliga River near Juliette, Ga., 1899–1901.
Oconee River at Barnett Shoals, near Watkinsville, Ga., 1902.
Oconee River near Greensboro, Ga., 1903–
Oconee River at Carey, Ga., 1896–1898.
Oconee River at Fraleys Ferry, near Milledgeville, Ga., 1905–1908; 1909-
Oconee River at Milledgeville, Ga., 1903–1905.
Oconee River at Dublin, Ga., 1894–1913.
Middle Oconee River near Athens, Ga., 1901–2.
Apalachee River near Buckhead, Ga., 1901–1908.
Ohoopee River near Reidsville, Ga., 1903–1907.

ST. JOHNS RIVER BASIN.

Silver Spring near Silver Springs, Fla., 1906–7.

FLORIDA EVERGLADES DRAINAGE CANALS.

North New River canal near Fort Lauderdale, Fla., 1913.
North New River canal near Rita, Fla., 1913.
South New River canal near Zona, Fla., 1913.
South New River canal near Rita, Fla., 1913.
Miami canal near Miami, Fla., 1913.

SUWANNEE RIVER BASIN.

Suwannee River near White Springs, Fla., 1906–1908.

APALACHICOLA RIVER BASIN.

Chattahoochee River (head of Apalachicola River) near Ariel, Ga., 1907–1909.
Chattahoochee River near Leaf, Ga., 1907.
Chattahoochee River near Gainesville, Ga., 1901–1903.
Chattahoochee River near Buford, Ga., 1901.
Chattahoochee River near Norcross, Ga., 1903–
Chattahoochee River at Oakdale, Ga., 1895–1904.
Chattahoochee River at West Point, Ga., 1896–1910; 1912–
Chattahoochee River at Columbus, Ga., 1912.

Chattahoochee River at Alaga, Ala., 1908–1912.
Soque River near Demorest, Ga., 1904–1909.
Sweetwater Creek near Austell, Ga., 1904–5; 1913.
Flint River near Molina, Ga., 1897–98.
Flint River near Woodbury, Ga., 1900–
Flint River near Musella, Ga., 1907.
Flint River near Culloden, Ga., 1911–
Flint River near Montezuma, Ga., 1905–1909; 1911–12.
Flint River at Albany, Ga., 1902–
Flint River at Bainbridge, Ga., 1908–1913.
Tobler Creek near Yatesville, Ga., 1914–
Kinchafoonee Creek near Leesburg, Ga., 1905–1909.
Kinchafoonee Creek near Albany, Ga., 1903.
Muckalee Creek near Albany, Ga., 1903.
Ichawaynochaway Creek at Milford, Ga., 1905–1907.
Chipola River at Altha, Fla., 1912–13.

CHOCTAWHATCHEE RIVER BASIN.

Choctawhatchee River near Newton, Ala., 1906–1908; 1911–12.
Choctawhatchee River near Geneva, Ala., 1904.
Double Bridges Creek at Geneva, Ala., 1904.
Pea River at Pera, Ala., 1904–1913.
Pea River at Elba, Ala., 1906.

ESCAMBIA RIVER BASIN.

Conecuh River at Beck, Ala., 1904–

MOBILE RIVER BASIN.

Cartecay River (head of Mobile River) near Cartecay, Ga., 1904–5; 1907.
Coosawattee River (continuation of Cartecay River) at Carters, Ga., 1892–1908.
Oostanaula River (continuation of Coosawattee River) at Resaca, Ga., 1896–1901; 1905–
Coosa River (continuation of Oostanaula River) at Rome, Ga., 1897–1903.
Coosa River at Lock No. 4, above Riverside, Ala., 1890–1901.
Coosa River at Riverside, Ala., 1896–
Coosa River at Lock No. 5, near Riverside, Ala., 1892–1899.
Coosa River at Childersburg, Ala., 1914.
Coosa River at Lock No. 12, near Clanton, Ala., 1914.
Coosa River at Lock No. 18, near Wetumpka, Ala., 1914.
Coosa River near Wetumpka, Ala., 1896–1898.
Alabama River (continuation of Coosa River) at Montgomery, Ala., 1899–1903.
Alabama River at Selma, Ala., 1899–1913.
Ellijay River at Ellijay, Ga., 1907.
Conasauga River at Beaverdale, Ga., 1907–8.
Etowah River near Ball Ground, Ga., 1907–
Etowah River at Canton, Ga., 1892–1905.
Etowah River near Rome, Ga., 1904–
Etowah River at Rome, Ga., 1903.
Amicalola River near Potts Mountain, Ga., 1907–8; 1910–1913.
Choccolocco Creek near Jenifer, Ala., 1903–1908.
Talladega Creek at Nottingham, Ala., 1900–1904.
Tallapoosa River at Sturdivant, Ala., 1900–.
Tallapoosa River near Susanna, Ala., 1900–1901.
Tallapoosa River at Cherokee Bluffs, near Tallassee, Ala., 1912–1914.

Alabama River tributaries—Continued.
Tallapoosa River at Milstead, Ala., 1897–1903.
Little Tallapoosa River near Wedowee, Ala., 1913–14.
Hillabee Creek near Alexander City, Ala., 1900–1903.
Big Sandy Creek near Dadeville, Ala., 1900–1901.
Cahaba River at Centerville, Ala., 1901–1908.
Tombigbee River at Columbus, Miss., 1900–1912.
Tombigbee River at Epes, Ala., 1900–1901; 1905–1913.
Black Warrior River (Mulberry Fork of Black Warrior River) near Cordova, Ala., 1900–1912.
Black Warrior River near Coal, Ala., 1908–1910.
Black Warrior River at Tuscaloosa, Ala., 1889–1905.
Sipsey Fork of Black Warrior River—
Clear Creek near Elk, Ala., 1904–5.
Locust Fork of Black Warrior River at Palos, Ala., 1902–1905.
Village Creek near Mulga, Ala., 1909–10.
Camp Branch near Ensley, Ala., 1908–1910.
Venison Branch near Mulga, Ala., 1908–9.

PEARL RIVER BASIN.

Pearl River at Jackson, Miss., 1901–1913.
Bogue Chitto at Warnerton, La., 1906.

REPORTS ON WATER RESOURCES OF THE SOUTH ATLANTIC AND EASTERN GULF STATES.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distances along rivers of the United States, and brief descriptions of many of the streams, including Roanoke, Cape Fear, Peedee, Santee, Savannah, Oconee, Apalachicola, Chattahoochee, Coosa, Tallapoosa, and Black Warrior rivers.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second edition was published as Water-Supply Paper 149 (q. v.).

62. Hydrography of the southern Appalachian Mountain region, Part I, by H. A. Pressey. 1902. 95 pp., 25 pls. 15c.

63. Hydrography of the southern Appalachian Mountain region, Part II, by H. A. Pressey. 1902. pp. 96–190, pls. 26–44. 15c.

Nos. 62 and 63 describe in a general way the mountains, rivers, climate, forests, soil, vegetation, and mineral resources of the southern Appalachian Mountains, and then discuss in detail the drainage basins, giving for each an account of the physical features, rainfall, forests, minerals, transportation, discharge measurements, and water powers. Most of the streams described are tributary through Tennessee River to the Ohio, but Part II (No. 63) includes also descriptions of several streams in the south Atlantic and eastern Gulf of Mexico drainage basins.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Contains an account of flood on tributaries of Broad River (of the Carolinas) in Spartanburg County, S. C.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on municipal water supplies, wells, and springs of Georgia, Alabama, and Mississippi. The reports comprise tabulated well records, giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

*107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp., 9 pls. 20c.

Contains gage heights, rating tables, and estimates of monthly discharge at stations on Tallapoosa, Coosa, Alabama, Cahaba, Black Warrior, and Tombigbee rivers and their tributaries; gives estimates and short descriptions of water powers.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains reports as follows:

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie. Scope indicated by title.

Water resources of the Cowee and Pisgah quadrangles, North Carolina, by Hoyt S. Gale. Discusses drainage, springs, and mineral waters of one of the units of the geologic atlas of the United States.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports relating to south Atlantic and eastern Gulf of Mexico drainage areas, as follows:

North Carolina, by M. L. Fuller.
South Carolina, by L. C. Glenn.
Georgia, by S. W. McCallie.
Florida, by M. L. Fuller.
Alabama, by E. A. Smith.

Each of these reports describes the geology of the area in its relation to water supplies, notes the principal mineral springs, and gives list of pertinent publications.

115. River surveys and profiles made during 1903, arranged by W. C. Hall and J. C. Hoyt. 1905. 115 pp., 4 pls. 10c.

Contains results of surveys made to determine location of undeveloped power sites. Gives elevations and distances along Catawba, Tallulah, Chattooga, Tugaloo, Savannah, Broad, Ocmulgee, Yellow, South, Alcovy, Towaliga, and Chattahoochee rivers.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains "Notes on certain hot springs of the southern United States," by Walter Harvey Weed, including the "Warm springs of Georgia." Describes the location of the springs, the geologic conditions, and the composition of the waters (with analyses); estimates discharge.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties) location, depth, diameter, yield, height of water, and other valuable information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

159. Summary of the underground-water resources of Mississippi, by A. F. Crider and L. C. Johnson. 1906. 86 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the State; discusses the source, depth of penetration, rate of percolation, and recovery of underground waters; artesian requisites, and special conditions in the Coastal Plain formations; gives notes on wells by counties, deep well records, and selected records in detail; treats of sanitary aspect of wells and gives analyses.

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*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Contains brief report entitled "Peculiar mineral waters from crystalline rocks of Georgia," by Myron L. Fuller, discussing origin of certain mineral springs and wells near Austell; gives analyses.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates of flood discharge and frequency on Cape Fear, Savannah, Alabama, and Black Warrior rivers.

*197. Water resources of Georgia, by B. M. and M. R. Hall. 1907. 342 pp., 1 pl. 50c.

Describes topographic and geologic features of the State; discusses by drainage basins, stream flow, river surveys, and water powers.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of James, Roanoke, Dan, Neuse, Cape Fear, Peedee, Wateree, Saluda, Savannah, Ocmulgee, Oconee, Chattahoochee, Flint, Oostanaula, Alabama, Cahaba, Tombigbee, and Pearl rivers.

319. Geology and ground waters of Florida, by George Charlton Matson and Samuel Sanford. 1913. 445 pp., 17 pls. 60c.

Describes the characteristic upland, lowland, and coastal features of the State—the springs, lakes, caverns, sand dunes, coral reefs, bars, inlets, tidal runways, pine lands, swamps, keys, and ocean currents; discusses in detail the stratigraphic position, lithologic character, thickness, physiographic expression, structure, and areal distribution of the geologic formations; treats of the source, amount, depth, circulation, and recovery of ground waters, the artesian waters, and public water supplies; and gives details concerning source, quality, and development of the water supplies by counties. Discusses briefly the quality of the well waters.

341. Underground waters of the coastal plain of Georgia, by L. W. Stephenson and J. O. Veatch, and a discussion of the quality of the waters, by R. B. Dole. 1915. 539 pp., 21 pls. 50c.

Describes the physiographic features of the State, the geologic provinces, the areal distribution, stratigraphic position, and lithologic character of the rocks belonging to the geologic systems; discusses the source and amount of the ground waters, the uses of the springs and shallow and artesian wells, and the distribution of the ground waters in the rocks of the various formations; gives details concerning each county. The chapter on the chemical character of the waters describes standards for classification and the general requisites of waters for miscellaneous industrial uses and for domestic use; teats also of methods of purifying water and of the relation of quality to geographic position, to water-bearing stratum, and to depth.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. I. Geology, xv, 774 pp., 98 pls. $2.35. Contains:

General account of the fresh-water morasses of the United States, with a description of the Dismal Swamp district of Virginia and North Carolina, by N. S. Shaler, pp. 255-339. Pls. vi-xix. Scope indicated by title.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II. Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*Potable waters of the eastern United States, by W J McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

37. The southern Appalachian forests, by H. B. Ayres and W. W. Ashe. 1905. 291 pp., 37 pls. 80c.

Describes the relief, drainage, climate, natural resources, scenery, and water supply of the southern Appalachian forests, the trees, shrubs, and rate of growth; gives details concerning forests by drainage basins, including New, Holston (southern tributaries of South Fork only), Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, Hiwassee, Tallulah-Chattooga, Toxaway, Saluda and First and Second Broad rivers, Catawba and Yadkin rivers, describing, many of the tributaries of each of the master streams.

72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*138. Artesian-well prospects in the Atlantic Coastal Plain region, by N. H. Darton. 1896. 232 pp., 19 pls.

Describes the general geologic structure of the Atlantic Coastal Plain region and summarizes the conditions affecting subterranean water in the Coastal Plain; discusses the general geologic relations in New York, southern New Jersey, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, and eastern Georgia; gives for each of the States a list of the deep wells and discusses well prospects. The notes on the wells that follow the tabulated lists contain many sections and analyses of the waters.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records, to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Alabama, Florida, Georgia, and North Carolina, and detailed records of wells in Hancock and Jackson counties, Mississippi. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia; and detailed records of wells in Madison, Marengo, and Mobile counties, Alabama; Duval, Escambia, Sumter, and Volusia counties, Florida; Chatham, Decatur, Fulton, Pierce, and Tattnall counties, Georgia; Lenoir, New Hanover, and Moore counties, North Carolina; Aiken, Barnwell, Charleston, Hampton, Lee, and Orangeburg counties, South Carolina; and Hancock, Harrison, Jackson, Marshall, Newton, and Panola counties, Mississippi. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately

surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

80. Norfolk, Virginia-North Carolina. 5c.

    Describes the plains, Dismal Swamp, and the tidal marshes; discusses the reclamation of swamp lands and gives an account of the underground waters; gives sections of wells near Norfolk and at Fort Monroe, and analyses of waters from the test boring at Norfolk and the boring at Lambert Point.

90. Cranberry, North Carolina-Tennessee. 5c.

124. Mount Mitchell, North Carolina-Tennessee. 5c.

147. Pisgah, North Carolina-South Carolina. 5c.

[1] Index maps showing areas in the South Atlantic States covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

175. Birmingham, Alabama.[1] 5c.

187. Ellijay, Georgia-North Carolina-Tennessee.[2] 25c.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the South Atlantic States are the reports of the State surveys of North Carolina, Georgia, Florida, and Alabama, and the Tenth Census (vol. 16).

The following reports deserve special mention:

Hydrography of Virginia, by N. C. Grover and R. H. Bolster: Virginia Geol. Survey Bull. 3, 1906.

Underground waters of the Coastal Plain province of Virginia, by Samuel Sanford: Virginia Geol. Survey Bull. 5, 1913.

Surface water supply of Virginia, by G. C. Stevens: Virginia Geol. Survey Bull. 10, 1916.

A preliminary report on the water powers of Georgia, by B. M. Hall: Georgia Geol. Survey Bull. 3-A, 1896.

A preliminary report on the artesian-well system of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 7, 1898.

A preliminary report on the underground waters of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 15, 1908.

Second report on the water powers of Georgia, by B. M. Hall and M. R. Hall: Georgia Geol. Survey Bull. 16, 1908.

A preliminary report on the mineral springs of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 20, 1913.

A preliminary report on the underground water supply of central Florida, by E. H. Sellards: Florida Geol. Survey Bull. 1, 1908.

Underground waters of Mississippi; a preliminary report by W. N. Logan and W. R. Perkins: Mississippi Agr. Exper. Sta. Bull. 89, 1905.

Report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the Southern Appalachian region: 57th Congress, 1st sess., S. Doc. 84, 1902.

Underground water resources of Alabama, by E. A. Smith. Montgomery, Ala., 1907.

Preliminary report on part of the water powers of Alabama, by B. M. Hall: Alabama Geol. Survey Bull. 7, 1903.

Papers on the water power in North Carolina, a preliminary report by George F. Swain, J. A. Holmes, and E. W. Myers: North Carolina Geol. Survey Bull. 8, 1899.

The Coastal Plain of North Carolina, by W. B. Clark, B. L. Miller, L. W. Stephenson, B. L. Johnson, and H. N. Parker: North Carolina Geol. and Econ. Survey Rept., vol. 3, 1912.

Many of these reports can be obtained by applying to the several organizations, and most of them can be consulted in the public libraries of the larger cities.

[1] Octavo edition only.

[2] Octavo edition, 50c.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kansas; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

32 Water resources of Puerto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. 15c.

Describes briefly topography, climate, rivers, irrigation methods, soils, forestation, water power, and transportation facilities.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901-2. (See also Nos. 64, 94, and 95.)

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow, and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing wells; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

77. The water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls. 10c.

Describes briefly the topography, geology, coral reefs, climate, soils, vegetation, forests, and fauna of the island, the springs, running streams and wells, and discusses the utilization of the surface and underground waters.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws of measurements of stream flow; gives formulas for rainfall, run-off, and evaporation; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane-table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

*95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

Notes on the hydrology of Cuba, by M. L. Fuller.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., and the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller, 1905. 128 pp. 10c.

Scope indicated by title.

122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y., gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest.

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers. 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905; lists of publications relating to underground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, * * * with a history of the sewage-disposal problem, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification by intermittent sand filtration and in beds of coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*196. Water supply of Nome region, Seward Peninsula, Alaska, 1906, by J. C. Hoyt and F. F. Henshaw. 1907. 52 pp., 6 pls. 15c.

Gives results of measurements of flow of Alaskan streams, discusses available water supply for ditch and pipe lines and power development; presents notes for investors.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*218. Water-supply investigations in Alaska, 1906–7 (Nome and Kougarok regions, Seward Peninsula; Fairbanks district, Yukon-Tanana region), by F. F. Henshaw and C. C. Covert. 1908. 156 pp., 12 pls. 25c.

Describes the drainage basins, gives results of observations at the gaging stations, and discusses the water supply of the ditches and pipe lines and possibilities of development; gives also meteorological records.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

228. Water-supply investigations of the Yukon-Tanana region, Alaska, 1907 and 1908 (Fairbanks, Circle, and Rampart districts), by C. C. Covert and C. E. Ellsworth. 1909. 108 pp., 7 pls. 20c.

Describes the drainage basins; gives results of observations at gaging stations; discusses the water supplies of the ditches and pipe lines and possibilities of hydraulic development.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool-scouring, bleaching, and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one-hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture and gives résumé of Federal and State water-power legislation in the United States.

255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

*258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

314. Surface water supply of Seward Peninsula, Alaska, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith, and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., 17 pls. 45c.

Contains results of work at gaging stations.

315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

318. Water resources of Hawaii, 1909–1911, by W. F. Martin and C. H. Pierce. 1913. 552 pp., 15 pls. 50c.

Describes the general features of the islands and gives results of measurements of streams and of observations of rainfall and evaporation; contains a gazetteer.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

336. Water resources of Hawaii, 1912, by C. H. Pierce and G. K. Larrison. 50c.

Contains results of stream measurements on the islands in 1912.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

342. Surface water supply of the Yukon-Tanana region, Alaska, by C. E. Ellsworth and R. W. Davenport. 1915. 343 pp., 13 pls. 45c.

Presents results of 6 years' observations of the water supply of the Yukon-Tanana region, discusses climate and precipitation, and gives station records.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 30c.

*(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65. Scope indicated by title.

(f) The discharge of Yukon River at Eagle, Alaska, by E. A. Porter and R. W. Davenport, pp. 67–77, pls. iv–v. 5c. Describes briefly the location and size of the Yukon basin, the climatic conditions in the basin, and methods of collecting hydrometric data; compares run-off with precipitation, and gives table showing the discharge of some of the large rivers in the United States as compared with the discharge of the Yukon and the Nile.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri, and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells, shelters, and structures for making discharge measurements and artificial controls.

373. Water resources of Hawaii, 1913, by G. K. Larrison. 1915. 190 pp. 20c.

Contains results of stream measurements on the islands in 1913.

375. Contributions to the hydrology of the United States, 1915. N. C. Grover, chief hydraulic engineer.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914, as follows:.

(c) Relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77–84.

(e) A method for correcting river discharge for a changing stage, by B. E. Jones, pp. 117–130.

(f) Conditions requiring the use of automatic gages in obtaining stream-flow records, by C. H. Pierce, pp. 131–139.

400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer.

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173, pl. xxi. Scope indicated by title.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363–561, pls. cvii to cxlvi. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. cxi to cxlvi. Discusses the economical aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, pp. xx, 597, 73 pls. $2.10. Contains:

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. iii and iv. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, papers chiefly of a theoretic nature, pp. v, 958, 172 plates. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. vi to xvi. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. xvii. Scope indicated by title.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, vii, 660 pp., 75 pls. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563–637, pls. lxiv to lxxv. Describes the topographic features of the boundary, the lake basin, and Rio San Juan; gives a brief résumé of the boundary dispute; discusses rainfall, temperature, and relative humidity, evaporation, resources, and productions, the ship-railway and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Juan and its tributaries.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901. Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts, Pt. IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507–630, pls. xxxvii to l. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharge of many of the streams, and rainfall, and evaporation tables for various points.

PROFESSIONAL PAPERS.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

A highly technical report.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural water; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses, discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

INDEX OF STREAMS.