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

# REPORT

OF

# PROGRESS OF STREAM MEASUREMENTS

FOR

# THE CALENDAR YEAR 1902

BY

F. H. NEWELL

PART II.—SOUTHERN ATLANTIC, EASTERN GULF, EASTERN MISSISSIPPI RIVER AND GREAT LAKES DRAINAGE

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1903

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DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
DIVISION OF HYDROGRAPHY,
*Washington, D. C., May 1, 1903.*

SIR: I have the honor to transmit herewith Water-Supply Paper No. 83, which is Part II of the Progress Report of Stream Measurements for 1902. This paper, with Water-Supply Paper No. 82, Part I, of the above report, makes up the report for the territory east of the Mississippi. The report for the territory west of the Mississippi will follow in Water-Supply Papers Nos. 84 and 85.

These papers contain for the various gaging stations the original data as collected and the results obtained from the discussion of these data; also such other information as is of interest in hydrographic studies.

Very respectfully,

F. H. NEWELL,
*Hydrographer in Charge.*

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

# PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1902.

## PART II.

By F. H. NEWELL

## INTRODUCTION.

This paper completes the Progress Report of Stream Measurements for the territory lying east of the Mississippi River, and with Water-Supply Paper No. 82 makes up the complete report for this section. The material in these papers consists of both the original data as collected, and the results obtained from the discussion of these data; also brief descriptions and facts regarding such other subjects as are allied to hydrographic studies. For convenience in arrangement the data in this paper have been grouped by drainage areas. These are arranged in the report geographically as follows: From north to south for those areas which drain into the southern Atlantic; from east to west for those that drain into the eastern Gulf of Mexico; from north to south for those draining into the Mississippi, and from east to west for those draining into the Great Lakes.

On figs. 1 and 2 the relative location of the stations at which the United States Geological Survey is collecting hydrographic data is shown. The section west of the shaded line shows those States which are covered by the national irrigation act of June 17, 1902, and the cross-lined areas show the location of the principal irrigation projects which are now under investigation.

In collecting hydrographic data the Geological Survey has received the hearty cooperation of various individuals, corporations, and States, as mentioned hereafter. This cooperation has made possible the publication of many valuable records which could not otherwise have been obtained.

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

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

1893.<br>1894. } Bulletin No. 131.

1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11, Part IV of the Eighteenth Annual Report.
1897. Water-Supply Papers Nos. 15 and 16, Part IV of the Nineteenth Annual Report.
1898. Water-Supply Papers Nos. 27 and 28, Part IV of the Twentieth Annual Report.

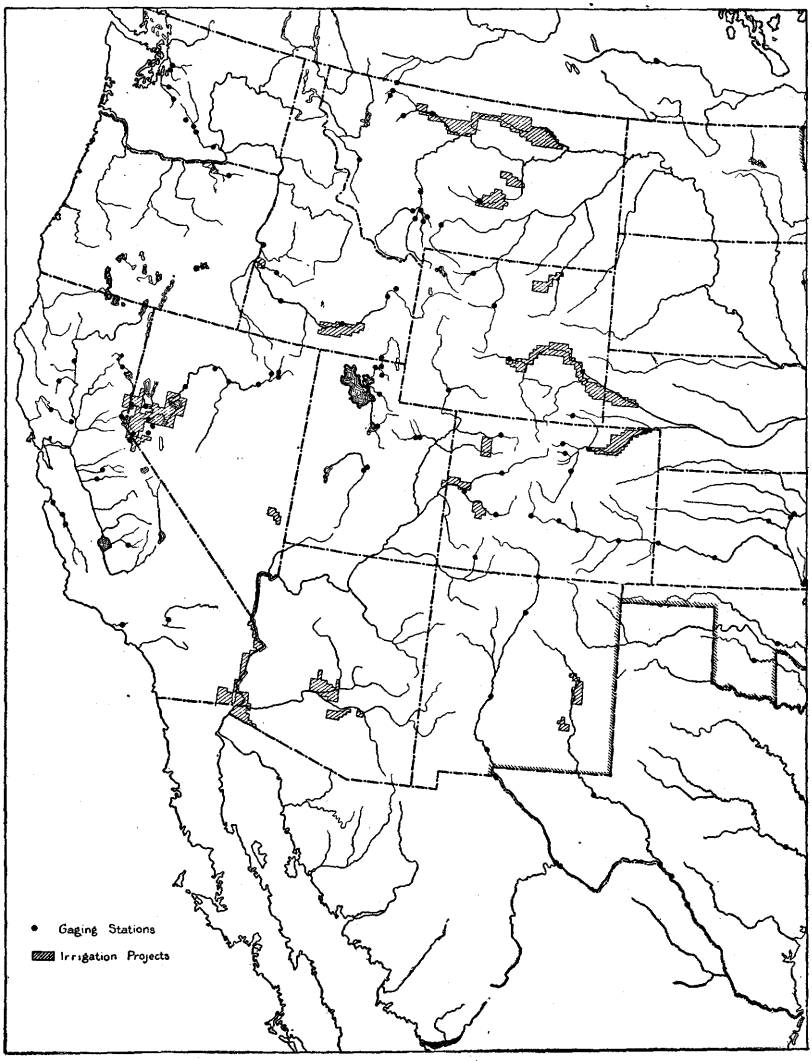


FIG. 1.—Location of river stations and principal irrigation projects in western half of United States, 1902–1903.

1899. Water-Supply Papers Nos. 35 to 39, inclusive, Part IV of the Twenty-first Annual Report.
1900. Water-Supply Papers Nos. 47 to 52, inclusive, Part IV of the Twenty-second Annual Report.
1901. Water-Supply Papers Nos. 65, 66, and 75.
1902. Water-Supply Papers Nos. 82 to 85, inclusive.

## ACKNOWLEDGMENTS.

Most of the data presented in this paper have been obtained through local hydrographers and engineers. Acknowledgment is due to each of these persons, and thanks are extended to other persons and corporations who have assisted local hydrographers, or who have coop-

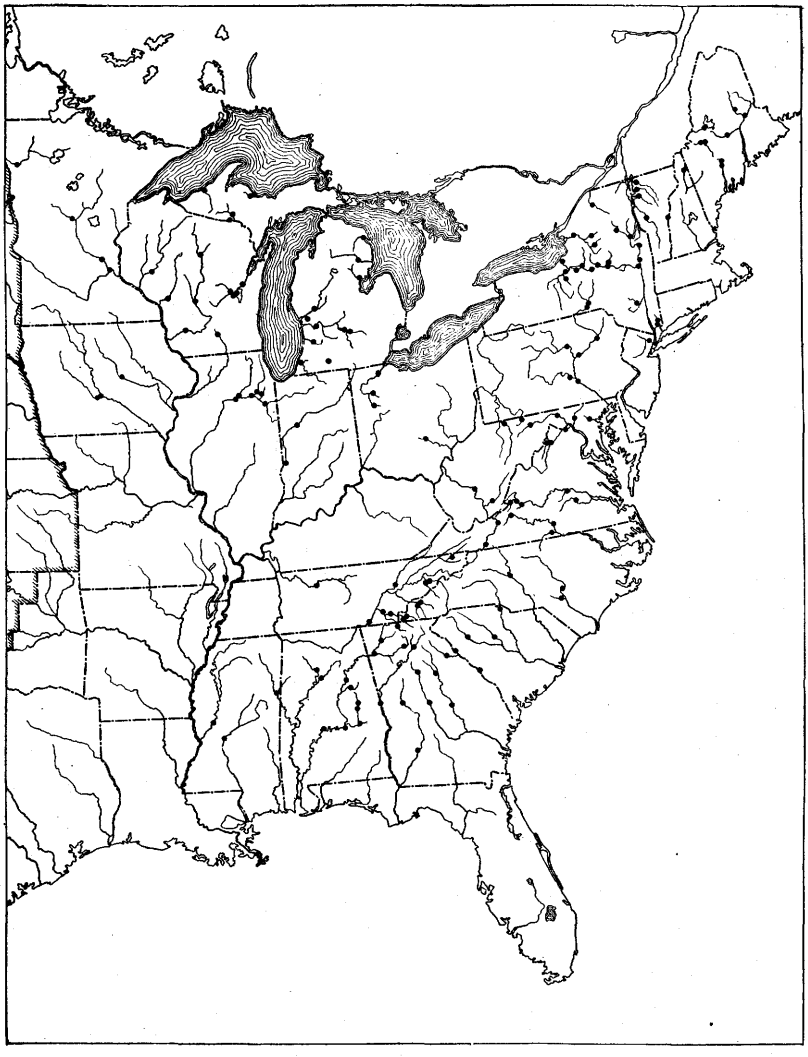

FIG. 2.—Location of river stations in eastern half of United States, 1902–1903.

erated in any way, either by furnishing records or by assisting in transportation.

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

Maryland: Resident hydrographer, E. G. Paul.

Virginia: Resident hydrographers, Prof. D. C. Humphreys and E. W. Myers, assisted by B. S. Drane.

North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Tennessee: Resident hydrographers, Prof. B. M. Hall and Maxcy R. Hall. Thanks are also due to the following individuals and corporations: Prof. W. S. Yates, State geologist of Georgia; for paying the salaries of observers at Barnett Shoals, Buckhead, Covington, Gainesville, Carters, Blueridge, and Canton, Ga.; Dr. Eugene A. Smith, State geologist of Alabama, for the salaries of observers at Sturdevant, Alexander, Nottingham, Riverside, Centerville, Cordova, and Milstead, Ala.; the city of Augusta, Ga., for gage heights at that place. The following Weather Bureau officials have furnished gage heights for the Weather Bureau stations, as noted in the descriptions of stations: D. Fisher, Augusta, Ga.; J. B. Marbury, Atlanta, Ga.; John R. Weeks, Macon, Ga.; F. P. Chaffee, Montgomery, Ala.; W. M. Dudley, Mobile, Ala.; W. S. Belden, Vicksburg, Miss.; L. M. Pindell, Chattanooga, Tenn.; H. C. Bate, Nashville, Tenn. R. C. McCalla, U. S. assistant engineer, has furnished gage heights at Tuscaloosa, Cordova, and Palos, Ala. Transportation has been furnished through the kindness of J. S. B. Thompson, general agent of the Southern Railway; by Capt. E. Berkeley, superintendent of the third division of the Seaboard Air Line; by Thomas K. Scott, general manager of the Georgia Railroad; by James T. Wright, vice-president and general manager of the Macon, Dublin and Savannah Railroad; by John M. Egan, president of the Central of Georgia Railway; by John B. Newton, general manager of the Atlanta, Knoxville and Northern Railway; by W. B. Denham, general superintendent of the Plant System; by Hunter McDonald, chief engineer of the Nashville, Chattanooga and St. Louis Railway; and by W. J. Murphy, general manager of the Queen and Crescent Route.

The stations at Fayetteville, Brunt, Catawba, Cumnock, Murphy, Judson, Neal, Bryson, and Salisbury, N. C.; Alston, Rockhill, and Waterloo, S. C.; and Bluff City, Oldtown, and Newport, Tenn., were under the care of resident hydrographer E. W. Myers, assisted by B. S. Drane. Mr. Myers also prepared the report on the Cape Fear drainage basin.

West Virginia: Resident hydrographer, Prof. D. C. Humphreys.

Ohio: Measurements in this State were mostly made by the late Benjamin H. Flynn, engineer of the state board of health. He was assisted by the engineering department of the Ohio State University, and valuable suggestions were given by William B. Gerrish, M. Am. Soc. C. E., of Oberlin.

Indiana: The gage heights of Lafayette River at Terre Haute have been furnished by D. M. Raubarger. Prof. George E. Waesche, of Purdue University, has furnished the data for Lafayette.

Illinois: Field assistant, E. H. Heilbron. Thanks are also due to the following gentlemen for suggestions and assistance: Isham Randolph, chief engineer, and George W. Wisner, assistant chief engineer, sanitary district of Chicago; L. E. and E. L. Cooley, of Chicago; and Jacob A. Harman, of Peoria.

Wisconsin: The hydrographic work in this State has been carried on in cooperation with the Wisconsin geological and natural history survey, of which E. A. Birge is director and superintendent. Prof. L. S. Smith, engineer of the above survey, has had general charge of the hydrographic work, which has been performed by L. R. Stockman.

Michigan: R. E. Horton, resident hydrographer. Acknowledgment should be made to the following individuals and corporations for services rendered and data furnished: L. W. Anderson, city engineer, Grand Rapids; Prof. H. K. Vedder, agricultural college; Newaygo Portland Cement Co., Newaygo; Fletcher Paper Co., Alpena; Cleveland-Cliffs Iron Co., Negaunee; J. M. Longyear, Marquette; Hugh H. Hosford, Buchannan; F. W. McCoy, Mendon; Dr. A. C. Lane, state geologist, Lansing;

F. M. Warner, secretary of state, Lansing; Kalamazoo Electric Company, Kalamazoo; H. M. Louds Sons Co., Oscoda; Frank Drake, chief engineer of the Oliver Iron Co., Duluth, Minn.

Acknowledgments are also due to John C. Hoyt, George L. Warner, H. G. Stokes, and Frank H. Brundage, for computations on and the arrangement of data of this report.

## SOUTHERN ATLANTIC COAST DRAINAGE.

Systematic measurements of discharge of many of the larger rivers of the Southern Atlantic States have been made during the year. The drainage areas of the rivers in that region are in general similar. Most of the streams rise in the southern Appalachian Mountains or their foothills. In the upper part of their courses they are rapid, with considerable fall. Across the Piedmont Plain their valleys are wide and their flow in general is sluggish, with occasional falls over rocky beds. Many of them have falls that could be utilized for water power, and it is largely to that end that data of the flow are being collected. In the study of water power it is important to know the flow and the fall. The fall can readily be determined by an engineer, but the variations in flow often require long and careful study. Gaging stations, to determine the latter, have been established on nearly all the larger streams in the region, and it is hoped that in the near future our information of their fall will be extended.

In this report the areas in this section from which data have been received during 1902 have been grouped as follows, and arranged geographically from north to south:

Roanoke, Cape Fear, Pedee or Yadkin, Santee, Savannah, and Altamaha rivers.

### ROANOKE RIVER DRAINAGE BASIN.

Roanoke River, draining a total area of about 9,200 square miles above its mouth, empties into Albemarle Sound a short distance below Plymouth, N. C., and is navigable at all stages as far upstream as Weldon, N. C., where the river crosses the fall line, a distance of 120 miles.

The Roanoke proper is formed by the confluence of the Dan and Staunton rivers, at Clarksville, Mecklenburg County, Va., 185 miles above the mouth of the stream, though the name "Roanoke" is also applied to the upper waters of Staunton River. These streams drain respectively 3,798 square miles and 3,546 square miles. The United States Weather Bureau maintains a gage at Clarksville, and gaging stations on both streams were also maintained here by the Geological Survey for some years.

Of these streams the Staunton is the more northerly, its drainage basin lying entirely in Virginia. It rises among the eastern foothills

of the Blue Ridge to the southwestward of Roanoke and Salem, being known in this part of its course as the Roanoke, and flows at first toward the northeast, then to the southeast, and through Montgomery, Roanoke, Bedford, Campbell, Halifax, and Mecklenburg counties to the junction with the Dan.

A large part of the area drained by the Dan lies in North Carolina. The stream rises in Surry County, N. C., and in Patrick County, Va., and flows at first to the southeast, through Stokes County, N. C., then turns to the northeast through Rockingham and Caswell counties, N. C., and through Pittsylvania, Halifax, and Mecklenburg counties, Va., to the junction with the Staunton.

The average rainfall on the basin of the Roanoke above the fall line is about 48 inches per annum. The average amount probably increases slightly as the stream is ascended, though the records of rainfall over the basin are too incomplete as yet to decide this matter. The amount of rainfall is quite evenly distributed throughout the seasons. This results in a variable flow, since it is probable that the evaporation over the basin is comparatively large.

The freshets on the river are violent, and the fluctuations of height occur with great rapidity. Rises of 50 feet and over have been noted at Weldon, and freshets in which the rate of rise is 10 feet a day or more are frequent.

The maximum recorded flood at the gaging station at Neal occurred in May, 1901, the gage reading being 30.3 feet, and the estimated discharge 84,400 second-feet, equivalent to about 9.7 second-feet per square mile. The minimum flow recorded at this station was 1,380 second-feet, or about 0.16 second-foot per square mile. The maximum flow is thus about 61 times the minimum.

The maximum flow so far recorded for the station on the Dan River at South Boston, Va., is 51,200 second-feet, or about 18 second-feet per square mile, while the greatest flood on the Staunton during the same period at the station at Randolph was 75,100 second-feet, equivalent to about 21 second-feet per square mile of drainage area above the station.

Gaging stations were maintained by the United States Geological Survey during 1902, under the direction of E. W. Myers and D. C. Humphreys, on the Roanoke River proper at Neal, near Kelford, N. C., on the Roanoke (upper portion of the Staunton) at Roanoke, Va., on the Dan at South Boston, Va., and on the Staunton at Randolph, Va.

### ROANOKE RIVER AT NEAL, N. C.

This station was established on July 27, 1896, and is on the Norfolk and Carolina Railroad bridge at Neal, near Kelford, N. C.

The zero of the gage rod is over the center of the fourth floor beam of the second span from the north end of the bridge. The distance

from the zero of the rod to the outer rim of the pulley is 2.47 feet, and the distance from the end of the weight to the pointer on the wire is 44.66 feet.

The section is a fairly good one, the course of the river being straight for some distance above and below the station and the bottom smooth. Being muddy, however, the bed is apt to cut out in seasons of high water, and both banks are subject to overflow. The observer is the bridge watchman, W. M. Adams, of Neal, N. C.

The following discharge measurements were made during 1902 by J. S. Henderson and B. S. Drane:

May 9: Gage height, 9.9 feet; discharge, 12,612 second-feet.
July 14: Gage height, 5.4 feet; discharge, 5,805 second-feet.
August 20: Gage height, 6.2 feet; discharge, 4,497 second-feet.
October 15: Gage height, 16.9 feet; discharge, 13,579 second-feet.

*Daily gage height, in feet, of Roanoke River at Neal, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 24.45 | 16.30 | 27.50 | 20.70 | 10.00 | 5.30 | 6.60 | 3.10 | 2.60 | 6.30 | 9.50 | 11.60 |
| 2 | 27.60 | 17.20 | 28.10 | 19.30 | 11.20 | 4.80 | 7.30 | 4.30 | 2.70 | 6.00 | 7.70 | 12.50 |
| 3 | 29.85 | 21.70 | 27.80 | 17.00 | 10.00 | 4.50 | 6.60 | 4.60 | 2.40 | 6.00 | 6.20 | 16.50 |
| 4 | 28.15 | 23.05 | 27.75 | 14.90 | 9.65 | 4.30 | 6.20 | 5.30 | 2.90 | 6.80 | 5.30 | 20.00 |
| 5 | 25.90 | 24.10 | 26.60 | 13.60 | 11.70 | 4.20 | 5.50 | 5.10 | 4.00 | 6.30 | 4.90 | 22.50 |
| 6 | 23.50 | 24.20 | 24.80 | 12.50 | 11.80 | 4.00 | 4.60 | 4.50 | 6.00 | 5.20 | 4.70 | 22.70 |
| 7 | 20.70 | 22.90 | 23.70 | 12.00 | 11.45 | 3.80 | 3.75 | 3.80 | 5.50 | 17.60 | 4.40 | 23.15 |
| 8 | 18.05 | 20.40 | 22.70 | 12.20 | 9.45 | 3.80 | 3.20 | 3.20 | 5.35 | 23.02 | 4.40 | 23.45 |
| 9 | 16.00 | 18.10 | 21.30 | 17.50 | 9.60 | 3.80 | 4.30 | 3.00 | 4.60 | 23.65 | 5.30 | 22.00 |
| 10 | 14.50 | 16.10 | 19.50 | 19.90 | 10.50 | 3.80 | 5.90 | 3.20 | 3.90 | 21.65 | 5.75 | 19.35 |
| 11 | 13.30 | 14.30 | 18.30 | 20.00 | 10.40 | 3.80 | 5.40 | 3.30 | 5.30 | 19.00 | 5.80 | 16.90 |
| 12 | 12.30 | 12.60 | 17.30 | 18.60 | 9.75 | 3.90 | 5.10 | 3.10 | 6.60 | 14.90 | 5.30 | 14.80 |
| 13 | 11.40 | 11.50 | 16.00 | 16.30 | 7.80 | 3.70 | 6.55 | (a) | 5.25 | 15.00 | 4.90 | 13.05 |
| 14 | 10.50 | 10.70 | 14.90 | 14.50 | 7.00 | 3.50 | 6.10 | ..... | 4.50 | 18.00 | 4.60 | 12.10 |
| 15 | 9.50 | 10.00 | 14.00 | 13.20 | 6.60 | 3.20 | 4.70 | ..... | 4.00 | 17.30 | 4.40 | 12.00 |
| 16 | 8.50 | 9.50 | 13.10 | 12.30 | 6.50 | 3.40 | 3.80 | ..... | 3.40 | 13.90 | 4.30 | 12.70 |
| 17 | 7.85 | 9.10 | 12.60 | 11.60 | 6.80 | 3.70 | 3.30 | ..... | 2.85 | 11.10 | 4.20 | 12.30 |
| 18 | 7.90 | 9.00 | 13.50 | 11.20 | 7.40 | 18.25 | 3.00 | ..... | 2.55 | 19.00 | 4.10 | 12.80 |
| 19 | 8.00 | 9.10 | 20.10 | 10.90 | 10.90 | 21.60 | 2.80 | ..... | 2.40 | 7.40 | 4.30 | 17.45 |
| 20 | 7.95 | 9.00 | 19.80 | 10.60 | 10.90 | 20.80 | 2.40 | 6.33 | 2.30 | 6.30 | 4.70 | 18.30 |
| 21 | 7.50 | 8.60 | 17.80 | 10.30 | 9.70 | 16.90 | 2.20 | 5.00 | 2.20 | 5.65 | 13.30 | 16.10 |
| 22 | 9.40 | 10.50 | 15.80 | 9.80 | 9.30 | 13.80 | 2.00 | 3.85 | 2.20 | 5.10 | 13.20 | 14.20 |
| 23 | 15.80 | 13.20 | 14.50 | 9.30 | 8.70 | 11.25 | 2.20 | 3.40 | 2.30 | 4.70 | 10.70 | 17.00 |
| 24 | 17.00 | 17.20 | 13.40 | 9.05 | 7.60 | 8 65 | 2.00 | 3.00 | 2.30 | 4.50 | 8.60 | 18.40 |
| 25 | 16.40 | 19.80 | 12.60 | 8.60 | 6.50 | 6.90 | 2.30 | 3.80 | 2.30 | 4.30 | 7.20 | 18.30 |
| 26 | 14.10 | 22.20 | 11.80 | 8.30 | 5.90 | 6.00 | 2.40 | 3.30 | 2.40 | 4.20 | 6.95 | 16.10 |
| 27 | 12.40 | 23.65 | 11.10 | 8.00 | 6.10 | 5.10 | 2.35 | 3.10 | 2.50 | 4.00 | 7.80 | 13.90 |
| 28 | 12.00 | 25.65 | 10.50 | 7.70 | 6.60 | 4.90 | 2.20 | 3.00 | 2.50 | 3.90 | 13.60 | 12.30 |
| 29 | 11.70 | ..... | 10.10 | 7.50 | 6.45 | 5.60 | 1.80 | 3.20 | 3.80 | 4.00 | 15.00 | 10.90 |
| 30 | 13.90 | ..... | 12.50 | 7.50 | 6.10 | 5.70 | 1.70 | 3.40 | 6.10 | 9.75 | 13.20 | 9.40 |
| 31 | 15.00 | ..... | 19.00 | ..... | 5.60 | ..... | 1.80 | 2.90 | ..... | 11.20 | ..... | 8.85 |

(a) Gage wire broken August 13 to 19.

*Rating table for Roanoke River at Neal, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 1,920 | 4.0 | 3,980 | 7.0 | 6,230 | 13.0 | 12,730 |
| 1.2 | 2,050 | 4.2 | 4,120 | 7.2 | 6,420 | 13.5 | 13,380 |
| 1.4 | 2,180 | 4.4 | 4,260 | 7.4 | 6,610 | 14.0 | 14,030 |
| 1.6 | 2,310 | 4.6 | 4,400 | 7.6 | 6,800 | 14.5 | 14,730 |
| 1.8 | 2,440 | 4.8 | 4,540 | 7.8 | 7,000 | 15.0 | 15,430 |
| 2.0 | 2,580 | 5.0 | 4,680 | 8.0 | 7,200 | 15.5 | 16,180 |
| 2.2 | 2,720 | 5.2 | 4,830 | 8.5 | 7,700 | 16.0 | 16,930 |
| 2.4 | 2,860 | 5.4 | 4,980 | 9.0 | 8,200 | 16.5 | 17,730 |
| 2.6 | 3,000 | 5.6 | 5,130 | 9.5 | 8,730 | 17.0 | 18,530 |
| 2.8 | 3,140 | 5.8 | 5,280 | 10.0 | 9,280 | 17.5 | 19,405 |
| 3.0 | 3,280 | 6.0 | 5,430 | 10.5 | 9,830 | 18.0 | 20,280 |
| 3.2 | 3,420 | 6.2 | 5,590 | 11.0 | 10,380 | 19.0 | 22,130 |
| 3.4 | 3.560 | 6.4 | 5,750 | 11.5 | 10,955 | 20.0 | 24,230 |
| 3.6 | 3,700 | 6.6 | 5,910 | 12.0 | 11,530 | 25.0 | 46,500 |
| 3.8 | 3,840 | 6.8 | 6,070 | 12.5 | 12,130 | 30.0 | 82,000 |

*Estimated monthly discharge of Roanoke River at Neal, N. C.*

[Drainage area, 8,717 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 80,800 | 6,705 | 21,294 | 2.44 | 2.81 |
| February | 50,202 | 7,800 | 20,529 | 2.36 | 2.46 |
| March | 67,250 | 9,390 | 26,139 | 3.00 | 3.46 |
| April | 25,910 | 6,705 | 13,258 | 1.52 | 1.70 |
| May | 11,300 | 5,130 | 7,965 | .91 | 1.05 |
| June | 28,650 | 3,420 | 7,493 | .86 | .96 |
| July | 6,515 | 2,375 | 3,916 | .45 | .52 |
| August 1 to 12 and 20 to 31 | ---------- | ---------- | [a] 3,833 | [a] .44 | [a] .39 |
| September | 5,910 | 2,720 | 3,703 | .42 | .47 |
| October | 39,075 | 3,910 | 11,793 | 1.35 | 1.56 |
| November | 15,430 | 4,050 | 6,795 | .78 | .87 |
| December | 37,975 | 8,050 | 18,288 | 2.10 | 2.42 |

[a] Partial month.

## DAN RIVER AT SOUTH BOSTON, VA.

This station, which was established on August 27, 1900, by E. W. Myers, is in the town of South Boston, Va., on the railroad bridge of the Norfolk and Western Railroad which crosses the river at that place. The gage rod is laid off on the downstream guard rail of the bridge, the graduations being indicated by brass nails driven into the rail. The zero of the rod is exactly over the center of the first span from the north end of the bridge. The distance between the zero of the rod and the outer rim of the pulley is 2.39 feet, and the distance between the end of the weight and the pointer on the wire rope is 36.44 feet. When the gage reading is 1 foot the water surface is 31.06 feet below the top of the head of the nut on the pin connecting the two tension rods with the lower chord of the bridge, this pin being on the lower side of the bridge and exactly opposite the zero of the gage. This is a very good station for the gaging of all except the very highest stages of flow. At extreme heights the river spreads out over a flood plain of considerable width. The trestle connecting the bridge with the embankment on the south side of the river is a curve of rather high degree. The bed of the stream is of coarse sand and probably shifts only slightly. C. T. Nichols, South Boston, Va., is the observer.

The following discharge measurements were made during 1902 by B. S. Drane:

July 9: Gage height, 1.90 feet; discharge, 1,551 second-feet.
August 15: Gage height, 1.65 feet; discharge, 1,333 second-feet.
October 13: Gage height, 7.95 feet; discharge, 6,864 second-feet.
December 5: Gage height, 8.90 feet; discharge, 9,197 second-feet.

*Daily gage height, in feet, of Dan River at South Boston, Va.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 19.50 | 8.70 | 18.35 | 7.75 | 5.30 | 3.90 | 4.75 | 1.40 | 1.10 | 2.70 | 1.70 | 4.50 |
| 2 | 8.00 | 13.10 | 15.10 | 6.60 | 5.05 | 3.85 | 4.45 | 1.40 | 1.10 | 2.60 | 1.80 | 7.30 |
| 3 | 6.70 | 14.20 | 11.00 | 5.90 | 4.75 | 3.70 | 4.20 | 1.35 | 1.20 | 2.60 | 1.80 | 10.70 |
| 4 | 6.00 | 8.50 | 8.15 | 5.50 | 4.55 | 3.60 | 4.00 | 1.45 | 1.20 | 2.50 | 1.90 | 13.20 |
| 5 | 5.20 | 6.70 | 7.80 | 5.50 | 4.55 | 3.50 | 3.90 | 1.30 | 1.30 | 6.80 | 1.90 | 9.65 |
| 6 | 4.60 | 5.50 | 8.60 | 5.50 | 4.90 | 3.35 | 2.60 | 1.20 | 1.40 | 7.25 | 2.00 | 10.95 |
| 7 | 4.60 | 5.30 | 7.40 | 5.50 | 5.00 | 3.05 | 2.00 | 1.20 | 1.50 | 6.90 | 2.30 | 10.65 |
| 8 | 4.70 | 5.20 | 6.55 | 7.75 | 5.05 | 2.90 | 1.90 | 1.20 | 1.60 | 6.40 | 2.30 | 6.85 |
| 9 | 4.60 | 4.90 | 6.50 | 9.45 | 5.25 | 2.90 | 1.70 | 1.20 | 1.70 | 5.90 | 2.30 | 4.55 |
| 10 | 4.50 | 4.50 | 6.50 | 7.20 | 4.95 | 3.05 | 2.60 | 1.10 | 1.70 | 6.15 | 2.30 | 4.10 |
| 11 | 4.40 | 4.10 | 6.00 | 6.55 | 4.65 | 3.20 | 3.20 | 1.10 | 1.60 | 6.75 | 2.20 | 4.10 |
| 12 | 4.10 | 4.00 | 5.65 | 6.05 | 4.60 | 3.10 | 2.90 | 1.20 | 1.40 | 7.90 | 2.20 | 4.10 |
| 13 | 3.80 | 3.90 | 5.20 | 5.60 | 4.70 | 3.00 | 2.10 | 1.20 | 1.30 | 8.50 | 2.20 | 4.00 |
| 14 | 3.60 | 3.80 | 4.70 | 5.50 | 4.70 | 3.00 | 1.65 | 1.30 | 1.20 | 8.10 | 2.20 | 4.00 |
| 15 | 3.50 | 3.80 | 5.10 | 5.40 | 4.70 | 2.90 | 1.30 | 1.60 | 1.10 | 5.70 | 2.30 | 4.00 |
| 16 | 3.70 | 3.90 | 5.70 | 5.35 | 4.85 | 3.40 | 1.30 | 1.80 | 1.00 | 3.70 | 2.30 | 4.00 |

*Daily gage height, in feet, of Dan River at South Boston, Va.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 17 | 4.00 | 4.00 | 8.20 | 5.45 | 5.05 | 8.30 | 1.40 | 1.70 | .90 | 2.50 | 2.50 | 3.90 |
| 18 | 3.80 | 4.10 | 7.70 | 5.75 | 5.45 | 16.45 | 1.50 | 1.30 | .80 | 2.10 | 2.60 | 3.65 |
| 19 | 3.50 | 3.80 | 7.20 | 5.80 | 5.25 | 8.85 | 1.40 | 1.20 | .70 | 1.80 | 2.60 | 3.45 |
| 20 | 3.80 | 4.00 | 6.30 | 5.65 | 5.05 | 5.00 | 1.30 | 1.10 | .70 | 1.80 | 2.60 | 3.30 |
| 21 | 4.80 | 4.10 | 6.00 | 5.55 | 4.90 | 4.45 | 1.30 | 1.20 | .70 | 1.80 | 2.70 | 3.15 |
| 22 | 5.65 | 5.20 | 5.50 | 5.30 | 4.80 | 3.35 | 1.30 | 1.30 | 1.00 | 1.70 | 2.70 | 3.00 |
| 23 | 7.75 | 6.10 | 5.65 | 5.05 | 4.95 | 3.00 | 1.20 | 1.65 | 1.50 | 1.60 | 2.80 | 3.00 |
| 24 | 5.30 | 7.20 | 5.80 | 4.90 | 5.10 | 2.90 | 1.10 | 1.70 | 2.60 | 1.60 | 2.70 | 2.90 |
| 25 | 5.20 | 13.35 | 5.70 | 4.80 | 5.10 | 2.90 | 1.10 | 1.45 | 3.05 | 1.50 | 2.70 | 2.80 |
| 26 | 5.10 | 18.55 | 5.10 | 4.70 | 5.10 | 2.80 | 1.05 | 1.15 | 4.20 | 1.40 | 2.50 | 2.80 |
| 27 | 5.00 | 18.40 | 5.00 | 4.85 | 5.00 | 2.80 | 1.10 | 1.00 | 4.35 | 1.50 | 2.40 | 2.80 |
| 28 | 4.80 | 12.85 | 5.15 | 4.95 | 4.65 | 3.45 | 1.30 | 1.00 | 3.75 | 1.60 | 2.30 | 2.80 |
| 29 | 4.80 | ..... | 9.35 | 5.70 | 4.45 | 4.30 | 1.30 | 1.00 | 3.15 | 1.70 | 2.65 | 2.90 |
| 30 | 4.90 | ..... | 15.80 | 5.20 | 4.15 | 4.85 | 1.30 | 1.10 | 2.90 | 1.70 | 3.30 | 2.90 |
| 31 | 4.90 | ..... | 12.05 | ..... | 4.00 | ..... | 1.30 | 1.10 | ..... | 1.70 | ..... | 2.90 |

*Rating table for Dan River at South Boston, Va., for 1902.*

| Gage height. | Discharge | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.7 | 900 | 3.8 | 2,930 | 7.0 | 6,000 | 13.5 | 14,000 |
| .8 | 950 | 4.0 | 3,100 | 7.2 | 6,200 | 14.0 | 14,900 |
| 1.0 | 1,050 | 4.2 | 3,280 | 7.4 | 6,400 | 14.5 | 15,950 |
| 1.2 | 1,150 | 4.4 | 3,460 | 7.6 | 6,600 | 15.0 | 17,000 |
| 1.4 | 1,250 | 4.6 | 3,640 | 7.8 | 6,800 | 15.5 | 18,200 |
| 1.6 | 1,360 | 4.8 | 3,820 | 8.0 | 7,000 | 16.0 | 19,400 |
| 1.8 | 1,480 | 5.0 | 4,000 | 8.5 | 7,550 | 16.5 | 20,750 |
| 2.0 | 1,600 | 5.2 | 4,200 | 9.0 | 8,100 | 17.0 | 22,100 |
| 2.2 | 1,730 | 5.4 | 4,400 | 9.5 | 8,700 | 17.5 | 23,550 |
| 2.4 | 1,860 | 5.6 | 4,600 | 10.0 | 9,300 | 18.0 | 25,000 |
| 2.6 | 2,000 | 5.8 | 4,800 | 10.5 | 9,900 | 18.5 | 26,600 |
| 2.8 | 2,150 | 6.0 | 5,000 | 11.0 | 10,500 | 19.0 | 28,200 |
| 3.0 | 2,300 | 6.2 | 5,200 | 11.5 | 11,100 | 19.5 | 30,000 |
| 3.2 | 2,450 | 6.4 | 5,400 | 12.0 | 11,700 | 20.0 | 31,800 |
| 3.4 | 2,600 | 6.6 | 5,600 | 12.5 | 12,400 | | |
| 3.6 | 2,760 | 6.8 | 5,800 | 13.0 | 13,100 | | |

*Estimated monthly discharge of Dan River at South Boston, Va.*

[Drainage area, 2,750 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 30,000 | 2,675 | 4,738 | 1.72 | 1.98 |
| February | 26,760 | 2,930 | 7,105 | 2.58 | 2.69 |
| March | 26,120 | 3,730 | 7,269 | 2.64 | 3.04 |
| April | 8,640 | 3,730 | 4,834 | 1.76 | 1.96 |
| May | 4,450 | 3,100 | 3,876 | 1.41 | 1.63 |
| June | 20,615 | 2,150 | 3,535 | 1.29 | 1.44 |
| July | 3,775 | 1,075 | 1,713 | .62 | .71 |
| August | 1,480 | 1,050 | 1,197 | .44 | .51 |
| September | 3,415 | 900 | 1,545 | .56 | .62 |
| October | 7,550 | 1,250 | 3,158 | 1.15 | 1.33 |
| November | 2,525 | 1,420 | 1,842 | .67 | .75 |
| December | 13,460 | 2,150 | 4,186 | 1.52 | 1.75 |
| The year | 30,000 | 900 | 3,750 | 1.36 | 18.41 |

## STAUNTON RIVER AT RANDOLPH, VA.

This station, which was originally established on August 27, 1900, by E. W. Myers, is on the railroad bridge about five-eighths of a mile southwest of Randolph station on the line of the Southern Railway from Richmond to Danville. During the months of July, August, and September the old bridge was replaced, and readings were taken on a temporary gage during that time. The present gage was put in on October 13, 1902, by B. S. Drane. The gage rod is of pine, well painted, graduated to feet and tenths, and nailed to the outside of the upstream guard rail, the zero of the rod being exactly over the center of the second span from the north end of the bridge. The distance from the zero of the rod to the outer rim of the pulley is 3.18 feet, and that from the end of the weight to the pointer on the wire rope is 45.23 feet. When the gage reads zero the water surface is 38.91 feet below the upper edge of the hexagonal nut on the pin opposite the zero of the gage, on the upstream side of the bridge. The present gage reads the same as the one it replaced.

The river is straight for a long distance above and below the station, and the velocity of the current is well distributed. The rise at this point is 25 feet or more. It is not probable that the channel changes

to any considerable extent during high water. The observer at this station is Justin Field, station agent at Randolph.

The following discharge measurements were made during 1902 by B. S. Drane:

August 15: Gage height, 4.05 feet; discharge, 2,312 second-feet.
October 13: Gage height, 9.15 feet; discharge, 6,203 second-feet.
December 5: Gage height, 13.45 feet; discharge, 10,921 second-feet.

*Daily gage height, in feet, of Staunton River at Randolph, Va.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 19.00 | 10.20 | 23.70 | 7.50 | 5.50 | 3.90 | 5.10 | 3.70 | 2.30 | 4.20 | 4.20 | 9.00 |
| 2 | 10.50 | 12.50 | 21.20 | 6.80 | 5.10 | 3.90 | 5.00 | 5.10 | 2.30 | 4.00 | 4.00 | 11.50 |
| 3 | 8.90 | 17.50 | 14.20 | 6.30 | 6.40 | 3.90 | 4.20 | 4.40 | 3.20 | 3.70 | 3.85 | 16.00 |
| 4 | 7.90 | 11.50 | 9.90 | 5.90 | 7.00 | 3.80 | 3.80 | 3.90 | 3.00 | 3.70 | 3.80 | 13.40 |
| 5 | 6.90 | 7.90 | 10.60 | 6.00 | 5.50 | 3.85 | 3.70 | 3.50 | 3.70 | 8.60 | 3.80 | 13.70 |
| 6 | 6.10 | 6.40 | 10.90 | 6.50 | 5.40 | 3.70 | 3.50 | 3.90 | 3.30 | 23.00 | 3.80 | 15.05 |
| 7 | 6.00 | 6.00 | 8.70 | 5.80 | 5.30 | 3.60 | 5.30 | 4.30 | 3.00 | 20.00 | 4.10 | 10.20 |
| 8 | 6.05 | 6.20 | 8.00 | 10.30 | 6.70 | 3.90 | 4.80 | 3.80 | 2.60 | 5.60 | 4.10 | 8.00 |
| 9 | 5.90 | 5.70 | 8.30 | 11.20 | 6.00 | 3.90 | 4.30 | 3.80 | 4.00 | 5.10 | 4.10 | 6.90 |
| 10 | 5.80 | 5.00 | 8.40 | 8.40 | 5.50 | 3.70 | 4.55 | 3.50 | 3.00 | 4.50 | 3.80 | 6.10 |
| 11 | 5.70 | 4.95 | 7.70 | 7.10 | 5.20 | 3.60 | 4.60 | 3.90 | 3.40 | 5.00 | 3.75 | 5.80 |
| 12 | 5.50 | 4.90 | 7.30 | 6.60 | 4.80 | 3.50 | 3.60 | 3.30 | 3.00 | 10.00 | 3.70 | 5.55 |
| 13 | 4.90 | 4.90 | 6.90 | 6.20 | 4.80 | 3.40 | 3.40 | 3.05 | 2.70 | 8.80 | 3.70 | 6.20 |
| 14 | 4.50 | 4.90 | 6.60 | 6.00 | 4.70 | 3.50 | 3.10 | 3.60 | 2.50 | 6.00 | 3.65 | 6.40 |
| 15 | 4.50 | 4.90 | 6.30 | 6.10 | 4.70 | 6.00 | 3.00 | 3.80 | 2.50 | 5.20 | 3.65 | 6.20 |
| 16 | 4.90 | 4.85 | 6.80 | 5.90 | 4.60 | 11.10 | 2.80 | 7.40 | 2.50 | 4.70 | 3.60 | 6.50 |
| 17 | 4.90 | 4.90 | 14.30 | 5.80 | 4.50 | 18.30 | 2.60 | 4.30 | 2.50 | 4.40 | 3.50 | 9.20 |
| 18 | 4.80 | 4.80 | 10.30 | 5.60 | 5.00 | 8.10 | 2.50 | 3.70 | 2.50 | 4.20 | 3.60 | 10.60 |
| 19 | 4.75 | 4.60 | 8.30 | 5.50 | 4.70 | 5.60 | 2.50 | 3.30 | 2.50 | 4.10 | 5.10 | 8.10 |
| 20 | 4.70 | 4.70 | 7.30 | 5.40 | 4.65 | 4.70 | 2.60 | 2.70 | 2.50 | 3.90 | 5.00 | 7.00 |
| 21 | 5.20 | 5.10 | 6.75 | 5.30 | 4.70 | 4.50 | 2.80 | 2.70 | 2.50 | 3.80 | 5.40 | 6.40 |
| 22 | 8.50 | 9.00 | 6.40 | 5.20 | 4.70 | 4.10 | 3.50 | 2.70 | 2.80 | 3.75 | 5.00 | 8.00 |
| 23 | 8.50 | 9.50 | 6.20 | 5.15 | 4.75 | 4.00 | 3.00 | 2.70 | 2.80 | 3.70 | 4.50 | 8.00 |
| 24 | 6.50 | 11.50 | 6.00 | 5.10 | 4.75 | 3.90 | 2.80 | 2.50 | 2.70 | 3.70 | 4.30 | 7.00 |
| 25 | 5.40 | 19.20 | 5.80 | 5.00 | 5.60 | 3.80 | 2.70 | 2.40 | 2.70 | 3.65 | 6.00 | 6.30 |
| 26 | 5.40 | 26.50 | 5.65 | 4.90 | 4.70 | 4.20 | 2.60 | 2.50 | 2.70 | 3.60 | 11.00 | 5.85 |
| 27 | 7.60 | 24.00 | 5.50 | 4.90 | 4.60 | 4.50 | 2.60 | 3.30 | 4.10 | 3.60 | 11.40 | 5.20 |
| 28 | 10.20 | 20.20 | 5.50 | 4.80 | 4.40 | 4.60 | 2.50 | 2.70 | 4.40 | 8.10 | 8.10 | 4.90 |
| 29 | 10.20 | ..... | 10.60 | 6.90 | 4.20 | 4.50 | 2.50 | 3.30 | 3.40 | 6.70 | 7.00 | 4.70 |
| 30 | 7.70 | ..... | 12.20 | 6.50 | 4.10 | 5.60 | 2.40 | 2.70 | 3.00 | 5.00 | 7.00 | 5.50 |
| 31 | 7.70 | ..... | 9.00 | ..... | 4.00 | ..... | 3.90 | 2.50 | ..... | 4.40 | ..... | 5.40 |

*Rating table for Staunton River at Randolph, Va., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.0 | 1,400 | 5.2 | 3,360 | 9.0 | 7,250 | 17.0 | 21,200 |
| 2.2 | 1,490 | 5.4 | 3,520 | 9.5 | 7,875 | 17.5 | 22,450 |
| 2.4 | 1,580 | 5.6 | 3,680 | 10.0 | 8,500 | 18.0 | 23,700 |
| 2.6 | 1,670 | 5.8 | 3,840 | 10.5 | 9,150 | 18.5 | 24,950 |
| 2.8 | 1,760 | 6.0 | 4,000 | 11.0 | 9,800 | 19.0 | 26,200 |
| 3.0 | 1,850 | 6.2 | 4,190 | 11.5 | 10,600 | 19.5 | 27,600 |
| 3.2 | 1,960 | 6.4 | 4,380 | 12.0 | 11,400 | 20.0 | 29,000 |
| 3.4 | 2,070 | 6.6 | 4,570 | 12.5 | 12,200 | 20.5 | ..... |
| 3.6 | 2,180 | 6.8 | 4,760 | 13.0 | 13,000 | 21.0 | ..... |
| 3.8 | 2,290 | 7.0 | 4,950 | 13.5 | 13,900 | 21.5 | ..... |
| 4.0 | 2,400 | 7.2 | 5,160 | 14.0 | 14,800 | 22.0 | ..... |
| 4.2 | 2,560 | 7.4 | 5,370 | 14.5 | 15,800 | 22.5 | ..... |
| 4.4 | 2,720 | 7.6 | 5,580 | 15.0 | 16,800 | 23.0 | ..... |
| 4.6 | 2,880 | 7.8 | 5,790 | 15.5 | 17,850 | 24.0 | ..... |
| 4.8 | 3,040 | 8.0 | 6,000 | 16.0 | 18,900 | 25.0 | ..... |
| 5.0 | 3,200 | 8.5 | 6,625 | 16.5 | 20,050 | | |

*Estimated monthly discharge of Staunton River at Randolph, Va.*

[Drainage area, 3,076 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 26,200 | 2,800 | 5,388 | 1.75 | 2.02 |
| February | 51,050 | 2,880 | 10,292 | 3.35 | 3.49 |
| March | 40,495 | 3,600 | 8,616 | 2.80 | 3.23 |
| April | 10,120 | 3,040 | 4,398 | 1.43 | 1.60 |
| May | 4,950 | 2,400 | 3,250 | 1.06 | 1.22 |
| June | 24,450 | 2,070 | 3,656 | 1.19 | 1.33 |
| July | 3,440 | 1,580 | 2,149 | .70 | .81 |
| August | 5,370 | 1,580 | 2,198 | .71 | .82 |
| September | 2,720 | 1,535 | 1,844 | .60 | .67 |
| October | 38,150 | 2,180 | 5,307 | 1.73 | 1.99 |
| November | 10,440 | 2,125 | 3,347 | 1.09 | 1.22 |
| December | 18,900 | 2,960 | 6,578 | 2.14 | 2.47 |
| The year | 51,050 | 1,535 | 4,752 | 1.55 | 20.87 |

## ROANOKE RIVER AT ROANOKE, VA.

This river rises in Montgomery County, Va. Its headwaters are near those of New River on the west. This stream lower down is known as Staunton River, and joins the Dan at Clarksville to form the main lower Roanoke River. There are a number of fine water powers along its length, described more fully in the Nineteenth Annual Report, Part IV, page 176. The gaging station was established by D. C. Humphreys on July 10, 1896, and is located at the edge of the city of Roanoke, Va., on the Walnut street bridge. The gage is of wire, with the rod fastened to the floor of the bridge. The top of the lower end of the first floor beam is 21.99 feet above gage datum. The length of gage wire is 24.39 feet. The right bank is above high water, but the left is liable to overflow in extreme high stages. The channel is nearly straight and the current good.

The following discharge measurements were made during 1902 by D. C. Humphreys:

July 10: Gage height, 1.09 feet; discharge, 199 second-feet.
August 21: Gage height, 0.63 foot; discharge, 78 second-feet.

*Daily gage height, in feet, of Roanoke River at Roanoke, Va.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 5.20 | 2.17 | 3.90 | 2.45 | 1.38 | 1.05 | 1.35 | 1.05 | 0.60 | 0.70 | 0.85 | 2.30 |
| 2 | 3.76 | 2.30 | 3.40 | 2.00 | 1.35 | 1.00 | 1.20 | .90 | .60 | .75 | .80 | 1.90 |
| 3 | 2.15 | 2.30 | 3.09 | 1.95 | 1.45 | 1.03 | 1.05 | .82 | .60 | .68 | .80 | 2.90 |
| 4 | 2.00 | 2.35 | 2.75 | 1.90 | 1.35 | 1.00 | 1.00 | .80 | .60 | .68 | .85 | 2.20 |
| 5 | 1.90 | 2.25 | 2.40 | 1.90 | 1.35 | 1.00 | .90 | .90 | .60 | 1.95 | .80 | 2.55 |
| 6 | 1.85 | 2.05 | 2.23 | 1.80 | 1.30 | 1.00 | .95 | .90 | .60 | 1.50 | .90 | 2.30 |
| 7 | 1.80 | 1.91 | 2.15 | 1.75 | 1.30 | 1.00 | .95 | .80 | .60 | 1.00 | .90 | 1.95 |
| 8 | 1.75 | 1.77 | 2.32 | 1.68 | 1.35 | 1.00 | .95 | .70 | .60 | .85 | .85 | 1.75 |
| 9 | 1.70 | 1.65 | 2.43 | 1.75 | 1.35 | 1.10 | 1.60 | .70 | .60 | .75 | .83 | 1.60 |
| 10 | 1.70 | 1.55 | 2.33 | 1.85 | 1.29 | 1.05 | 1.10 | .70 | .65 | .70 | .80 | 1.50 |
| 11 | 1.65 | 1.48 | 2.20 | 1.93 | 1.25 | 1.00 | .95 | .70 | .65 | .80 | .75 | 1.45 |
| 12 | 1.47 | 1.40 | 2.15 | 2.00 | 1.22 | .95 | .95 | .70 | .63 | 1.05 | .80 | 1.40 |
| 13 | 1.30 | 1.34 | 2.09 | 1.93 | 1.22 | .93 | .90 | .68 | .60 | 1.00 | .78 | 1.40 |
| 14 | 1.25 | 1.30 | 2.03 | 1.80 | 1.25 | 1.00 | .85 | .70 | .60 | .90 | .80 | 1.50 |
| 15 | 1.40 | 1.25 | 1.98 | 1.73 | 1.29 | 1.05 | .85 | .68 | .60 | .85 | .80 | 1.50 |
| 16 | 1.50 | 1.21 | 2.03 | 1.73 | 1.25 | 1.25 | .80 | .70 | .60 | .80 | .80 | 1.50 |
| 17 | 1.43 | 1.18 | 2.95 | 1.66 | 1.20 | 1.25 | .80 | .70 | .60 | .75 | .80 | 2.40 |
| 18 | 1.38 | 1.15 | 2.50 | 1.65 | 1.19 | 1.15 | .75 | .65 | .60 | .75 | 1.70 | 2.20 |
| 19 | 1.30 | 1.15 | 2.25 | 1.63 | 1.19 | 1.10 | .70 | .65 | .60 | .75 | 1.60 | 1.90 |
| 20 | 1.35 | 1.20 | 2.12 | 1.63 | 1.19 | 1.05 | .70 | .65 | .60 | .75 | 1.30 | 1.70 |
| 21 | 1.50 | 1.35 | 2.00 | 1.63 | 1.25 | 1.05 | .70 | .65 | .60 | .70 | 1.15 | 1.60 |
| 22 | 1.67 | 1.70 | 1.95 | 1.55 | 1.20 | 1.00 | .70 | .65 | .65 | .70 | 1.05 | 1.75 |
| 23 | 1.75 | 2.10 | 1.70 | 1.50 | 1.15 | 1.00 | .70 | .65 | .65 | .70 | 1.00 | 1.65 |
| 24 | 1.60 | 2.15 | 1.64 | 1.50 | 1.15 | 1.00 | .92 | .63 | .63 | .70 | 1.00 | 1.55 |
| 25 | 1.53 | 10.06 | 1.50 | 1.50 | 1.12 | 1.00 | .85 | .61 | .65 | .73 | 1.15 | 1.50 |
| 26 | 1.40 | 5.15 | 1.45 | 1.50 | 1.12 | 1.25 | .78 | .60 | .70 | .75 | 2.10 | 1.40 |
| 27 | 1.80 | 5.50 | 1.40 | 1.48 | 1.13 | 1.25 | .70 | .60 | .70 | .80 | 2.40 | 1.10 |
| 28 | 2.95 | 8.75 | 2.05 | 1.45 | 1.12 | 1.25 | .70 | .60 | .70 | .93 | 1.80 | 1.30 |
| 29 | 2.80 | ..... | 3.50 | 1.50 | 1.10 | 1.35 | .72 | .60 | .65 | 1.10 | 1.65 | 1.30 |
| 30 | 2.71 | ..... | 3.00 | 1.50 | 1.10 | 1.35 | 1.22 | .60 | .63 | .90 | 1.40 | 1.30 |
| 31 | 2.35 | ..... | 2.73 | ..... | 1.08 | ..... | 1.15 | .60 | ..... | .90 | ..... | 1.20 |

*Rating table for Roanoke River at Roanoke, Va., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.2 | 25 | 3.0 | 1,960 | 5.8 | 5,728 | 9.5 | 10,760 |
| 0.4 | 55 | 3.2 | 2,228 | 6.0 | 6,000 | 10.0 | 11,440 |
| 0.6 | 85 | 3.4 | 2,496 | 6.2 | 6,272 | 10.5 | 12,120 |
| 0.8 | 120 | 3.6 | 2,764 | 6.4 | 6,544 | 11.0 | 12,800 |
| 1.0 | 170 | 3.8 | 3,032 | 6.6 | 6,816 | 11.5 | 13,480 |
| 1.2 | 240 | 4.0 | 3,300 | 6.8 | 7,088 | 12.0 | 14,160 |
| 1.4 | 325 | 4.2 | 3,568 | 7.0 | 7,360 | 12.5 | 14,840 |
| 1.6 | 429 | 4.4 | 3,836 | 7.2 | 7,632 | 13.0 | 15,520 |
| 1.8 | 554 | 4.6 | 4,104 | 7.4 | 7,904 | 13.5 | 16,200 |
| 2.0 | 688 | 4.8 | 4,372 | 7.6 | 8,176 | 14.0 | 16,880 |
| 2.2 | 888 | 5.0 | 4,640 | 7.8 | 8,448 | 14.5 | 17,560 |
| 2.4 | 1,156 | 5.2 | 4,912 | 8.0 | 8,720 | 15.0 | 18,240 |
| 2.6 | 1,424 | 5.4 | 5,184 | 8.5 | 9,400 | | |
| 2.8 | 1,692 | 5.6 | 5,456 | 9.0 | 10,080 | | |

*Estimated monthly discharge of Roanoke River at Roanoke, Va.*

[Drainage area, 388 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 4,912 | 260 | 944 | 2.43 | 2.80 |
| February | 11,508 | 222 | 1,576 | 4.06 | 4.23 |
| March | 3,166 | 325 | 1,143 | 2.95 | 3.40 |
| April | 1,223 | 349 | 525 | 1.35 | 1.51 |
| May | 349 | 205 | 255 | .66 | .76 |
| June | 302 | 154 | 200 | .52 | .58 |
| July | 429 | 100 | 156 | .40 | .46 |
| August | 187 | 85 | 103 | .27 | .31 |
| September | 100 | 85 | 89 | .23 | .26 |
| October | 654 | 100 | 149 | .38 | .44 |
| November | 1,156 | 110 | 251 | .65 | .73 |
| December | 1,826 | 205 | 574 | 1.48 | 1.71 |
| The year | 11,508 | 85 | 497 | 1.28 | 17.19 |

## CAPE FEAR RIVER DRAINAGE BASIN.

Cape Fear River is formed by the junction, near Moncure, in Chatham County, N. C., of Haw and Deep rivers. It is usual to consider the Haw, the Deep, and the Cape Fear as each a separate stream with an individual and independent existence of its own, irrespective of the others; and to a certain extent in a consideration of the physical features of the entire drainage basin this method of treatment is desirable. All of these streams, however, form a single river system, and it is more convenient to treat of the basin as a whole in parts of what follows.

Viewed from this standpoint, Cape Fear River rises among the red clay hills of Guilford and Rockingham counties, N. C., the sources of Haw and Deep rivers being but a short distance apart. Haw River is the more northerly of the two branches, and flows at first slightly toward the northeast, but turning soon to the southeast drains the southern portion of Rockingham County and the greater part of Guilford, and passes thence through Alamance, a corner of Orange, and Chatham County to its junction with the Deep River in the lower part of Chatham. Deep River flows at first toward the south, but soon turns to the southeast and flows practically parallel with Haw River for many miles through Guilford and Randolph counties, and into Moore County, where it turns abruptly toward the east, flowing in this direction through Moore and Chatham counties to the junction with the Haw.

The area drained by the entire river system above the town of Fayetteville, N. C., the head of navigation on the river, is 4,493 square miles, of which Haw River drains 1,800, Deep River 1,400, and Cape Fear River below the junction 1,293 square miles. The form and general dimensions of the basin are shown on the accompanying map.

The elevations of the divides between the drainage basin of the Cape Fear system and those of the adjacent streams are not very great, and the minor tributaries can not therefore furnish much power except in places where considerable storage may be obtained by the construction of suitable dams.

The declivity of the main streams is shown in the following tables:

*Table of declivity, Cape Fear River.*

| Locality. | Distance from Fayetteville. | Elevation above tide. | Distance between points. | Fall between points. | Average fall between points. per mile. |
|---|---|---|---|---|---|
| | *Miles.* | *Feet.* | *Miles.* | *Feet.* | *Feet.* |
| Fayetteville | 0.0 | 22.5 | ..... | ..... | ..... |
| Foot Smileys Falls[a] | 25.0 | 53.8 | 25 | 31.3 | 1.252 |
| Head Smileys Falls | 36.0 | 110.2 | 11 | 56.4 | 5.127 |
| Junction of Haw and Deep rivers | 58.0 | 155.3 | 22 | 45.1 | 2.050 |

[a] In the above table Smileys Falls has been taken to include the entire long rapids or series of rapids in which this river crosses the fall line, though the name is properly applied only to the lower 3.5 miles of this distance, the descent in the falls proper being 27 feet.

*Table of declivity, Haw River.*

| Locality. | Distance from junction of Haw and Deep rivers. | Elevation above tide. | Distance between points. | Fall between points. | Average fall between points per mile. |
|---|---|---|---|---|---|
| | *Miles.* | *Feet.* | *Miles.* | *Feet.* | *Feet.* |
| Confluence with Deep River | 0.0 | 155.3 | ..... | ..... | ..... |
| Haw River station | 50.0 | 476.0 | 50 | 320.7 | 6.4 |
| Haw River at Southern Railway crossing | 77.0 | 647.0 | 27 | 171.0 | 6.3 |
| Reedy Fork of Haw River at Southern Railway crossing | 80.0 | 676.0 | 30 | 200.0 | 6.7 |

*Table of declivity, Deep River.*

| Locality. | Distance from junction of Haw and Deep rivers. | Elevation above tide. | Distance between points. | Fall between points. | Average fall between points per mile. |
|---|---|---|---|---|---|
| | *Miles.* | *Feet.* | *Miles.* | *Feet.* | *Feet.* |
| Confluence with Haw River | 0.0 | 155.3 | ..... | ..... | ..... |
| Egypt | 14.0 | 204.6 | 14 | 49.3 | 3.52 |
| Jamestown | 100.0 | 715.0 | 86 | 510.4 | 5.93 |

## WATER POWERS IN CAPE FEAR RIVER DRAINAGE BASIN.

As will be seen by reference to the map of the basin, the water power interests of the main Cape Fear River below the junction of Deep and Haw rivers are relatively unimportant at present, though

important developments are now in progress and others are understood to be in contemplation.

The first of the developments now in progress is located on Smileys Falls, which have been previously mentioned. The site of the development is located about 28 miles above Fayetteville, at a point known as Narrow Gap, from the fact that in the ledge of rock from three to four feet high which crosses the river at this point a small gap occurs, through which at low water the entire flow of the stream passes. A stone dam will be built across the stream and the power thus developed will be used in the operation of a large cotton mill now in course of construction.

The second locality at which development work has been done is at Buckhorn Falls, located a short distance below the junction of Haw and Deep rivers. The project for this place includes the development of the power at Lockville, on Deep River, a short distance above the junction with the Haw, and the electrical transmission of the power to Fayetteville and other manufacturing towns. Many contracts for the power have been made.

The power possibilities of the stream are developed to a much greater extent on Haw and Deep rivers, which are the most important manufacturing streams in the State in respect to number of mills operated. Haw River and its tributaries operate 11 cotton mills, while Deep River operates 10 cotton mills and a number of flour mills. There are several fine power sites still available on Haw River and a number on Deep River.

Unfortunately Cape Fear, Deep, and Haw rivers are subject to floods of greater violence than are experienced on any other North Carolina stream. At times the Cape Fear at Fayetteville has risen to a height of 58 feet above low water, and there are records of one flood exceeding 60 feet above low water at this place, the height being recorded on the same gage. This extreme high water is not caused by greater violence and magnitude of precipitation over the drainage basin of the stream than on the basins of the other rivers of the State, for the flood discharge per unit of area for the basin of the Cape Fear is less than those of many of the other rivers where the flood rise is not so great; but below Fayetteville there is a considerable diminution in the slope of the channel, and, in addition, the channel becomes U-shaped at this point, the sides of the trough being very high and the bottom only wide enough for the dry-weather flow.

At points farther upstream where the slope is greater and the channel of different shape, the extreme rise in some places does not exceed 20 feet, though the volume of water to be passed does not greatly differ from that which flows past Fayetteville. The rise in flood is less on the upper 30 miles of the course of the Cape Fear than on the Deep and the Haw, on which streams near their junction floods of 25 feet rise and over have many times occurred.

Many of the tributaries of these streams rise and flow in a slate country, where the soil is either very thin or, in many instances, washed away entirely, and where the topography is broken. In such a country the hills shed the storm waters into the streams with great rapidity, not only producing thus the floods just mentioned, but also, since little subterranean storage is possible in a country of this character, making the dry-weather flow extremely small. Many of the smaller streams are completely dry in time of severe drought. The slate country covers a large proportion of the entire area drained by the stream above Fayetteville, and, as a consequence, the flow of the Cape Fear, and in a greater degree that of the Deep and the Haw, becomes during severe drought very small in proportion to area drained. The mean discharge for the basin above Fayetteville, for an entire month, has fallen as low as 0.12 second-foot per square mile, while the minimum recorded flow is equivalent to only 0.069 second-foot per square mile. This remarkably low stage occurred in October, 1900. The next lowest stage occurred in October, 1897, the volume being 340 second-feet, equivalent to 0.073 second-foot per square mile of area above Fayetteville.

Low as these rates of flow seem, it is a matter of practical certainty that a large portion of the basin discharges at such times at a much lower rate, although there are, unfortunately, no direct measurements of the flow of any of the tributaries made at such times to prove the statement. However, the governing conditions are very similar over portions of the area drained by the Neuse River, whose drainage basin borders that of the Cape Fear on the north, and whose head streams are interlaced with those of the Cape Fear. A weir measurement of the flow of Eno River, one of the head streams of the Neuse River, at a point where the drainage area, as measured from the best maps available, is about 100 square miles, gave a flow of only 3,000,000 gallons per twenty-four hours, or 4.64 second-feet, which is at the rate of 0.046 second-foot per square mile. This measurement was made during the severe drought of 1897, at the time when the flow of Cape Fear River reached so low a stage.

For a clearer discussion of the physical features of the drainage basin, and of the effect of such features on the flow of the stream, the entire area above Fayetteville will be divided as follows: (1) That part of the basin lying below the junction of Haw and Deep rivers; (2) the area drained by Haw River; and (3) the area drained by Deep River.

The area drained by Cape Fear River, below the junction of the Haw and the Deep, may, topographically, be divided into two parts, the first and largest including the sand-hill belt, the second all the remainder of the area, which is characterized by different geologic formations.

The sand-hill belt forms the largest part of the drainage basin of Cape Fear River below the junction of the Haw and the Deep, and

exerts an important influence on the character and distribution of the flow of the streams rising and flowing in it, and consequently on the flow of Cape Fear River, to which these streams are tributary. This region is a belt of sand hills from 30 to 40 miles in width, located, as a rule, immediately below the fall line, though at times extending above it, and consisting of broad and flattened swells, which are usually well wooded with long-leaf pine, and generally with an undergrowth. During comparatively recent years, however, a considerable part of the timber of this region has been removed, and the sand hills are now covered in many places with a sparse growth of scrub oaks, which barely shades the soil, and in other places with the charred remains of the original pines, and with a straggling growth of a coarse species of grass.

The deposit of sand varies in thickness from a foot or two to about 100 feet, depending somewhat on its proximity to the fall line, and this bed of sand is underlain with a nearly or quite impervious stratum of compact grit and clay, which is also very thick.

The sand deposit absorbs the rain which falls on it with great rapidity, removing it from the action of the sun and wind and diminishing the evaporation to a great extent, while the great thickness of the mass enables it to store up a large amount of water and to give it out gradually as it sinks to and flows along the impervious stratum underlying the sand. The sand thus acts as a storage reservoir and regulates the flow of the streams of this region to a truly remarkable extent. Sand and gravel in general, though absorbing water with great rapidity, give it out with equal rapidity unless they occur in masses of sufficient size to store up a large amount of water without reaching the point of saturation, and as a consequence of this the regularity of the flow of the streams draining an area of sand will be somewhat in direct proportion to the thickness of the deposit. If the depth is great, then the flow of the streams draining the area will be regular and the run-off will be large in proportion to the rainfall, while if the depth is less, the flow will be less and less regular as the depth is diminished, and while the total run-off may be as great as in the first case, or greater, the distribution will be such as to render the useful amount much smaller.

The depth of the deposit of sand becomes less as the western limits of the belt are approached. Even above the limit of the sand-hill region, and up as far as the junction of Haw and Deep rivers, the typical formations of the coastal plain region predominate, the soils being sands and sandy clays, and the topography does not differ greatly from that of the sand-hill belt, except that the hills possibly rise to slightly greater heights and the slopes are steeper. The considerable differences in soil texture, however, cause very appreciable differences in flow between the streams of this portion of the basin and those of

the sand hills, the floods being much more sudden and violent, and the dry-weather flow much smaller per unit of area drained.

The area drained by the Haw, for a short distance above its junction with the Deep, is a region of sandstone and shale formations; but there is soon a change to metamorphosed slates and schists, and for a long distance the country near the river is rough, rugged, and broken, though it becomes somewhat smoother and more regular at considerable distances from the stream. Throughout this section the soil is thin, or in many places largely removed, exposing the bare rock in the hillsides, and as the slopes are steep the storm waters are shed into the streams with great rapidity, causing violent and destructive floods, which, however, are of short duration. The small depth of the soil affords space for only a very small amount of subterranean storage in the soil interstices, and in time of drought many of the minor streams cease flowing altogether, while the flow in many of the larger streams becomes nearly inappreciable.

Passing farther up this stream, however, the character of the basin changes again, the country rock becoming a granite. At the same time the character of the topography becomes less bold and rugged and the soil becomes deeper and more pervious. Therefore, throughout this portion of its course, the violence of the floods is not so great and the dry-weather flow is much larger per unit of area drained.

The statements made above relative to the area drained by the Haw apply with equal force to the area drained by the Deep; but a larger proportion of the basin of the Deep is in the slate region, and as a consequence its flow is even more variable than that of the Haw, the floods being more violent and the dry-weather flow smaller. Only a very small portion of this basin lies in the granite belt mentioned above. This portion is at the very source of the stream, and is entirely too small to exert any appreciable influence on the flow at points many miles below.

Gage heights of Cape Fear River have been taken at Fayetteville, N. C., since 1889. This station was established by the United States Weather Bureau, and maintained by it until 1895, when the United States Geological Survey began to make measurements of the river at this point. The Geological Survey has stations also on Rockfish Creek, near Brunt, and on Deep River at Cumnock. The description of these stations, the results for 1902 at the last two stations, and a complete recapitulation of the data collected at Fayetteville are given below:

### CAPE FEAR RIVER AT FAYETTEVILLE, N. C.

This gaging station is at the bridge of the Atlantic Coast Line, about a mile east of Fayetteville, N. C. The Weather Bureau has a gage fastened on the lower side of the east abutment of the covered highway bridge, this being about 400 feet above the railroad bridge, from

which discharge measurements are made. The lower 29 feet of this gage consists of a rod divided into feet and tenths and firmly fastened to the abutment. Above the 29-foot mark the scale is painted on the rock. The observer is Frank Glover, who has charge of the steamboat landing just below the railroad bridge. For his convenience, he has placed a subsidiary gage at the steamboat landing reading about the same as the official gage, and from this observations are taken. The channel is straight and the current moderately swift and not influenced by dams or other obstructions. The banks are high and the total flow of the river is in one channel, even during the highest floods. The bed is fairly constant.

*Discharge measurements of Cape Fear River at Fayetteville, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1895. | | *Feet.* | *Second-feet.* |
| September 26 | C. C. Babb | 1.59 | 489 |
| December 7 | do | 2.90 | 1,109 |
| 1896. | | | |
| April 5 | E. W. Myers | 19.30 | 10,525 |
| April 25 | do | 4.00 | 1,618 |
| May 22 | do | 4.00 | 1,322 |
| June 8 | do | 10.00 | 5,041 |
| June 8 | do | 9.20 | 4,207 |
| July 11 [a] | do | 49.10 | 51,115 |
| September 2 | do | 1.10 | 519 |
| September 19 | A. P. Davis | 1.88 | 770 |
| 1897. | | | |
| March 12 | E. W. Myers | 23.00 | 16,777 |
| July 27 | do | 7.00 | 2,682 |
| September 30 | do | .70 | 424 |
| 1898. | | | |
| January 10 | E. W. Myers | 3.55 | 1,303 |
| August 22 | do | 28.35 | 23,215 |
| 1899. | | | |
| February 7 | E. W. Myers | 46.50 | 61,921 |
| May 24 | do | 6.40 | 3,142 |
| June 6 | do | 4.20 | 1,577 |
| October 13 | do | 6.00 | 2,132 |
| November 29 | do | 9.65 | 7,742 |

[a] Inaccurate; disregarded.

*Discharge measurements of Cape Fear River at Fayetteville, N. C.*—Continued.

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| February 9 | E. W. Myers | 6.90 | 3,748 |
| April 12 | do | 6.10 | 2,686 |
| April 25 | do | 25.30 | 13,479 |
| May 17 | do | 3.80 | 1,596 |
| June 29 | do | 5.80 | 2,331 |
| August 11 | do | .70 | 415 |
| November 3 | do | .75 | 416 |
| 1901. | | | |
| April 5 | E. Graves | 47.60 | 46,519 |
| July 15 | E. W. Myers | 40.30 | 38,300 |
| November 29 | J. S. Henderson | 4.50 | 1,783 |
| 1902. | | | |
| May 8 | J. S. Henderson | 4.50 | 2,111 |
| July 12 | B. S. Drane | 2.50 | 1,120 |
| August 19 | do | 2.70 | 1,178 |
| September 5 | do | .50 | 446 |
| October 16 | do | 5.13 | 2,487 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889. | | | | | | | | | | | | |
| 1 | 10.00 | 18.00 | 15.00 | 8.70 | 12.00 | 10.00 | 40.60 | 33.50 | 14.00 | 5.50 | 8.50 | 14.00 |
| 2 | 11.00 | 15.00 | 13.00 | 8.40 | 10.00 | 40.00 | 42.60 | 44.20 | 13.10 | 6.00 | 7.40 | 10.20 |
| 3 | 10.00 | 13.00 | 11.00 | 8.10 | 8.50 | 30.00 | 43.90 | 37.50 | 9.20 | 5.60 | 6.90 | 8.10 |
| 4 | 9.00 | 12.20 | 9.00 | 7.80 | 7.50 | 22.00 | 41.40 | 28.00 | 8.60 | 5.20 | 6.80 | 7.50 |
| 5 | 25.00 | 10.70 | 7.20 | 7.50 | 7.00 | 15.00 | 37.40 | 33.50 | 8.10 | 4.50 | 7.20 | 7.20 |
| 6 | 38.00 | 10.40 | 5.80 | 7.20 | 6.60 | 9.50 | 33.00 | 38.00 | 7.50 | 4.40 | 7.40 | 7.10 |
| 7 | 35.00 | 10.20 | 5.70 | 6.90 | 6.30 | 8.00 | 28.40 | 37.00 | 7.10 | 4.20 | 6.90 | 7.00 |
| 8 | 31.00 | 10.10 | 5.60 | 6.60 | 6.20 | 6.80 | 20.00 | 33.00 | 7.50 | 4.60 | 6.80 | 6.80 |
| 9 | 26.00 | 10.00 | 5.50 | 6.30 | 6.10 | 6.00 | 12.00 | 24.00 | 9.50 | 4.70 | 6.60 | 6.70 |
| 10 | 20.00 | 10.00 | 5.40 | 6.00 | 6.00 | 5.00 | 7.00 | 18.00 | 8.30 | 5.00 | 7.80 | 6.40 |
| 11 | 17.00 | 9.80 | 5.30 | 5.80 | 5.80 | 6.00 | 6.80 | 20.00 | 7.80 | 4.00 | 7.90 | 6.30 |
| 12 | 14.00 | 9.60 | 5.30 | 5.60 | 5.50 | 7.00 | 9.00 | 16.00 | 6.80 | 3.80 | 7.50 | 6.00 |
| 13 | 11.00 | 9.50 | 5.20 | 5.40 | 5.00 | 6.50 | 10.40 | 14.00 | 6.30 | 3.70 | 7.20 | 5.80 |
| 14 | 9.00 | 9.40 | 18.00 | 5.30 | 4.50 | 6.00 | 10.00 | 10.10 | 6.10 | 3.50 | 7.60 | 5.70 |
| 15 | 8.00 | 10.00 | 21.00 | 10.00 | 4.00 | 5.80 | 9.50 | 10.00 | 6.00 | 3.40 | 7.90 | 5.60 |
| 16 | 8.00 | 15.00 | 16.00 | 15.00 | 3.80 | 6.00 | 9.00 | 12.00 | 6.50 | 3.30 | 7.20 | 5.40 |
| 17 | 15.00 | 25.00 | 14.00 | 20.00 | 3.50 | 5.70 | 8.20 | 12.20 | 6.90 | 3.20 | 6.90 | 5.00 |
| 18 | 30.00 | 34.50 | 10.00 | 18.00 | 3.40 | 6.00 | 7.50 | 10.00 | 7.30 | 3.20 | 8.20 | 4.90 |
| 19 | 28.00 | 40.00 | 13.00 | 16.00 | 3.30 | 7.00 | 15.40 | 7.50 | 7.00 | 3.20 | 9.50 | 4.70 |
| 20 | 30.00 | 43.00 | 12.00 | 12.00 | 3.20 | 8.50 | 11.00 | 6.90 | 6.90 | 3.10 | 10.20 | 4.60 |
| 21 | 35.00 | 42.00 | 11.70 | 9.00 | 3.20 | 8.00 | 9.00 | 6.40 | 6.00 | 3.10 | 16.20 | 4.40 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889. | | | | | | | | | | | | |
| 22 | 30.00 | 38.00 | 11.50 | 7.00 | 3.20 | 7.50 | 8.50 | 6.20 | 6.00 | 3.10 | 19.90 | 4.40 |
| 23 | 25.00 | 34.00 | 11.30 | 6.00 | 3.10 | 8.00 | 8.20 | 6.00 | 5.80 | 3.00 | 24.00 | 4.40 |
| 24 | 20.00 | 36.00 | 11.00 | 5.00 | 3.10 | 7.50 | 8.00 | 6.50 | 5.70 | 3.00 | 29.00 | 4.30 |
| 25 | 16.00 | 31.00 | 10.80 | 5.50 | 3.00 | 7.00 | 9.00 | 7.00 | 5.60 | 4.00 | 32.00 | 4.30 |
| 26 | 22.00 | 25.00 | 10.60 | 12.00 | 3.00 | 6.00 | 20.00 | 8.00 | 5.50 | 5.50 | 27.20 | 4.30 |
| 27 | 38.00 | 20.00 | 10.20 | 18.00 | 2.90 | 5.00 | 33.50 | 11.00 | 10.00 | 13.00 | 19.10 | 4.20 |
| 28 | 34.00 | 17.00 | 10.00 | 20.00 | 2.90 | 5.50 | 43.00 | 21.00 | 9.00 | 21.50 | 21.00 | 4.20 |
| 29 | 27.00 | ..... | 9.80 | 18.00 | 2.80 | 10.00 | 45.00 | 31.00 | 8.40 | 25.00 | 20.20 | 4.20 |
| 30 | 23.00 | ..... | 9.40 | 15.00 | 2.80 | 38.00 | 43.00 | 28.00 | 7.90 | 20.00 | 17.00 | 4.10 |
| 31 | 19.00 | ..... | 9.00 | ..... | 3.60 | ..... | 38.70 | 22.00 | ..... | 15.00 | ..... | 4.80 |
| 1890. | | | | | | | | | | | | |
| 1 | 7.20 | 4.60 | 22.00 | 7.70 | 6.00 | 6.40 | 2.90 | 1.10 | 16.50 | 8.00 | 7.80 | 5.80 |
| 2 | 7.50 | 4.80 | 23.10 | 7.60 | 5.80 | 6.00 | 2.80 | 1.60 | 13.40 | 7.60 | 7.60 | 5.90 |
| 3 | 7.40 | 5.00 | 20.00 | 7.80 | 5.70 | 5.50 | 3.10 | 4.20 | 10.20 | 7.00 | 7.40 | 6.40 |
| 4 | 7.00 | 5.70 | 17.40 | 8.00 | 7.60 | 4.00 | 4.50 | 5.10 | 7.10 | 6.50 | 7.00 | 5.10 |
| 5 | 6.50 | 5.90 | 16.20 | 7.80 | 9.40 | 3.60 | 6.20 | 4.90 | 5.20 | 6.20 | 8.40 | 4.90 |
| 6 | 6.20 | 6.20 | 11.40 | 7.70 | 12.00 | 3.10 | 5.70 | 4.80 | 4.80 | 6.00 | 9.20 | 4.70 |
| 7 | 5.80 | 7.50 | 9.30 | 7.60 | 14.60 | 2.90 | 5.00 | 5.60 | 4.60 | 5.80 | 9.00 | 4.60 |
| 8 | 5.70 | 8.20 | 9.10 | 7.50 | 12.00 | 3.90 | 4.70 | 10.20 | 4.50 | 5.60 | 8.40 | 4.80 |
| 9 | 5.40 | 10.00 | 9.00 | 7.40 | 10.10 | 6.70 | 3.90 | 14.40 | 4.20 | 5.20 | 8.00 | 5.20 |
| 10 | 5.00 | 14.80 | 8.80 | 7.30 | 9.20 | 10.00 | 2.80 | 18.10 | 4.00 | 4.00 | 7.80 | 6.70 |
| 11 | 4.90 | 12.20 | 8.60 | 7.20 | 8.90 | 11.00 | 2.60 | 22.00 | 5.90 | 3.90 | 7.70 | 6.40 |
| 12 | 4.80 | 11.00 | 8.20 | 7.80 | 8.70 | 9.80 | 2.30 | 24.50 | 6.20 | 3.80 | 7.50 | 6.00 |
| 13 | 4.70 | 10.20 | 7.40 | 8.20 | 8.50 | 8.60 | 1.90 | 20.10 | 6.00 | 3.50 | 8.40 | 5.80 |
| 14 | 4.60 | 10.00 | 7.20 | 8.30 | 8.20 | 7.40 | 1.60 | 15.20 | 7.10 | 4.00 | 8.90 | 5.60 |
| 15 | 4.50 | 9.20 | 8.40 | 8.00 | 7.90 | 6.80 | 1.40 | 10.60 | 14.80 | 3.80 | 8.70 | 5.10 |
| 16 | 4.30 | 10.40 | 12.20 | 7.80 | 7.80 | 6.40 | 1.20 | 8.40 | 27.90 | 3.70 | 8.50 | 5.00 |
| 17 | 4.20 | 11.20 | 14.10 | 8.40 | 7.60 | 6.20 | 2.20 | 8.20 | 30.20 | 4.80 | 8.40 | 4.90 |
| 18 | 4.00 | 10.10 | 12.20 | 10.20 | 7.50 | 6.80 | 2.50 | 9.40 | 21.40 | 5.90 | 8.00 | 6.20 |
| 19 | 4.00 | 9.00 | 10.10 | 12.00 | 7.00 | 6.70 | 2.80 | 13.50 | 16.20 | 13.40 | 7.80 | 10.10 |
| 20 | 4.20 | 8.20 | 8.90 | 14.50 | 6.70 | 6.60 | 2.90 | 17.60 | 11.00 | 15.00 | 7.40 | 20.20 |
| 21 | 4.20 | 7.80 | 10.20 | 12.40 | 6.00 | 6.40 | 2.70 | 21.40 | 8.00 | 11.20 | 7.00 | 18.00 |
| 22 | 4.20 | 7.50 | 12.10 | 10.20 | 5.70 | 6.00 | 2.60 | 20.10 | 6.10 | 8.90 | 6.50 | 14.10 |
| 23 | 4.10 | 8.60 | 14.40 | 9.10 | 4.00 | 5.50 | 5.20 | 17.20 | 5.20 | 8.00 | 6.10 | 12.20 |
| 24 | 4.20 | 11.00 | 16.80 | 8.80 | 3.70 | 5.10 | 7.10 | 15.10 | 4.90 | 10.20 | 5.70 | 10.10 |
| 25 | 4.20 | 12.00 | 23.20 | 8.50 | 3.50 | 4.80 | 10.20 | 18.40 | 4.80 | 12.40 | 5.00 | 9.80 |
| 26 | 4.10 | 14.20 | 20.00 | 8.20 | 5.40 | 4.70 | 9.10 | 18.00 | 5.20 | 22.80 | 4.70 | 12.40 |
| 27 | 4.10 | 19.00 | 16.40 | 7.90 | 9.20 | 4.10 | 8.20 | 13.20 | 6.80 | 18.10 | 4.50 | 18.20 |
| 28 | 4.20 | 20.00 | 12.10 | 7.40 | 12.40 | 3.80 | 12.40 | 10.40 | 7.20 | 12.40 | 4.20 | 14.10 |
| 29 | 4.20 | ..... | 10.20 | 6.80 | 9.80 | 3.40 | 15.10 | 10.10 | 8.10 | 10.20 | 5.10 | 12.00 |
| 30 | 4.20 | ..... | 8.10 | 6.20 | 7.20 | 3.00 | 18.20 | 8.40 | 8.40 | 8.40 | 5.20 | 10.20 |
| 31 | 4.20 | ..... | 7.80 | ..... | 6.80 | ..... | 20.00 | 10.20 | ..... | 8.00 | ..... | 9.40 |
| 1891. | | | | | | | | | | | | |
| 1 | 9.00 | 12.40 | 10.20 | 16.40 | 6.20 | 31.40 | 4.70 | 10.50 | 26.10 | 4.50 | 3.50 | 13.10 |
| 2 | 8.50 | 15.60 | 12.40 | 14.10 | 6.00 | 22.00 | 5.30 | 19.10 | 17.20 | 4.40 | 3.80 | 12.40 |
| 3 | 8.00 | 14.20 | 14.00 | 17.20 | 5.80 | 16.20 | 6.40 | 31.40 | 14.40 | 5.20 | 3.70 | 10.00 |
| 4 | 7.70 | 13.10 | 16.20 | 19.10 | 5.40 | 10.20 | 6.00 | 29.20 | 13.70 | 5.30 | 3.60 | 8.10 |
| 5 | 7.20 | 12.00 | 19.10 | 20.00 | 5.00 | 9.50 | 5.10 | 25.00 | 12.80 | 4.90 | 3.50 | 7.30 |
| 6 | 7.00 | 11.40 | 17.40 | 18.00 | 5.80 | 10.40 | 6.40 | 20.60 | 10.10 | 4.80 | 3.90 | 7.00 |
| 7 | 7.40 | 10.00 | 15.20 | 16.40 | 6.40 | 12.20 | 8.20 | 17.00 | 12.40 | 4.60 | 3.80 | 6.80 |
| 8 | 7.80 | 12.40 | 12.10 | 13.60 | 7.00 | 14.50 | 15.10 | 16.10 | 13.60 | 6.20 | 3.40 | 7.40 |
| 9 | 8.00 | 18.20 | 11.20 | 12.20 | 6.80 | 16.20 | 13.20 | 11.20 | 14.80 | 7.80 | 3.20 | 8.00 |
| 10 | 10.20 | 17.00 | 14.40 | 11.00 | 6.40 | 14.30 | 11.70 | 10.10 | 14.00 | 7.20 | 3.60 | 7.70 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1891. | | | | | | | | | | | | |
| 11 | 16.40 | 16.10 | 16.10 | 10.10 | 5.50 | 12.00 | 8.20 | 9.00 | 11.80 | 6.80 | 4.20 | 7.50 |
| 12 | 21.20 | 14.20 | 22.10 | 12.40 | 5.00 | 13.40 | 7.10 | 8.40 | 10.20 | 6.60 | 4.70 | 7.30 |
| 13 | 18.00 | 12.10 | 34.20 | 15.70 | 4.70 | 14.50 | 6.40 | 7.20 | 9.10 | 5.90 | 4.40 | 7.00 |
| 14 | 14.10 | 11.00 | 41.00 | 12.00 | 6.80 | 10.20 | 5.20 | 6.90 | 8.40 | 5.70 | 4.00 | 6.80 |
| 15 | 12.20 | 10.20 | 36.20 | 10.20 | 9.40 | 8.10 | 6.10 | 7.00 | 8.00 | 7.10 | 3.80 | 7.90 |
| 16 | 10.10 | 10.00 | 29.40 | 11.40 | 12.20 | 6.50 | 6.80 | 6.20 | 7.60 | 9.20 | 3.60 | 8.60 |
| 17 | 9.40 | 9.50 | 21.00 | 12.00 | 12.00 | 6.20 | 6.00 | 5.30 | 6.90 | 8.00 | 4.10 | 8.40 |
| 18 | 10.20 | 8.10 | 16.60 | 11.20 | 10.20 | 6.80 | 5.80 | 5.10 | 5.40 | 7.70 | 4.90 | 8.00 |
| 19 | 14.20 | 8.00 | 14.40 | 10.10 | 9.40 | 7.40 | 5.60 | 7.20 | 6.00 | 7.20 | 4.80 | 7.80 |
| 20 | 16.40 | 9.20 | 16.80 | 9.40 | 8.10 | 7.90 | 5.20 | 8.40 | 5.20 | 6.80 | 4.70 | 7.40 |
| 21 | 14.10 | 14.10 | 21.70 | 8.20 | 7.60 | 7.00 | 6.10 | 8.00 | 5.00 | 6.40 | 4.40 | 7.00 |
| 22 | 12.20 | 39.20 | 18.90 | 10.70 | 7.00 | 6.50 | 7.70 | 17.90 | 4.90 | 6.00 | 4.00 | 6.80 |
| 23 | 13.10 | 37.40 | 17.10 | 10.90 | 6.50 | 8.20 | 10.40 | 32.40 | 4.70 | 5.50 | 3.80 | 6.70 |
| 24 | 18.40 | 30.10 | 16.20 | 9.10 | 6.10 | 8.00 | 11.10 | 43.10 | 5.00 | 5.00 | 4.20 | 7.80 |
| 25 | 19.60 | 19.20 | 18.40 | 9.00 | 5.20 | 7.20 | 12.90 | 40.20 | 4.90 | 4.80 | 5.10 | 8.00 |
| 26 | 18.00 | 16.00 | 20.00 | 8.70 | 10.40 | 6.90 | 13.00 | 39.00 | 4.80 | 4.20 | 4.40 | 7.40 |
| 27 | 16.20 | 14.40 | 26.40 | 7.10 | 25.90 | 6.00 | 12.50 | 35.20 | 4.90 | 4.00 | 4.70 | 7.10 |
| 28 | 14.10 | 12.00 | 30.00 | 7.00 | 35.70 | 5.40 | 10.10 | 24.60 | 5.10 | 3.80 | 3.90 | 6.80 |
| 29 | 12.40 | ..... | 25.80 | 6.80 | 40.20 | 4.10 | 8.90 | 30.10 | 4.80 | 3.70 | 6.20 | 6.60 |
| 30 | 10.60 | ..... | 20.10 | 6.40 | 45.10 | 4.20 | 8.40 | 31.40 | 4.60 | 3.90 | 10.20 | 7.50 |
| 31 | 10.00 | ..... | 18.20 | ..... | 39.20 | ..... | 9.60 | 32.20 | ..... | 3.60 | ..... | 8.10 |
| 1892. | | | | | | | | | | | | |
| 1 | 8.80 | 9.90 | 26.20 | 8.00 | 7.40 | 7.40 | 12.10 | 5.40 | 5.80 | 2.60 | 1.00 | 2.00 |
| 2 | 7.50 | 9.40 | 21.40 | 7.80 | 7.00 | 8.10 | 14.20 | 5.80 | 5.10 | 2.50 | .90 | 1.80 |
| 3 | 7.00 | 9.00 | 18.10 | 9.40 | 6.80 | 8.40 | 11.60 | 5.50 | 4.20 | 2.30 | .80 | 1.70 |
| 4 | 7.60 | 8.80 | 14.20 | 10.20 | 6.70 | 9.60 | 10.10 | 5.20 | 3.70 | 2.10 | 1.40 | 2.00 |
| 5 | 8.00 | 8.70 | 11.60 | 10.00 | 6.50 | 10.40 | 14.40 | 5.10 | 3.00 | 1.90 | 1.60 | 2.10 |
| 6 | 9.40 | 9.40 | 10.40 | 9.40 | 6.40 | 14.60 | 15.00 | 5.00 | 2.70 | 1.70 | 1.70 | 2.20 |
| 7 | 9.00 | 9.20 | 9.20 | 13.80 | 6.20 | 14.00 | 17.40 | 4.90 | 2.40 | 1.50 | 1.90 | 2.40 |
| 8 | 8.60 | 9.00 | 10.40 | 21.40 | 6.10 | 10.40 | 16.30 | 4.70 | 2.00 | 1.30 | 2.00 | 2.00 |
| 9 | 7.50 | 8.80 | 11.00 | 34.20 | 6.00 | 12.60 | 14.10 | 4.50 | 1.80 | 1.10 | 2.50 | 1.90 |
| 10 | 8.80 | 8.40 | 9.80 | 33.10 | 5.80 | 14.10 | 11.60 | 4.10 | 1.70 | 1.00 | 4.10 | 2.50 |
| 11 | 8.70 | 8.20 | 9.40 | 20.50 | 7.20 | 11.40 | 9.40 | 3.90 | 1.50 | 1.40 | 5.40 | 2.70 |
| 12 | 8.90 | 9.40 | 8.70 | 17.10 | 7.90 | 10.20 | 7.20 | 3.60 | 1.20 | 1.60 | 4.50 | 2.60 |
| 13 | 9.40 | 9.10 | 8.20 | 14.20 | 8.20 | 8.40 | 8.60 | 3.20 | 1.00 | 1.50 | 4.00 | 2.40 |
| 14 | 12.00 | 8.70 | 7.80 | 12.70 | 7.80 | 7.00 | 11.40 | 2.80 | .90 | 1.40 | 3.70 | 2.30 |
| 15 | 13.60 | 8.40 | 7.00 | 12.00 | 7.60 | 6.60 | 12.70 | 2.40 | 2.50 | 1.30 | 3.40 | 2.10 |
| 16 | 18.50 | 7.90 | 6.80 | 15.20 | 7.00 | 6.00 | 13.10 | 1.90 | 5.50 | 1.20 | 3.80 | 2.20 |
| 17 | 22.00 | 7.70 | 8.20 | 13.60 | 7.40 | 5.80 | 17.20 | 1.60 | 3.60 | 1.10 | 7.50 | 2.70 |
| 18 | 30.20 | 7.50 | 10.10 | 12.00 | 7.90 | 4.90 | 14.10 | 1.40 | 2.40 | 1.00 | 8.00 | 3.00 |
| 19 | 29.10 | 7.20 | 9.60 | 10.80 | 7.40 | 5.10 | 10.40 | 1.20 | 1.80 | 1.10 | 7.30 | 3.30 |
| 20 | 37.80 | 8.40 | 9.20 | 11.10 | 6.80 | 7.20 | 7.70 | 1.00 | 1.60 | 1.20 | 6.80 | 9.60 |
| 21 | 49.50 | 8.80 | 8.70 | 10.40 | 7.60 | 9.40 | 6.90 | .90 | 1.80 | 1.10 | 6.30 | 12.00 |
| 22 | 47.20 | 8.00 | 8.10 | 10.00 | 7.90 | 11.20 | 6.70 | .80 | 4.90 | 1.00 | 5.00 | 14.40 |
| 23 | 36.40 | 7.60 | 7.80 | 17.20 | 10.80 | 12.60 | 7.00 | 1.70 | 7.40 | .90 | 4.10 | 13.10 |
| 24 | 28.10 | 7.40 | 7.40 | 19.50 | 14.40 | 10.00 | 6.80 | 2.30 | 6.10 | .80 | 3.50 | 10.70 |
| 25 | 22.30 | 7.00 | 8.80 | 14.10 | 12.00 | 9.40 | 7.20 | 3.80 | 5.30 | .90 | 3.00 | 8.20 |
| 26 | 17.40 | 8.40 | 10.60 | 12.70 | 10.60 | 10.20 | 7.00 | 5.70 | 4.90 | 1.00 | 2.90 | 6.00 |
| 27 | 15.10 | 10.20 | 17.10 | 10.60 | 8.10 | 12.40 | 5.40 | 6.10 | 4.60 | 1.20 | 2.60 | 4.90 |
| 28 | 13.70 | 17.40 | 14.20 | 8.40 | 7.40 | 16.20 | 4.90 | 5.20 | 4.00 | 1.30 | 2.50 | 4.40 |
| 29 | 12.00 | 24.60 | 10.00 | 8.10 | 6.80 | 20.00 | 4.60 | 3.80 | 3.40 | 1.40 | 2.30 | 4.00 |
| 30 | 11.30 | ..... | 9.10 | 7.80 | 6.20 | 18.70 | 4.40 | 4.90 | 2.70 | 1.20 | 2.10 | 3.90 |
| 31 | 10.20 | ..... | 8.20 | ..... | 6.00 | ..... | 4.00 | 4.60 | ..... | 1.10 | ..... | 3.80 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1893. | | | | | | | | | | | | |
| 1 | 3.00 | 19.60 | 12.90 | 5.10 | 4.50 | 7.80 | 3.80 | 1.80 | 22.80 | 6.10 | 7.00 | 9.00 |
| 2 | 12.00 | 14.30 | 20.80 | 4.80 | 5.00 | 5.00 | 5.60 | 3.70 | 27.40 | 5.70 | 6.80 | 7.00 |
| 3 | 20.50 | 10.80 | 17.20 | 4.50 | 7.00 | 6.20 | 4.90 | 6.90 | 32.30 | 5.00 | 6.50 | 6.30 |
| 4 | 16.50 | 8.40 | 14.80 | 4.40 | 15.00 | 8.00 | 4.10 | 7.00 | 30.00 | 5.30 | 6.10 | 5.90 |
| 5 | 13.00 | 7.50 | 13.40 | 4.80 | 31.50 | 6.60 | 4.80 | 6.80 | 20.80 | 5.10 | 6.00 | 15.90 |
| 6 | 10.00 | 6.60 | 12.40 | 6.20 | 29.00 | 6.00 | 5.20 | 10.00 | 14.00 | 9.00 | 5.80 | 15.60 |
| 7 | 8.00 | 6.70 | 11.10 | 6.40 | 19.90 | 7.00 | 4.80 | 7.30 | 8.60 | 8.00 | 5.80 | 15.00 |
| 8 | 6.10 | 9.50 | 10.00 | 5.80 | 17.90 | 14.00 | 3.60 | 6.40 | 6.00 | 6.00 | 5.70 | 15.40 |
| 9 | 5.40 | 11.40 | 9.40 | 5.30 | 14.20 | 23.70 | 2.80 | 4.80 | 4.80 | 5.10 | 5.90 | 14.00 |
| 10 | 5.00 | 10.00 | 8.60 | 5.00 | 8.00 | 14.10 | 3.20 | 3.50 | 4.70 | 4.90 | 5.90 | 13.50 |
| 11 | 4.10 | 12.60 | 8.90 | 4.40 | 7.90 | 7.00 | 2.50 | 2.60 | 5.50 | 4.10 | 5.30 | 12.90 |
| 12 | 4.50 | 24.80 | 8.10 | 4.10 | 7.70 | 6.40 | 2.00 | 2.10 | 12.50 | 3.70 | 6.10 | 11.50 |
| 13 | 4.60 | 35.60 | 7.20 | 4.10 | 6.50 | 5.70 | 1.70 | 1.80 | 16.00 | 3.60 | 6.00 | 9.20 |
| 14 | 4.40 | 41.00 | 7.10 | 4.70 | 6.00 | 4.10 | 1.60 | 1.60 | 39.00 | 13.60 | 6.30 | 8.40 |
| 15 | 4.50 | 42.30 | 7.00 | 7.00 | 5.40 | 5.70 | 1.40 | 1.40 | 35.00 | 23.00 | 6.20 | 7.30 |
| 16 | 4.00 | 38.60 | 6.60 | 7.90 | 5.50 | 8.10 | 1.40 | 1.30 | 29.00 | 20.60 | 6.00 | 7.00 |
| 17 | 3.70 | 40.20 | 6.20 | 7.20 | 5.60 | 7.00 | 1.30 | 1.20 | 23.00 | 14.20 | 5.80 | 16.00 |
| 18 | 3.20 | 37.40 | 6.10 | 5.70 | 7.00 | 15.00 | 1.40 | 1.20 | 15.60 | 11.20 | 5.60 | 26.00 |
| 19 | 3.00 | 35.10 | 6.50 | 5.50 | 5.00 | 13.70 | 1.40 | 1.60 | 8.00 | 8.00 | 5.30 | 22.50 |
| 20 | 4.30 | 30.00 | 6.70 | 4.70 | 4.20 | 10.20 | 3.90 | 6.70 | 5.30 | 5.80 | 5.00 | 17.30 |
| 21 | 4.70 | 24.30 | 6.80 | 5.00 | 3.90 | 8.40 | 2.50 | 4.40 | 4.20 | 5.60 | 4.90 | 14.80 |
| 22 | 4.80 | 19.90 | 6.90 | 5.20 | 3.80 | 6.40 | 2.40 | 2.70 | 4.60 | 6.00 | 4.70 | 10.70 |
| 23 | 4.70 | 15.60 | 7.00 | 4.80 | 3.60 | 5.60 | 2.00 | 1.90 | 4.20 | 33.50 | 4.60 | 9.00 |
| 24 | 4.40 | 13.00 | 6.50 | 4.30 | 3.30 | 6.00 | 1.40 | 1.80 | 4.00 | 42.00 | 5.10 | 8.00 |
| 25 | 4.30 | 12.20 | 6.50 | 4.00 | 3.20 | 9.50 | 1.30 | 7.80 | 4.10 | 39.00 | 5.00 | 7.70 |
| 26 | 4.60 | 9.80 | 6.90 | 3.90 | 3.00 | 6.40 | 1.20 | 5.90 | 3.80 | 31.00 | 4.90 | 7.00 |
| 27 | 5.60 | 8.00 | 7.70 | 3.70 | 4.20 | 5.00 | 1.10 | 3.80 | 3.60 | 23.40 | 4.50 | 6.20 |
| 28 | 7.40 | 8.50 | 7.40 | 4.00 | 4.10 | 4.00 | 1.10 | 3.60 | 4.40 | 17.20 | 4.90 | 6.20 |
| 29 | 15.50 | ..... | 7.20 | 5.00 | 3.80 | 2.70 | 1.50 | 5.60 | 6.70 | 14.20 | 8.60 | 5.90 |
| 30 | 19.00 | ..... | 5.80 | 5.60 | 4.20 | 3.50 | 1.20 | 22.90 | 6.90 | 12.00 | 12.90 | 5.80 |
| 31 | 23.60 | ..... | 5.20 | ..... | 8.60 | ..... | 1.20 | 25.90 | ..... | 8.80 | ..... | 6.00 |
| 1894. | | | | | | | | | | | | |
| 1 | 8.00 | 15.90 | 25.00 | 5.70 | 3.40 | 7.20 | 2.10 | 6.00 | 5.00 | 14.30 | 12.60 | 4.30 |
| 2 | 9.30 | 11.60 | 28.20 | 5.40 | 3.40 | 5.30 | 2.10 | 7.00 | 4.30 | 12.90 | 12.00 | 4.30 |
| 3 | 7.30 | 10.60 | 26.50 | 5.00 | 3.30 | 4.00 | 5.00 | 5.50 | 3.90 | 9.40 | 10.00 | 4.40 |
| 4 | 7.00 | 9.70 | 22.00 | 4.90 | 3.30 | 3.60 | 7.70 | 14.00 | 3.40 | 7.20 | 14.20 | 4.10 |
| 5 | 6.00 | 12.80 | 18.00 | 5.00 | 3.20 | 3.10 | 7.60 | 25.40 | 4.20 | 6.60 | 20.00 | 4.40 |
| 6 | 6.10 | 15.00 | 16.10 | 5.80 | 3.40 | 2.60 | 5.80 | 31.20 | 4.60 | 11.30 | 15.90 | 5.10 |
| 7 | 6.40 | 12.00 | 12.80 | 4.80 | 10.60 | 2.50 | 4.50 | 34.40 | 4.00 | 9.70 | 11.50 | 5.40 |
| 8 | 23.00 | 10.90 | 10.00 | 4.60 | 9.80 | 2.30 | 3.90 | 29.60 | 3.80 | 7.00 | 8.70 | 5.50 |
| 9 | 27.00 | 8.60 | 8.30 | 4.40 | 7.50 | 2.00 | 3.80 | 24.70 | 3.60 | 6.00 | 7.00 | 5.60 |
| 10 | 23.50 | 12.00 | 8.30 | 4.10 | 5.40 | 2.10 | 3.10 | 19.00 | 3.40 | 29.00 | 6.20 | 5.70 |
| 11 | 25.60 | 10.20 | 8.30 | 4.20 | 4.80 | 2.00 | 2.60 | 12.20 | 3.10 | 47.40 | 6.50 | 5.80 |
| 12 | 23.50 | 8.60 | 8.00 | 8.30 | 4.40 | 2.00 | 2.50 | 9.00 | 2.60 | 47.90 | 6.20 | 10.20 |
| 13 | 19.50 | 8.20 | 7.80 | 8.60 | 3.30 | 1.90 | 2.00 | 7.60 | 2.30 | 38.80 | 6.20 | 17.20 |
| 14 | 17.00 | 8.00 | 7.30 | 7.00 | 3.20 | 1.60 | 1.80 | 8.80 | 1.90 | 29.00 | 6.30 | 18.40 |
| 15 | 15.40 | 13.60 | 7.30 | 6.20 | 3.60 | 1.60 | 1.60 | 8.10 | 1.90 | 22.30 | 6.50 | 12.00 |
| 16 | 14.40 | 27.40 | 7.00 | 5.00 | 3.40 | 1.50 | 1.60 | 8.40 | 1.80 | 16.60 | 7.10 | 10.40 |
| 17 | 12.00 | 28.00 | 6.90 | 4.70 | 4.20 | 1.20 | 1.80 | 10.40 | 1.50 | 12.40 | 6.20 | 8.00 |
| 18 | 11.60 | 23.80 | 6.30 | 4.30 | 4.00 | 1.10 | 2.10 | 10.30 | 1.40 | 8.60 | 6.90 | 7.20 |
| 19 | 11.00 | 18.60 | 8.60 | 4.20 | 4.50 | 1.00 | 3.30 | 9.00 | 4.60 | 7.20 | 6.40 | 6.50 |
| 20 | 10.00 | 16.00 | 9.70 | 4.00 | 6.80 | 1.30 | 2.90 | 7.80 | 12.00 | 5.80 | 5.90 | 6.00 |
| 21 | 8.20 | 15.00 | 8.50 | 5.60 | 10.00 | 2.90 | 2.70 | 8.60 | 8.90 | 6.20 | 5.90 | 5.90 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1894. | | | | | | | | | | | | |
| 22 | 7.30 | 12.40 | 7.00 | 5.80 | 8.00 | 3.00 | 2.30 | 6.70 | 7.00 | 5.80 | 6.00 | 5.30 |
| 23 | 7.00 | 11.00 | 6.90 | 5.80 | 6.40 | 2.70 | 4.30 | 5.60 | 5.20 | 5.60 | 5.70 | 5.50 |
| 24 | 6.80 | 11.00 | 6.30 | 5.30 | 7.20 | 2.80 | 8.00 | 5.00 | 4.20 | 5.50 | 5.40 | 5.10 |
| 25 | 7.00 | 11.20 | 6.00 | 5.00 | 8.40 | 2.80 | 14.20 | 4.70 | 3.30 | 5.40 | 5.40 | 5.00 |
| 26 | 7.00 | 12.00 | 6.90 | 4.20 | 8.20 | 2.20 | 11.00 | 3.60 | 2.90 | 5.30 | 5.60 | 4.90 |
| 27 | 6.80 | 14.40 | 8.60 | 4.00 | 7.00 | 1.80 | 7.70 | 5.30 | 4.00 | 5.50 | 5.20 | 4.90 |
| 28 | 6.60 | 20.00 | 8.00 | 3.70 | 4.90 | 1.80 | 4.60 | 9.40 | 11.60 | 10.50 | 5.00 | 8.50 |
| 29 | 7.00 | ..... | 7.00 | 3.70 | 4.80 | 1.70 | 3.90 | 11.00 | 17.00 | 15.60 | 4.90 | 11.60 |
| 30 | 11.40 | ..... | 6.50 | 3.50 | 4.30 | 1.70 | 3.30 | 7.00 | 15.50 | 13.20 | 4.60 | 8.90 |
| 31 | 17.00 | ..... | 6.00 | ..... | 4.60 | ..... | 4.50 | 5.90 | ..... | 10.40 | ..... | 7.00 |
| 1895. | | | | | | | | | | | | |
| 1 | 6.00 | 28.00 | 10.20 | 9.00 | 44.60 | 6.00 | 10.30 | 4.80 | 5.00 | 1.20 | 4.20 | 3.60 |
| 2 | 6.00 | 25.00 | 9.80 | 8.40 | 40.80 | 5.20 | 11.20 | 4.80 | 4.30 | 1.10 | 5.00 | 3.10 |
| 3 | 6.00 | 28.00 | 12.00 | 10.90 | 33.60 | 4.10 | 15.50 | 4.10 | 4.40 | 1.00 | 6.00 | 3.20 |
| 4 | 6.40 | 27.80 | 24.80 | 11.00 | 27.00 | 4.00 | 14.00 | 3.80 | 4.40 | 1.00 | 7.00 | 3.00 |
| 5 | 7.80 | 23.40 | 25.20 | 11.00 | 22.00 | 4.00 | 11.50 | 3.60 | 4.00 | .70 | 6.00 | 3.00 |
| 6 | 7.40 | 18.90 | 19.20 | 9.40 | 17.90 | 4.20 | 8.00 | 3.40 | 3.70 | .90 | 4.80 | 3.00 |
| 7 | 6.10 | 15.20 | 17.00 | 9.00 | 14.20 | 4.00 | 6.50 | 3.10 | 3.40 | 1.10 | 4.10 | 2.90 |
| 8 | 5.90 | 14.00 | 15.40 | 11.50 | 17.20 | 4.50 | 5.40 | 3.70 | 3.20 | 1.30 | 3.60 | 2.80 |
| 9 | 8.00 | 11.80 | 23.60 | 42.00 | 18.00 | 4.40 | 5.00 | 3.90 | 3.20 | 1.60 | 3.20 | 2.60 |
| 10 | 37.00 | 11.00 | 20.00 | 47.70 | 14.80 | 4.30 | 5.10 | 4.70 | 4.70 | 1.90 | 3.10 | 3.90 |
| 11 | 52.00 | 10.00 | 18.70 | 46.40 | 11.80 | 4.10 | 5.00 | 4.40 | 5.00 | 1.70 | 3.70 | 10.60 |
| 12 | 58.00 | 9.80 | 17.80 | 35.00 | 12.40 | 5.30 | 4.90 | 4.00 | 4.70 | 1.60 | 7.00 | 13.20 |
| 13 | 56.40 | 9.40 | 20.60 | 25.20 | 11.20 | 7.00 | 5.40 | 4.30 | 4.50 | 2.00 | 8.90 | 10.00 |
| 14 | 47.40 | 9.00 | 23.00 | 18.50 | 10.90 | 9.40 | 5.40 | 8.00 | 3.90 | 2.00 | 6.60 | 8.20 |
| 15 | 38.00 | 8.80 | 30.40 | 14.20 | 9.00 | 8.40 | 4.40 | 7.00 | 3.10 | 1.80 | 5.40 | 6.20 |
| 16 | 25.50 | 9.20 | 26.50 | 11.80 | 8.50 | 10.20 | 5.50 | 7.20 | 2.80 | 1.60 | 4.40 | 5.20 |
| 17 | 17.80 | 10.50 | 24.00 | 12.40 | 8.40 | 11.00 | 5.70 | 12.90 | 2.80 | 1.50 | 4.00 | 4.70 |
| 18 | 14.80 | 11.60 | 20.20 | 29.20 | 8.00 | 12.20 | 5.80 | 20.00 | 2.60 | 1.30 | 3.80 | 4.30 |
| 19 | 12.00 | 14.00 | 18.00 | 36.70 | 11.80 | 8.90 | 7.00 | 20.20 | 2.40 | 1.50 | 3.50 | 4.10 |
| 20 | 11.00 | 16.20 | 14.80 | 32.50 | 10.40 | 5.80 | 5.20 | 15.30 | 2.10 | 1.50 | 3.20 | 4.20 |
| 21 | 10.40 | 16.40 | 31.00 | 26.50 | 12.00 | 4.80 | 4.50 | 11.50 | 2.10 | 1.20 | 3.10 | 4.00 |
| 22 | 9.90 | 18.40 | 41.00 | 18.00 | 8.40 | 4.20 | 4.20 | 8.90 | 2.00 | 1.30 | 3.10 | 4.00 |
| 23 | 11.00 | 18.90 | 37.10 | 14.00 | 7.80 | 5.20 | 4.90 | 8.00 | 1.70 | 1.40 | 3.00 | 18.50 |
| 24 | 10.40 | 19.00 | 30.10 | 12.90 | 7.20 | 5.60 | 5.00 | 8.30 | 1.70 | 1.30 | 2.90 | 13.40 |
| 25 | 9.70 | 16.40 | 23.40 | 12.20 | 8.00 | 4.50 | 5.70 | 6.80 | 1.60 | 1.30 | 2.80 | 9.20 |
| 26 | 11.00 | 15.20 | 18.20 | 10.20 | 8.70 | 4.50 | 15.60 | 5.70 | 1.50 | 1.10 | 2.80 | 7.00 |
| 27 | 29.00 | 12.00 | 15.00 | 12.00 | 10.80 | 7.20 | 21.00 | 4.80 | 1.40 | 1.30 | 3.00 | 5.80 |
| 28 | 24.20 | 11.20 | 12.80 | 18.50 | 10.20 | 9.10 | 15.50 | 5.60 | 1.30 | 1.20 | 4.50 | 5.00 |
| 29 | 20.20 | ..... | 10.20 | 28.00 | 9.50 | 10.20 | 10.00 | 7.00 | 1.30 | 1.40 | 4.00 | 4.90 |
| 30 | 24.00 | ..... | 9.90 | 39.30 | 8.00 | 9.20 | 6.20 | 6.40 | 1.30 | 1.30 | 4.00 | 4.80 |
| 31 | 26.40 | ..... | 9.40 | ..... | 7.10 | ..... | 5.10 | 6.10 | ..... | 1.60 | ..... | 6.00 |
| 1896. | | | | | | | | | | | | |
| 1 | 18.00 | 6.50 | 9.00 | 7.50 | 3.70 | 4.00 | 7.00 | 3.30 | 1.30 | 31.00 | 2.50 | 6.00 |
| 2 | 18.90 | 6.50 | 10.40 | 9.50 | 5.00 | 3.20 | 5.30 | 4.30 | 1.10 | 26.80 | 2.70 | 15.40 |
| 3 | 11.40 | 7.90 | 9.30 | 22.50 | 8.00 | 2.70 | 4.00 | 4.00 | 1.00 | 19.50 | 2.70 | 14.00 |
| 4 | 8.00 | 27.70 | 7.60 | 19.40 | 12.80 | 4.00 | 3.50 | 3.30 | .80 | 12.90 | 3.00 | 12.40 |
| 5 | 6.50 | 31.00 | 6.80 | 13.00 | 10.40 | 19.00 | 3.50 | 3.00 | 1.50 | 7.80 | 4.30 | 10.40 |
| 6 | 5.70 | 30.00 | 6.00 | 9.80 | 8.30 | 20.00 | 5.90 | 3.00 | 3.00 | 4.90 | 17.00 | 9.50 |
| 7 | 4.60 | 45.40 | 5.80 | 8.00 | 6.00 | 14.00 | 4.40 | 2.80 | 8.50 | 4.20 | 19.00 | 9.60 |
| 8 | 4.40 | 48.00 | 5.80 | 6.80 | 4.50 | 10.00 | 15.00 | 2.60 | 9.50 | 3.60 | 14.30 | 13.50 |
| 9 | 4.60 | 45.00 | 5.40 | 6.00 | 4.40 | 8.00 | 34.80 | 2.30 | 5.50 | 3.20 | 10.40 | 14.50 |
| 10 | 4.60 | 42.40 | 5.40 | 5.40 | 3.90 | 6.20 | 47.50 | 2.00 | 4.00 | 3.00 | 7.70 | 13.60 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1896. | | | | | | | | | | | | |
| 11 | 4.70 | 36.00 | 5.50 | 5.20 | 3.50 | 6.00 | 49.50 | 2.00 | 3.30 | 2.70 | 6.00 | 11.70 |
| 12 | 4.40 | 30.40 | 7.80 | 5.50 | 3.20 | 6.00 | 47.00 | 1.90 | 2.50 | 2.70 | 4.80 | 9.50 |
| 13 | 4.20 | 19.00 | 11.00 | 5.50 | 2.80 | 5.00 | 41.00 | 2.70 | 2.00 | 2.70 | 4.60 | 8.20 |
| 14 | 4.00 | 16.20 | 10.00 | 5.00 | 2.80 | 7.00 | 30.30 | 4.00 | 1.50 | 3.00 | 4.50 | 7.00 |
| 15 | 4.10 | 17.40 | 8.60 | 4.90 | 2.60 | 10.90 | 19.00 | 3.40 | 1.40 | 3.30 | 4.50 | 7.50 |
| 16 | 4.00 | 16.00 | 7.20 | 5.00 | 2.50 | 8.50 | 14.40 | 3.70 | 1.20 | 3.20 | 4.80 | 9.40 |
| 17 | 5.00 | 13.40 | 7.50 | 4.90 | 2.50 | 5.70 | 9.50 | 3.70 | 1.00 | 3.00 | 4.20 | 14.00 |
| 18 | 19.00 | 11.60 | 8.00 | 4.70 | 2.10 | 4.60 | 9.30 | 3.00 | 1.50 | 2.90 | 4.00 | 12.30 |
| 19 | 26.00 | 10.50 | 7.80 | 4.50 | 2.40 | 6.00 | 9.00 | 2.60 | 1.90 | 2.60 | 4.00 | 9.00 |
| 20 | 21.40 | 10.60 | 8.50 | 4.20 | 2.30 | 5.30 | 8.70 | 2.50 | 3.00 | 2.40 | 3.80 | 9.00 |
| 21 | 15.00 | 9.80 | 10.50 | 4.00 | 3.50 | 6.40 | 8.90 | 2.50 | 2.50 | 2.10 | 3.60 | 8.20 |
| 22 | 12.20 | 9.00 | 9.60 | 3.80 | 4.10 | 5.00 | 8.30 | 2.10 | 1.50 | 2.20 | 3.50 | 7.00 |
| 23 | 10.00 | 8.00 | 7.80 | 3.60 | 8.17 | 4.30 | 7.90 | 2.70 | 6.00 | 2.30 | 3.20 | 6.90 |
| 24 | 25.00 | 7.80 | 6 80 | 3.50 | 11.40 | 4.50 | 7.20 | 2.00 | 6.80 | 2.70 | 3.10 | 6.30 |
| 25 | 25.60 | 7.80 | 6.50 | 4.00 | 17.40 | 6.40 | 7.50 | 2.40 | 5.00 | 4.40 | 3.00 | 5.40 |
| 26 | 21.00 | 7.70 | 6.60 | 4.60 | 12.00 | 7.80 | 7.00 | 4.00 | 3.90 | 4.10 | 3.00 | 4.60 |
| 27 | 16.20 | 7.40 | 7.00 | 7.00 | 9.50 | 8.60 | 5.20 | 3.70 | 3.20 | 3.50 | 3.00 | 5.00 |
| 28 | 12.00 | 7.30 | 6.30 | 5.50 | 8.00 | 6.00 | 4.30 | 2.70 | 2.90 | 3 00 | 3.30 | 4.90 |
| 29 | 9.40 | 7.90 | 6.20 | 4.90 | 7.20 | 10.80 | 3.70 | 2.00 | 3.50 | 2.80 | 3.20 | 4.80 |
| 30 | 8.10 | ..... | 5.80 | 4.10 | 6.00 | 8.90 | 3.60 | 1.90 | 8.00 | 2.50 | 3.50 | 4.90 |
| 31 | 7.00 | ..... | 5.30 | ..... | 5.00 | ..... | 3.40 | 1.40 | ..... | 2.50 | ..... | 5.00 |
| 1897. | | | | | | | | | | | | |
| 1 | 6.20 | 5.50 | 13.40 | 7.70 | 6.10 | 7.00 | 5.00 | 4.70 | 2.20 | 0.70 | 1.90 | 5.50 |
| 2 | 6.00 | 5.90 | 11.70 | 8.00 | 10.00 | 8.60 | 3.20 | 3.20 | 4.60 | .70 | 5.50 | 6.00 |
| 3 | 5.50 | 25.00 | 10.20 | 7.30 | 14.40 | 6.50 | 2.50 | 3.00 | 3.50 | .80 | 9.70 | 5.10 |
| 4 | 5.50 | 27.00 | 9.00 | 8.00 | 13.20 | 5.00 | 2.00 | 2.70 | 3.00 | .60 | 9.30 | 4.60 |
| 5 | 5.30 | 19.70 | 8.50 | 9.30 | 9.30 | 4.20 | 1.90 | 2.20 | 2.50 | .70 | 7.20 | 4.30 |
| 6 | 5.00 | 15.00 | 7.60 | 27.00 | 8.00 | 4.30 | 3.90 | 2.60 | 2.10 | .50 | 5.00 | 5.10 |
| 7 | 4.80 | 29.10 | 9.20 | 28.30 | 6.30 | 7.00 | 4.20 | 4.10 | 1.80 | .30 | 4.00 | 5.20 |
| 8 | 4.60 | 36.50 | 25.60 | 22.00 | 5.60 | 5.50 | 4.80 | 6.80 | 1.50 | .20 | 3.50 | 4.70 |
| 9 | 4.60 | 32.00 | 26.20 | 15.40 | 5.00 | 7.00 | 4.20 | 6.20 | 1.10 | .20 | 2.90 | 4.10 |
| 10 | 4.40 | 24.30 | 20.00 | 23.50 | 4.60 | 7.80 | 4.00 | 6.20 | 1.10 | .30 | 2.60 | 3.70 |
| 11 | 4.20 | 17.60 | 21.40 | 28.00 | 4.20 | 5.50 | 4.00 | 5.40 | 1.10 | .60 | 2.40 | 3.40 |
| 12 | 4.10 | 13.00 | 22.00 | 22.70 | 5.20 | 4.40 | 3.90 | 4.30 | 1.10 | .60 | 2.50 | 3.30 |
| 13 | 4.00 | 18.20 | 29.70 | 18.30 | 6.00 | 4.20 | 6.00 | 3.50 | .90 | .60 | 2.40 | 3.30 |
| 14 | 4.50 | 19.00 | 32.00 | 14.30 | 10.00 | 3.50 | 11.10 | 3.00 | .80 | .60 | 2.30 | 3.00 |
| 15 | 6.00 | 16.30 | 36.40 | 12.80 | 17.40 | 3.20 | 6.00 | 2.40 | .70 | .40 | 2.00 | 3.00 |
| 16 | 6.40 | 12.80 | 37.60 | 10.20 | 14.00 | 3.00 | 4.60 | 3.80 | .60 | .30 | 2.00 | 4.00 |
| 17 | 7.80 | 13.20 | 37.60 | 10.00 | 10.30 | 2.70 | 3.20 | 3.00 | .30 | .30 | 1.80 | 4.90 |
| 18 | 7.00 | 15.00 | 29.00 | 9.80 | 8.30 | 3.00 | 3.20 | 2.50 | .80 | .30 | 1.60 | 5.20 |
| 19 | 8.50 | 12.90 | 23.80 | 8.40 | 6.70 | 3.50 | 3.80 | 2.20 | .80 | .30 | 1.90 | 4.50 |
| 20 | 9.60 | 10.80 | 19.20 | 7.70 | 5.50 | 4.50 | 5.50 | 3.00 | .90 | .40 | 1.90 | 3.90 |
| 21 | 7.80 | 14.00 | 18.00 | 7.00 | 4.80 | 4.30 | 16.50 | 3.20 | 1.40 | .90 | 1.70 | 3.50 |
| 22 | 20.40 | 24.30 | 16.60 | 6.70 | 4.50 | 3.50 | 25.30 | 5.00 | 1.40 | 1.50 | 1.70 | 3.50 |
| 23 | 24.55 | 23.50 | 13.70 | 6.30 | 4.30 | 3.00 | 16.40 | 5.20 | 1.10 | 1.60 | 1.70 | 4.80 |
| 24 | 16.80 | 23.50 | 11.20 | 5.80 | 4.20 | 2.40 | 12.70 | 6.50 | 1.10 | 1.70 | 1.50 | 9.00 |
| 25 | 12.60 | 24.20 | 10.00 | 5.50 | 4.30 | 1.80 | 8.50 | 5.60 | 1.10 | 2.00 | 1.40 | 7.80 |
| 26 | 8.50 | 23.30 | 9.30 | 5.50 | 4.60 | 4.80 | 6.10 | 4.90 | 1.10 | 2.20 | 1.60 | 5.70 |
| 27 | 7.20 | 20.40 | 8.40 | 5.20 | 4.50 | 3.40 | 7.00 | 4.00 | .90 | 1.90 | 1.70 | 6.00 |
| 28 | 7.00 | 16.60 | 8.00 | 4.70 | 4.40 | 2.80 | 7.30 | 3.50 | 1.10 | 1.90 | 1.90 | 10.00 |
| 29 | 6.60 | ..... | 7.40 | 4.50 | 4.00 | 3.70 | 6.90 | 2.90 | .80 | 1.70 | 2.30 | 9.50 |
| 30 | 5.90 | ..... | 7.20 | 4.40 | 4.40 | 4.00 | 5.60 | 2.50 | .70 | 1.90 | 3.50 | 7.10 |
| 31 | 5.60 | ..... | 7.20 | ..... | 4.30 | ..... | 5.00 | 2.50 | ..... | 1.70 | ..... | 5.00 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1898. | | | | | | | | | | | | |
| 1 | 5.00 | 5.00 | 3.50 | 21.00 | 6.60 | 3.20 | 2.00 | 6.00 | 10.30 | 2.90 | 14.00 | 6.10 |
| 2 | 4.90 | 4.90 | 3.20 | 17.30 | 5.50 | 3.00 | 2.00 | 7.00 | 9.60 | 2.50 | 9.30 | 6.90 |
| 3 | 4.50 | 4.80 | 3.50 | 11.00 | 5.00 | 3.00 | 1.50 | 7.00 | 7.20 | 2.40 | 7.10 | 6.70 |
| 4 | 4.30 | 4.40 | 3.50 | 9.40 | 4.30 | 2.70 | 1.20 | 6.40 | 5.70 | 2.50 | 5.50 | 8.40 |
| 5 | 3.70 | 4.00 | 7.00 | 6.00 | 4.10 | 2.30 | 1.00 | 5.20 | 14.00 | 2.40 | 4.70 | 16.00 |
| 6 | 3.70 | 3.90 | 20.50 | 12.80 | 3.80 | 1.90 | 5.10 | 5.00 | 18.80 | 2.50 | 4.20 | 18.00 |
| 7 | 3.60 | 3.80 | 17.70 | 21.50 | 3.10 | 1.40 | 12.00 | 4.10 | 14.00 | 5.50 | 3.80 | 14.60 |
| 8 | 4.00 | 3.60 | 11.00 | 15.30 | 8.00 | 1.20 | 16.20 | 3.00 | 12.50 | 5.60 | 5.40 | 11.80 |
| 9 | 3.60 | 3.50 | 8.70 | 11.70 | 7.00 | 1.10 | 12.40 | 3.00 | 13.20 | 4.20 | 5.00 | 9.00 |
| 10 | 3.50 | 3.40 | 7.90 | 8.00 | 6.30 | 1.20 | 10.20 | 2.60 | 10.00 | 3.40 | 4.80 | 7.00 |
| 11 | 3.40 | 3.40 | 5.80 | 7.00 | 5.40 | 1.10 | 12.50 | 2.30 | 8.70 | 2.70 | 4.30 | 5.50 |
| 12 | 3.30 | 3.50 | 5.20 | 6.10 | 4.50 | 1.10 | 8.00 | 3.70 | 6.50 | 2.30 | 3.70 | 5.30 |
| 13 | 3.40 | 3.50 | 4.90 | 5.90 | 4.00 | 1.20 | 6.00 | 5.00 | 5.00 | 2.00 | 3.50 | 5.30 |
| 14 | 3.60 | 3.40 | 5.00 | 5.70 | 3.70 | 1.30 | 5.10 | 9.40 | 4.30 | 1.90 | 3.90 | 5.30 |
| 15 | 3.80 | 3.20 | 5.10 | 5.40 | 5.00 | 1.30 | 5.10 | 16.00 | 4.10 | 1.80 | 4.30 | 5.00 |
| 16 | 3.60 | 2.90 | 8.00 | 5.40 | 4.90 | 2.50 | 5.50 | 14.00 | 3.80 | 1.80 | 6.00 | 5.00 |
| 17 | 3.70 | 2.90 | 9.20 | 5.60 | 5.10 | 3.90 | 5.50 | 10.00 | 3.60 | 1.50 | 7.00 | 4.80 |
| 18 | 3.60 | 2.90 | 7.70 | 5.40 | 4.70 | 4.30 | 4.10 | 7.00 | 3.40 | 1.30 | 9.80 | 4.60 |
| 19 | 3.70 | 3.10 | 6.20 | 4.70 | 4.20 | 3.90 | 6.00 | 9.20 | 3.10 | 2.00 | 10.20 | 4.70 |
| 20 | 3.80 | 4.50 | 5.50 | 4.40 | 4.00 | 4.00 | 5.50 | 22.20 | 2.90 | 5.00 | 11.00 | 4.60 |
| 21 | 3.60 | 5.30 | 5.00 | 4.20 | 3.50 | 7.00 | 5.50 | 29.00 | 2.50 | 5.00 | 12.20 | 5.30 |
| 22 | 4.10 | 5.70 | 5.00 | 4.00 | 3.00 | 7.00 | 4.20 | 29.20 | 2.20 | 4.50 | 9.60 | 6.10 |
| 23 | 4.40 | 6.00 | 4.70 | 3.90 | 3.00 | 5.50 | 3.60 | 23.50 | 2.50 | 10.00 | 7.80 | 8.00 |
| 24 | 4.40 | 5.50 | 4.50 | 4.10 | 2.90 | 4.30 | 10.00 | 18.00 | 15.00 | 9.80 | 5.60 | 7.30 |
| 25 | 4.40 | 5.10 | 4.20 | 4.40 | 12.00 | 3.20 | 7.00 | 10.30 | 14.00 | 6.00 | 5.10 | 7.00 |
| 26 | 5.50 | 4.50 | 5.00 | 7.20 | 11.40 | 2.70 | 6.00 | 6.00 | 9.80 | 4.50 | 5.00 | 6.40 |
| 27 | 14.00 | 4.10 | 6.00 | 10.40 | 9.00 | 2.20 | 4.60 | 6.10 | 7.00 | 4.70 | 5.10 | 5.50 |
| 28 | 11.00 | 3.80 | 5.60 | 10.70 | 6.70 | 1.70 | 4.10 | 6.20 | 5.00 | 4.50 | 4.70 | 5.30 |
| 29 | 9.20 | ..... | 4.70 | 12.00 | 5.00 | 1.60 | 4.00 | 7.00 | 3.90 | 3.60 | 4.40 | 5.10 |
| 30 | 6.50 | ..... | 4.30 | 9.60 | 4.00 | 2.10 | 3.90 | 8.50 | 3.40 | 3.50 | 4.70 | 4.90 |
| 31 | 5.30 | ..... | 14.80 | ..... | 3.50 | ..... | 4.00 | 11.00 | ..... | 10.00 | ..... | 4.70 |
| 1899. | | | | | | | | | | | | |
| 1 | 4.50 | 11.00 | 30.80 | 17.80 | 7.20 | 6.00 | 2.90 | 11.50 | 2.40 | 2.00 | 11.00 | 8.00 |
| 2 | 4.60 | 18.10 | 25.00 | 17.00 | 6.00 | 6.40 | 6.40 | 10.00 | 2.20 | 1.70 | 21.40 | 6.40 |
| 3 | 6.50 | 14.00 | 21.00 | 14.00 | 6.00 | 8.00 | 8.00 | 8.80 | 1.90 | 1.70 | 17.50 | 6.50 |
| 4 | 6.50 | 12.80 | 28.60 | 12.20 | 5.50 | 7.60 | 7.60 | 7.00 | 1.60 | 1.50 | 12.80 | 7.00 |
| 5 | 5.80 | 23.00 | 34.40 | 15.60 | 5.50 | 6.10 | 6.10 | 5.50 | 1.50 | 1.40 | 10.40 | 6.70 |
| 6 | 5.50 | 31.90 | 33.20 | 21.00 | 5.50 | 4.20 | 4.20 | 4.20 | 1.60 | 2.10 | 8.30 | 5.50 |
| 7 | 5.50 | 41.00 | 27.40 | 17.60 | 5.50 | 4.20 | 4.20 | 3.20 | 1.40 | 14.40 | 6.50 | 5.10 |
| 8 | 17.00 | 50.80 | 25.00 | 23.20 | 8.60 | 3.80 | 3.80 | 2.60 | 2.00 | 13.50 | 5.00 | 4.90 |
| 9 | 21.40 | 52.00 | 20.00 | 35.50 | 14.20 | 3.50 | 8.30 | 7.00 | 1.80 | 17.00 | 5.00 | 4.70 |
| 10 | 14.90 | 47.30 | 15.00 | 30.30 | 13.00 | 4.50 | 9.30 | 10.20 | 1.90 | 13.20 | 5.00 | 4.30 |
| 11 | 10.20 | 37.40 | 11.50 | 23.00 | 9.80 | 7.50 | 6.40 | 7.00 | 1.80 | 10.00 | 4.80 | 4.30 |
| 12 | 8.00 | 30.00 | 10.20 | 19.40 | 10.90 | 8.10 | 5.00 | 5.50 | 5.70 | 7.00 | 4.50 | 4.50 |
| 13 | 9.30 | 20.80 | 9.40 | 15.80 | 11.00 | 10.00 | 3.60 | 4.60 | 4.00 | 5.00 | 4.60 | 4.00 |
| 14 | 10.00 | 12.30 | 8.70 | 13.50 | 15.40 | 11.10 | 3.10 | 3.70 | 4.00 | 4.50 | 4.30 | 14.00 |
| 15 | 19.00 | 10.00 | 18.60 | 10.20 | 17.30 | 8.00 | 2.60 | 3.00 | 4.60 | 3.80 | 4.00 | 10.00 |
| 16 | 23.60 | 12.50 | 38.60 | 9.80 | 12.00 | 5.80 | 2.40 | 2.70 | 4.00 | 3.50 | 4.00 | 7.50 |
| 17 | 17.20 | 24.00 | 42.00 | 9.00 | 9.70 | 5.00 | 2.40 | 2.50 | 2.50 | 3.50 | 4.00 | 6.00 |
| 18 | 14.50 | 36.50 | 38.00 | 10.00 | 7.20 | 4.60 | 4.50 | 2.40 | 1.80 | 3.00 | 3.90 | 5.40 |
| 19 | 13.40 | 42.60 | 28.00 | 9.20 | 5.50 | 4.10 | 4.00 | 2.70 | 1.60 | 3.30 | 3.80 | 5.00 |
| 20 | 11.00 | 43.00 | 28.80 | 9.40 | 5.30 | 3.70 | 3.50 | 2.70 | 1.80 | 3.00 | 3.60 | 4.80 |
| 21 | 9.20 | 38.50 | 32.00 | 9.00 | 5.20 | 3.20 | 3.00 | 2.30 | 2.50 | 2.70 | 3.50 | 4.50 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1899. | | | | | | | | | | | | |
| 22 | 8.00 | 34.00 | 25.00 | 8.50 | 5.00 | 3.20 | 2.40 | 2.20 | 4.00 | 2.50 | 3.30 | 4.00 |
| 23 | 7.00 | 28.30 | 18.00 | 8.40 | 5.30 | 3.00 | 2.30 | 5.00 | 3.70 | 2.20 | 3.30 | 4.20 |
| 24 | 6.20 | 23.00 | 14.70 | 8.00 | 6.30 | 3.10 | 2.80 | 3.70 | 3.20 | 2.30 | 3.80 | 5.40 |
| 25 | 6.20 | 18.20 | 12.00 | 6.60 | 6.00 | 2.90 | 4.00 | 2.50 | 2.60 | 2.10 | 4.00 | 10.00 |
| 26 | 6.00 | 16.40 | 10.00 | 7.00 | 5.50 | 2.50 | 6.40 | 2.70 | 2.90 | 2.10 | 4.00 | 12.00 |
| 27 | 7.00 | 17.00 | 10.00 | 10.00 | 5.30 | 2.80 | 7.00 | 2.10 | 3.70 | 2.10 | 4.50 | 9.70 |
| 28 | 6.80 | 28.40 | 12.00 | 11.40 | 4.70 | 3.10 | 12.80 | 1.60 | 3.90 | 2.10 | 5.60 | 7.30 |
| 29 | 6.60 | ..... | 17.80 | 10.00 | 4.20 | 3.50 | 11.70 | 1.60 | 3.00 | 2.10 | 10.00 | 6.00 |
| 30 | 6.60 | ..... | 21.70 | 8.80 | 4.20 | 3.20 | 9.90 | 1.50 | 2.50 | 2.10 | 9.50 | 5.90 |
| 31 | 7.00 | ..... | 19.20 | ..... | 5.00 | ..... | 7.60 | 2.90 | ..... | 4.20 | ..... | ..... |
| 1900. | | | | | | | | | | | | |
| 1 | 5.00 | 5.20 | 12.00 | 9.00 | 8.30 | 3.20 | 5.00 | 2.60 | 5.00 | 0.90 | 0.60 | 2.80 |
| 2 | 4.90 | 5.00 | 27.00 | 7.70 | 9.70 | 3.20 | 4.30 | 2.80 | 4.50 | .80 | .50 | 2.20 |
| 3 | 4.30 | 4.60 | 33.70 | 6.90 | 7.30 | 3.00 | 4.00 | 2.20 | 3.80 | .70 | .70 | 2.10 |
| 4 | 4.40 | 4.40 | 29.00 | 6.70 | 6.90 | 2.80 | 3.50 | 1.80 | 2.50 | .60 | 2.50 | 2.30 |
| 5 | 4.20 | 5.30 | 22.30 | 9.10 | 6.40 | 2.80 | 3.10 | 1.80 | 1.80 | .90 | 12.50 | 14.00 |
| 6 | 4.40 | 7.50 | 15.00 | 10.00 | 5.60 | 2.70 | 3.60 | 1.40 | 1.20 | 1.20 | 10.50 | 15.00 |
| 7 | 4.20 | 10.00 | 11.70 | 9.20 | 5.30 | 2.70 | 3.10 | 1.40 | .80 | 1.00 | 7.00 | 9.20 |
| 8 | 4.10 | 8.00 | 9.70 | 6.70 | 5.00 | 2.60 | 3.10 | 1.20 | .70 | .80 | 5.20 | 8.40 |
| 9 | 3.90 | 6.40 | 10.00 | 6.00 | 5.00 | 3.50 | 2.60 | .90 | .60 | .70 | 4.00 | 6.50 |
| 10 | 3.90 | 7.00 | 23.00 | 5.80 | 4.90 | 3.90 | 2.20 | .80 | .40 | .70 | 3.40 | 4.80 |
| 11 | 4.80 | 10.00 | 19.00 | 5.80 | 5.50 | 4.20 | 1.80 | .70 | .60 | .90 | 2.90 | 4.00 |
| 12 | 9.00 | 20.80 | 17.20 | 5.60 | 5.50 | 4.20 | 1.60 | .70 | .50 | .80 | 2.50 | 3.50 |
| 13 | 21.30 | 25.70 | 14.30 | 18.00 | 5.00 | 3.00 | 1.40 | .70 | .30 | 1.80 | 2.40 | 3.40 |
| 14 | 21.00 | 36.00 | 10.40 | 18.00 | 4.70 | 2.60 | 1.80 | .70 | .40 | 1.60 | 2.00 | 3.30 |
| 15 | 17.30 | 35.80 | 8.70 | 14.40 | 4.00 | 2.50 | 5.00 | .80 | .50 | 1.30 | 1.90 | 3.30 |
| 16 | 12.00 | 30.00 | 9.80 | 10.20 | 3.80 | 3.00 | 3.00 | .60 | 2.10 | 1.40 | 2.00 | 3.40 |
| 17 | 9.10 | 24.70 | 19.00 | 7.00 | 3.80 | 2.70 | 2.50 | .50 | 10.40 | 2.90 | 1.80 | 3.10 |
| 18 | 7.50 | 18.40 | 19.00 | 6.00 | 3.60 | 5.50 | 2.00 | 4.50 | 8.40 | 2.70 | 1.50 | 3.00 |
| 19 | 6.50 | 13.70 | 15.00 | 6.00 | 8.00 | 14.00 | 1.70 | 3.90 | 4.60 | 1.90 | 1.30 | 3.00 |
| 20 | 7.70 | 9.00 | 12.40 | 38.00 | 18.00 | 8.00 | 1.50 | 2.80 | 3.20 | 1.60 | 1.10 | 2.60 |
| 21 | 12.50 | 8.20 | 10.00 | 44.00 | 14.00 | 5.70 | 1.30 | 2.40 | 2.10 | 1.20 | 1.00 | 4.00 |
| 22 | 14.00 | 9.10 | 9.40 | 44.00 | 10.40 | 4.40 | 1.10 | 1.70 | 1.70 | 1.00 | 1.10 | 12.80 |
| 23 | 11.70 | 23.00 | 8.50 | 38.00 | 7.00 | 4.00 | 1.00 | 1.60 | 1.40 | .90 | 1.10 | 16.00 |
| 24 | 8.00 | 23.00 | 7.60 | 33.00 | 5.40 | 12.00 | .90 | 3.50 | 1.30 | .80 | 1.10 | 11.40 |
| 25 | 7.10 | 17.50 | 7.00 | 26.00 | 5.70 | 17.40 | 3.50 | 2.20 | 1.00 | .80 | 1.10 | 9.80 |
| 26 | 6.50 | 21.00 | 9.80 | 22.00 | 5.50 | 16.00 | 3.80 | 2.30 | .90 | .70 | 1.50 | 7.00 |
| 27 | 6.10 | 19.00 | 14.00 | 17.00 | 5.50 | 13.70 | 4.50 | 1.70 | .80 | .70 | 1.50 | 5.60 |
| 28 | 5.60 | 14.10 | 14.00 | 12.20 | 5.00 | 8.00 | 12.00 | 1.20 | 1.30 | .80 | 2.50 | 4.40 |
| 29 | 5.70 | ..... | 11.60 | 10.00 | 4.50 | 5.50 | 9.00 | .90 | 1.00 | .60 | 3.20 | 4.00 |
| 30 | 5.50 | ..... | 9.80 | 8.30 | 4.00 | 5.00 | 5.80 | .90 | 1.10 | .70 | 3.10 | 4.40 |
| 31 | 5.30 | ..... | 9.60 | ..... | 3.70 | ..... | 4.60 | 1.10 | ..... | .70 | ..... | 6.20 |
| 1901. | | | | | | | | | | | | |
| 1 | 12.00 | 6.40 | 4.20 | 12.80 | 5.20 | 13.30 | 9.20 | 4.70 | 11.00 | 10.40 | 3.60 | 3.80 |
| 2 | 11.40 | 6.40 | 4.00 | 9.60 | 4.80 | 10.00 | 10.00 | 4.90 | 13.60 | 9.30 | 3.80 | 3.70 |
| 3 | 10.00 | 5.50 | 3.90 | 14.40 | 4.50 | 9.00 | 9.50 | 4.20 | 12.40 | 10.00 | 3.80 | 3.60 |
| 4 | 8.20 | 5.60 | 3.70 | 45.90 | 4.50 | 7.80 | 7.00 | 4.00 | 9.80 | 9.40 | 3.60 | 4.00 |
| 5 | 6.00 | 9.00 | 3.70 | 47.70 | 4.30 | 6.30 | 5.50 | 3.60 | 7.60 | 8.50 | 3.60 | 4.00 |
| 6 | 5.70 | 11.00 | 3.70 | 41.70 | 4.00 | 6.30 | 4.60 | 6.00 | 6.50 | 7.50 | 3.60 | 3.80 |
| 7 | 5.20 | 8.20 | 3.30 | 30.80 | 3.90 | 6.00 | 3.80 | 29.40 | 5.80 | 6.30 | 3.70 | 4.10 |
| 8 | 4.60 | 6.40 | 3.10 | 23.80 | 4.00 | 5.90 | 4.10 | 43.60 | 5.50 | 5.90 | 3.70 | 4.00 |
| 9 | 4.00 | 6.00 | 3.10 | 16.60 | 5.00 | 5.60 | 6.00 | 44.80 | 5.30 | 5.30 | 3.70 | 3.80 |
| 10 | 4.20 | 10.00 | 3.00 | 10.00 | 5.50 | 5.40 | 10.20 | 38.00 | 5.00 | 5.20 | 3.70 | 3.90 |

*Daily gage height, in feet, of Cape Fear River at Fayetteville, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 11 | 4.50 | 11.20 | 3.50 | 7.00 | 7.70 | 5.00 | 10.00 | 30.70 | 4.70 | 5.20 | 3.50 | 3.80 |
| 12 | 4.80 | 9.30 | 4.30 | 6.60 | 10.50 | 4.80 | 8.70 | 19.80 | 4.70 | 5.00 | 3.50 | 4.00 |
| 13 | 12.90 | 10.00 | 5.30 | 6.00 | 10.00 | 4.40 | 7.00 | 11.00 | 4.40 | 4.80 | 3.50 | 3.90 |
| 14 | 15.40 | 9.50 | 5.00 | 7.00 | 8.30 | 6.30 | 8.00 | 28.80 | 4.30 | 5.00 | 3.60 | 4.00 |
| 15 | 11.00 | 7.40 | 4.50 | 20.40 | 7.00 | 9.40 | 30.10 | 42.00 | 4.10 | 9.00 | 3.60 | 5.00 |
| 16 | 8.40 | 6.60 | 4.00 | 20.80 | 5.80 | 9.00 | 41.50 | 40.00 | 4.00 | 8.00 | 3.60 | 15.40 |
| 17 | 6.70 | 5.40 | 3.70 | 16.00 | 4.70 | 14.40 | 36.50 | 32.00 | 7.80 | 6.20 | 3.60 | 16.20 |
| 18 | 9.00 | 5.00 | 3.40 | 11.80 | 4.40 | 22.30 | 29.70 | 30.00 | 14.00 | 5.50 | 3.50 | 11.00 |
| 19 | 12.20 | 5.00 | 3.20 | 9.30 | 5.00 | 23.00 | 25.30 | 26.50 | 37.50 | 5.00 | 3.60 | 9.20 |
| 20 | 10.00 | 4.80 | 3.10 | 7.50 | 6.60 | 15.70 | 31.10 | 26.00 | 43.60 | 4.50 | 3.50 | 7.00 |
| 21 | 8.50 | 4.50 | 4.00 | 8.30 | 10.00 | 11.40 | 33.00 | 23.80 | 40.00 | 4.40 | 3.50 | 5.20 |
| 22 | 6.00 | 4.40 | 4.50 | 13.20 | 14.00 | 9.00 | 25.80 | 20.40 | 29.00 | 4.10 | 3.50 | 4.60 |
| 23 | 5.20 | 4.00 | 4.00 | 14.00 | 48.00 | 13.40 | 18.20 | 15.60 | 21.80 | 3.80 | 3.50 | 4.20 |
| 24 | 4.60 | 4.00 | 3.90 | 12.00 | 58.50 | 10.80 | 12.00 | 13.40 | 15.00 | 4.00 | 3.70 | 4.60 |
| 25 | 5.30 | 4.10 | 3.80 | 14.00 | 54.70 | 9.00 | 10.30 | 20.00 | 10.40 | 3.90 | 6.00 | 5.60 |
| 26 | 5.30 | 4.00 | 5.50 | 12.00 | 42.00 | 8.70 | 9.00 | 23.00 | 8.30 | 3.80 | 6.10 | 7.00 |
| 27 | 5.40 | 4.00 | 28.30 | 9.60 | 33.90 | 7.80 | 6.80 | 17.80 | 7.20 | 4.00 | 5.00 | 7.30 |
| 28 | 5.20 | 3.90 | 36.00 | 8.00 | 27.50 | 9.20 | 5.60 | 15.60 | 7.30 | 3.80 | 4.70 | 12.00 |
| 29 | 4.60 | ..... | 32.00 | 7.00 | 27.20 | 16.60 | 5.40 | 16.40 | 9.00 | 3.60 | 4.50 | 16.00 |
| 30 | 4.60 | ..... | 25.80 | 6.10 | 23.00 | 11.20 | 5.00 | 16.00 | 10.00 | 3.60 | 3.80 | 25.20 |
| 31 | 5.00 | ..... | 19.70 | ..... | 18.00 | ..... | 4.60 | 12.50 | ..... | 3.50 | ..... | 35.50 |
| 1902. | | | | | | | | | | | | |
| 1 | 35.50 | 17.00 | 40.50 | 16.80 | 7.00 | 3.10 | 4.40 | 2.70 | 1.00 | 3.90 | 2.60 | 7.60 |
| 2 | 30.00 | 27.70 | 41.70 | 12.60 | 7.00 | 2.90 | 3.30 | 2.30 | .90 | 4.40 | 2.30 | 20.00 |
| 3 | 22.00 | 39.80 | 39.80 | 10.20 | 5.80 | 2.80 | 2.70 | 2.30 | .90 | 5.80 | 2.00 | 19.20 |
| 4 | 16.60 | 40.30 | 33.50 | 8.00 | 5.80 | 2.60 | 2.40 | 1.80 | .50 | 4.60 | 1.90 | 21.60 |
| 5 | 12.50 | 35.80 | 29.30 | 7.30 | 5.40 | 2.50 | 2.10 | 1.60 | .50 | 4.00 | 1.70 | 19.40 |
| 6 | 9.00 | 26.20 | 23.00 | 10.00 | 5.00 | 2.40 | 1.80 | 1.40 | .80 | 3.60 | 1.70 | 17.80 |
| 7 | 8.00 | 19.00 | 19.90 | 8.80 | 4.50 | 2.30 | 1.60 | 1.80 | .80 | 5.70 | 2.30 | 14.00 |
| 8 | 7.00 | 14.20 | 16.80 | 7.60 | 4.50 | 2.10 | 1.40 | 2.10 | .80 | 6.00 | 2.80 | 11.20 |
| 9 | 6.90 | 11.00 | 13.60 | 8.00 | 4.50 | 2.20 | 1.20 | 2.10 | 1.00 | 5.00 | 3.20 | 9.70 |
| 10 | 6.90 | 9.50 | 12.90 | 8.00 | 4.80 | 2.40 | 3.30 | 1.80 | 1.10 | 3.80 | 3.60 | 7.00 |
| 11 | 6.80 | 8.00 | 12.00 | 8.50 | 4.80 | 2.20 | 2.80 | 1.80 | 4.40 | 3.30 | 3.00 | 6.00 |
| 12 | 6.50 | 7.90 | 11.00 | 11.00 | 4.50 | 2.40 | 2.30 | 3.00 | 5.80 | 3.80 | 2.50 | 5.60 |
| 13 | 6.20 | 7.80 | 10.20 | 11.00 | 4.40 | 2.50 | 2.70 | 3.40 | 3.80 | 7.00 | 2.40 | 6.00 |
| 14 | 5.80 | 7.70 | 9.20 | 9.60 | 5.20 | 2.20 | 3.50 | 2.40 | 3.60 | 8.00 | 2.20 | 16.00 |
| 15 | 5.70 | 7.50 | 8.80 | 8.00 | 5.00 | 1.90 | 2.80 | 1.60 | 2.20 | 6.10 | 2.10 | 15.60 |
| 16 | 5.30 | 6.80 | 8.70 | 7.30 | 6.00 | 1.90 | 2.60 | 1.70 | 1.50 | 5.60 | 1.80 | 11.20 |
| 17 | 5.30 | 7.90 | 11.00 | 6.80 | 6.00 | 2.40 | 2.30 | 2.80 | 1.40 | 4.70 | 1.90 | 9.20 |
| 18 | 5.30 | 9.00 | 20.00 | 6.00 | 5.40 | 8.00 | 2.30 | 2.80 | 1.00 | 3.80 | 1.90 | 9.50 |
| 19 | 5.30 | 9.80 | 17.80 | 5.80 | 6.20 | 7.80 | 2.10 | 2.70 | .90 | 3.00 | 2.00 | 10.00 |
| 20 | 5.30 | 10.00 | 14.00 | 11.00 | 6.50 | 6.00 | 1.60 | 2.40 | .90 | 3.00 | 6.50 | 8.40 |
| 21 | 5.20 | 10.80 | 11.00 | 9.60 | 6.80 | 5.00 | 1.30 | 2.70 | .80 | 2.90 | 6.60 | 7.80 |
| 22 | 11.50 | 12.20 | 9.80 | 8.00 | 5.80 | 3.70 | 1.50 | 2.50 | .70 | 2.50 | 5.20 | 7.80 |
| 23 | 19.80 | 18.50 | 9.00 | 7.30 | 4.40 | 3.00 | 1.30 | 2.20 | .80 | 1.90 | 4.00 | 14.80 |
| 24 | 17.20 | 24.50 | 8.50 | 6.80 | 3.90 | 2.70 | 1.00 | 2.20 | .70 | 2.00 | 3.50 | 14.00 |
| 25 | 12.80 | 26.90 | 8.30 | 6.00 | 3.60 | 2.70 | 1.00 | 2.20 | .50 | 2.00 | 3.00 | 9.80 |
| 26 | 10.00 | 35.30 | 8.00 | 5.80 | 3.80 | 3.40 | 1.70 | 2.10 | 2.00 | 1.70 | 3.70 | 8.60 |
| 27 | 8.00 | 38.30 | 7.70 | 5.70 | 4.80 | 4.40 | 1.60 | 1.70 | 4.60 | 1.60 | 7.00 | 7.00 |
| 28 | 7.50 | 35.00 | 7.20 | 5.40 | 5.00 | 4.40 | 1.10 | 1.40 | 8.60 | 1.70 | 10.00 | 6.20 |
| 29 | 8.20 | ..... | 7.80 | 5.10 | 4.80 | 4.70 | 1.50 | 1.30 | 8.00 | 1.90 | 8.00 | 5.80 |
| 30 | 10.00 | ..... | 15.60 | 6.00 | 4.00 | 5.30 | 1.90 | 1.30 | 6.20 | 1.80 | 5.00 | 5.30 |
| 31 | 12.20 | ..... | 20.00 | ..... | 3.60 | ..... | 1.80 | 1.20 | ..... | 2.80 | ..... | 5.80 |

*Rating table for Cape Fear River at Fayetteville, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.5 | 450 | 3.8 | 1,620 | 7.2 | 3,048 | 14.5 | 6,650 |
| .6 | 480 | 4.0 | 1,700 | 7.4 | 3,136 | 15.0 | 6,900 |
| .8 | 540 | 4.2 | 1,780 | 7.6 | 3,224 | 15.5 | 7,150 |
| 1.0 | 600 | 4.4 | 1,860 | 7.8 | 3,312 | 16.0 | 7,450 |
| 1.2 | 660 | 4.6 | 1,940 | 8.0 | 3,400 | 16.5 | 7,725 |
| 1.4 | 720 | 4.8 | 2,020 | 8.5 | 3.650 | 17.0 | 8,000 |
| 1.6 | 780 | 5.0 | 2,100 | 9.0 | 3,900 | 17.5 | 8,275 |
| 1.8 | 840 | 5.2 | 2,180 | 9.5 | 4,150 | 18.0 | 8,550 |
| 2.0 | 900 | 5.4 | 2,260 | 10.0 | 4,400 | 19.0 | 9,200 |
| 2.2 | 980 | 5.6 | 2,344 | 10.5 | 4,650 | 20.0 | 9,850 |
| 2.4 | 1,060 | 5.8 | 2,432 | 11.0 | 4.900 | 25.0 | 13,350 |
| 2.6 | 1,140 | 6.0 | 2,520 | 11.5 | 5,150 | 30.0 | 18,600 |
| 2.8 | 1,220 | 6.2 | 2,608 | 12.0 | 5,400 | 35.0 | 26,350 |
| 3.0 | 1,300 | 6.4 | 2,696 | 12.5 | 5,650 | 40.0 | 35,050 |
| 3.2 | 1,380 | 6.6 | 2,784 | 13.0 | 5,900 | 45.0 | 43,800 |
| 3.4 | 1,460 | 6.8 | 2,872 | 13.5 | 6,150 | 50.0 | 53,550 |
| 3.6 | 1,540 | 7.0 | 2,960 | 14.0 | 6,400 | | |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*

[Drainage area, 4,493 square miles.]

NOTE.—For the years 1889 to 1900, inclusive, the discharge curve above 30 feet gage-height is not well determined. The discharges above 30 feet gage-height are, therefore, approximate for those years. The first discharge measurement was made in 1895. The computed discharges for 1889 to 1892, inclusive, are from measurements made during the years 1895 to 1899. The bed of the stream is believed to have changed but little from 1889 to 1899.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1889. | | | | | | |
| January | 41,250 | 3,570 | 17,373 | 3.87 | 4.46 | 6.11 |
| February | 53,250 | 4,500 | 17,244 | 3.84 | 4.00 | 3.94 |
| March | 14,660 | 2,000 | 5,441 | 1.21 | 1.39 | 2.99 |
| April | 13,610 | 1,910 | 5,395 | 1.20 | 1.34 | 3.69 |
| May | 6,580 | 1,042 | 1,978 | .44 | .51 | 4.85 |
| June | 46,050 | 1,910 | 7,082 | 1.58 | 1.76 | 4.27 |
| July | 58,150 | 2,805 | 20,784 | 4.63 | 5.33 | 10.38 |
| August | 56,150 | 2,385 | 15,881 | 3.53 | 4.07 | 6.60 |
| September | 8,180 | 2,135 | 3,452 | .77 | .85 | 3.20 |
| October | 18,910 | 1,108 | 3,348 | .75 | .86 | 3.36 |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*—Continued.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1889. | | | | | | |
| November | 29,350 | 2,695 | 7,834 | 1.74 | 1.94 | 4.31 |
| December | 8,180 | 1,515 | 2,451 | .54 | .63 | .59 |
| The year | 58,150 | 1,108 | 9,022 | 2.01 | 27.14 | 54.29 |
| 1890. | | | | | | |
| January | 3,245 | 1,515 | 1,921 | 0.43 | 0.49 | 1.93 |
| February | 13,610 | 1,730 | 5,073 | 1.13 | 1.16 | 3.77 |
| March | 16,970 | 3,050 | 7,381 | 1.64 | 1.89 | 2.71 |
| April | 8,580 | 2,485 | 3,948 | .88 | .98 | 2.20 |
| May | 8,660 | 1,275 | 3,666 | .82 | .94 | 4.93 |
| June | 5,780 | 1,075 | 2,435 | .54 | .62 | 3.51 |
| July | 13,610 | 550 | 2,763 | .62 | .71 | 6.08 |
| August | 18,360 | 1,820 | 7,898 | 1.77 | 2.04 | 3.18 |
| September | 26,190 | 1,475 | 5,397 | 1.20 | 1.34 | 5.34 |
| October | 16,550 | 1,275 | 3,775 | .84 | .97 | 5.31 |
| November | 4,350 | 1,555 | 3,125 | .70 | .78 | .22 |
| December | 13,820 | 1,730 | 4,368 | .97 | 1.12 | 4.15 |
| The year | 26,190 | 550 | 4,312 | .96 | 13.04 | 43.33 |
| 1891. | | | | | | |
| January | 14,870 | 2,920 | 6,994 | 1.56 | 1.79 | 5.13 |
| February | 44,030 | 3,570 | 10,419 | 2.32 | 2.41 | 5.12 |
| March | 48,450 | 5,140 | 14,955 | 3.33 | 3.84 | 7.89 |
| April | 13,610 | 2,585 | 6,595 | 1.47 | 1.64 | 2.50 |
| May | 58,400 | 1,775 | 9,274 | 2.06 | 2.38 | 7.86 |
| June | 28,270 | 1,515 | 5,839 | 1.29 | 1.43 | 3.43 |
| July | 9,060 | 1,775 | 3,925 | .87 | 1.00 | 7.31 |
| August | 53,490 | 1,955 | 15,851 | 3.53 | 4.07 | 9.13 |
| September | 20,236 | 1,730 | 4,864 | 1.08 | 1.21 | 1.36 |
| October | 4,350 | 1,315 | 2,301 | .51 | .59 | 1.93 |
| November | 5,140 | 1,174 | 1,660 | .37 | .41 | 2.98 |
| December | 7,460 | 2,695 | 3,501 | .78 | .90 | 1.84 |
| The year | 58,400 | 1,174 | 7,181 | 1.60 | 21.67 | 56.48 |
| 1892. | | | | | | |
| January | 69,700 | 2,920 | 14,162 | 3.15 | 3.63 | 6.28 |
| February | 18,470 | 2,920 | 4,676 | 1.04 | 1.12 | 3.20 |
| March | 20,362 | 2,805 | 5,881 | 1.31 | 1.51 | 2.93 |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*—Continued.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1892. | | | | | | |
| April | 34,090 | 3,440 | 8,090 | 1.80 | 2.01 | 2.56 |
| May | 8,500 | 2,885 | 3,437 | .76 | .88 | 4.05 |
| June | 13,610 | 1,865 | 5,506 | 1.23 | 1.37 | 5.90 |
| July | 11,010 | 1,475 | 5,336 | 1.19 | 1.37 | 5.75 |
| August | 2,285 | 440 | 1,410 | .31 | .36 | 2.95 |
| September | 3,180 | 464 | 1,294 | .29 | .32 | 2.33 |
| October | 976 | 440 | 604 | .13 | .15 | .46 |
| November | 3,245 | 440 | 1,413 | .31 | .35 | 3.60 |
| December | 8,500 | 700 | 2,054 | .46 | .53 | 2.95 |
| The year | 69,700 | 440 | 4,488 | 1.00 | 13.60 | 42.96 |
| 1893. | | | | | | |
| January | 16,461 | 1,145 | 3,865 | 0.86 | 0.99 | 2.81 |
| February | 41,873 | 3,010 | 18,596 | 4.14 | 4.31 | 6.11 |
| March | 12,453 | 2,264 | 4,356 | .97 | 1.12 | 1.48 |
| April | 3,334 | 1,517 | 2,211 | .49 | .55 | 2.03 |
| May | 27,137 | 1,145 | 3,046 | .68 | .78 | 5.31 |
| June | 16,627 | 1,367 | 3,619 | .80 | .89 | 5.38 |
| July | 2,470 | 519 | 1,063 | .24 | .28 | 3.13 |
| August | 19,587 | 550 | 2,798 | .62 | .71 | 7.52 |
| September | 37,390 | 1,417 | 9,341 | 2.08 | 2.32 | 5.81 |
| October | 41,467 | 1,417 | 8,454 | 1.88 | 2.17 | 6.56 |
| November | 6,613 | 1,890 | 2,692 | .60 | .67 | 1.70 |
| December | 19,723 | 2,578 | 5,750 | 1.28 | 1.48 | 2.93 |
| The year | 41,873 | 519 | 5,483 | 1.22 | 16.27 | 50.77 |
| 1894. | | | | | | |
| January | 21,082 | 2,740 | 6,911 | 1.54 | 1.78 | 4.03 |
| February | 22,441 | 3,766 | 7,820 | 1.74 | 1.81 | 3.67 |
| March | 22,712 | 2,686 | 5,973 | 1.33 | 1.53 | 1.51 |
| April | 4,102 | 1,367 | 2,207 | .49 | .55 | 1.61 |
| May | 5,245 | 1,229 | 2,418 | .54 | .62 | 4.48 |
| June | 3,384 | 489 | 1,006 | .22 | .25 | 2.33 |
| July | 7,393 | 678 | 1,911 | .43 | .48 | 6.34 |
| August | 31,137 | 1,417 | 7,193 | 1.60 | 1.84 | 5.50 |
| September | 9,099 | 612 | 2,330 | .55 | .61 | 5.69 |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*—Continued.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1894. | | | | | | |
| October | 49,485 | 2,318 | 9,770 | 1.95 | 2.25 | 6.76 |
| November | 11,569 | 1,940 | 3,779 | .83 | .92 | 1.75 |
| December | 9,967 | 1,674 | 3,386 | .75 | .86 | 2.85 |
| The year | 49,485 | 489 | 4,559 | 1.00 | 13.40 | 46.53 |
| 1895. | | | | | | |
| January | 90,650 | 2,632 | 18,334 | 4.08 | 4.70 | 7.36 |
| February | 22,441 | 4,214 | 9,299 | 2.07 | 2.15 | 2.38 |
| March | 40,108 | 4,550 | 13,867 | 3.09 | 3.56 | 5.71 |
| April | 49,213 | 3,990 | 15,646 | 3.48 | 3.89 | 9.21 |
| May | 44,728 | 3,280 | 5,500 | 1.22 | 1.41 | 3.64 |
| June | 6,193 | 1,620 | 2,912 | .65 | .72 | 4.08 |
| July | 12,928 | 1,728 | 3,833 | .85 | .98 | 5.66 |
| August | 11,840 | 1,187 | 3,439 | .76 | .87 | 5.29 |
| September | 2,156 | 581 | 1,232 | .27 | .30 | .62 |
| October | 810 | 399 | 608 | .14 | .16 | 1.70 |
| November | 4,270 | 1,075 | 1,833 | .41 | .46 | 3.26 |
| December | 10,029 | 1,008 | 2,737 | .61 | .70 | 3.88 |
| The year | 90,650 | 399 | 6,603 | 1.48 | 19.90 | 52.79 |
| 1896. | | | | | | |
| January | 19,723 | 1,620 | 6,273 | 1.40 | 1.61 | 2.78 |
| February | 49,621 | 2,956 | 14,436 | 3.21 | 3.46 | 6.63 |
| March | 5,477 | 2,318 | 3,498 | .78 | .90 | 2.27 |
| April | 14,287 | 1,367 | 3,216 | .72 | .80 | 1.62 |
| May | 6,553 | 843 | 2,774 | .62 | .71 | 4.88 |
| June | 11,569 | 1,041 | 3,593 | .80 | .89 | 6.94 |
| July | 52,340 | 1,319 | 10,827 | 2.41 | 2.78 | 7.11 |
| August | 1,782 | 612 | 1,116 | .25 | .29 | 1.67 |
| September | 4,616 | 430 | 1,435 | .32 | .36 | 7.59 |
| October | 26,458 | 843 | 3,210 | .71 | .82 | 1.42 |
| November | 10,339 | 975 | 2,435 | .54 | .60 | 4.03 |
| December | 8,113 | 1,940 | 4,058 | .90 | 1.04 | 2.14 |
| The year | 52,340 | 430 | 4,739 | 1.06 | 14.26 | 49.08 |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*—Continued.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1897. | | | | | | |
| January | 17,688 | 1,580 | 3,694 | 0.82 | 0.94 | 2.29 |
| February | 33,688 | 2,255 | 12,802 | 2.85 | 2.97 | 5.23 |
| March | 35,708 | 3,100 | 12,233 | 2.72 | 3.14 | 4.79 |
| April | 22,788 | 1,760 | 6,871 | 1.53 | 1.71 | 3.46 |
| May | 9,760 | 1,580 | 3,191 | .71 | .82 | 4.58 |
| June | 3,860 | 750 | 1,833 | .41 | .46 | 3.34 |
| July | 18,708 | 780 | 3,180 | .71 | .82 | 6.63 |
| August | 2,900 | 875 | 1,570 | .35 | .40 | 3.74 |
| September | 1,850 | 360 | 664 | .15 | .17 | 1.68 |
| October | 875 | 340 | 517 | .12 | .14 | 2.25 |
| November | 4,520 | 630 | 1,281 | .29 | .32 | 3.82 |
| December | 4,700 | 1,180 | 2,165 | .48 | .55 | 2.56 |
| The year | 35,708 | 340 | 4,166 | .93 | 12.44 | 44.37 |
| 1898. | | | | | | |
| January | 7,333 | 1,319 | 2,126 | 0.47 | 0.54 | 2.00 |
| February | 2,740 | 1,145 | 1,735 | .39 | .41 | .92 |
| March | 12,249 | 1,273 | 3,303 | .74 | .85 | 4.38 |
| April | 13,608 | 1,620 | 4,395 | .98 | 1.09 | 3.38 |
| May | 6,133 | 1,145 | 2,369 | .53 | .61 | 3.68 |
| June | 3,280 | 519 | 1,181 | .26 | .29 | 2.92 |
| July | 8,665 | 489 | 2,793 | .62 | .71 | 5.68 |
| August | 24,072 | 910 | 5,655 | 1.26 | 1.45 | 7.80 |
| September | 10,277 | 876 | 3,674 | .82 | .91 | 3.79 |
| October | 4,955 | 612 | 1,739 | .39 | .45 | 4.30 |
| November | 7,333 | 1,417 | 2,982 | .66 | .73 | 3.16 |
| December | 9,781 | 1,994 | 3,387 | .75 | .86 | 2.17 |
| The year | 24,072 | 489 | 2,945 | .66 | 8.90 | 44.18 |
| 1899. | | | | | | |
| January | 16,462 | 1,940 | 5,116 | 1.14 | 1.31 | 4.02 |
| February | 69,200 | 4,955 | 25,842 | 5.75 | 5.98 | 8.31 |
| March | 48,200 | 4,214 | 17,042 | 3.79 | 4.31 | 6.85 |
| April | 34,600 | 3,064 | 8,408 | 1.87 | 2.09 | 3.17 |
| May | 9,347 | 1,782 | 3,706 | .82 | .85 | 4.01 |
| June | 5,593 | 984 | 2,280 | .51 | .57 | 3.37 |
| July | 6,613 | 910 | 2,481 | .55 | .63 | 6.79 |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*—Continued.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1899. | | | | | | |
| August | 5,833 | 645 | 1,947 | 0.43 | 0.44 | 2.14 |
| September | 2,578 | 612 | 1,133 | .25 | .28 | 3.58 |
| October | 9,161 | 612 | 2,132 | .47 | .54 | 4.65 |
| November | 13,482 | 1,319 | 3,151 | .70 | .78 | 1.89 |
| December | 7,333 | 1,674 | 2,992 | .67 | .77 | 3.24 |
| The year | 69,200 | 612 | 6,352 | 1.41 | 18.65 | 52.02 |
| 1900. | | | | | | |
| January | 13,336 | 1,620 | 4,001 | 0.89 | 1.03 | 2.47 |
| February | 35,600 | 1,890 | 10,058 | 2.24 | 2.33 | 5.20 |
| March | 31,060 | 3,280 | 8,649 | 1.92 | 2.21 | 4.53 |
| April | 52,400 | 2,524 | 11,848 | 2.64 | 2.94 | 4.68 |
| May | 9,781 | 1,467 | 2,969 | .66 | .76 | 3.04 |
| June | 9,409 | 984 | 2,688 | .60 | .67 | 5.50 |
| July | 6,133 | 459 | 1,472 | .33 | .38 | 3.49 |
| August | 1,940 | 350 | 736 | .16 | .18 | 3.00 |
| September | 5,187 | 310 | 1,010 | .22 | .25 | 2.74 |
| October | 1,145 | 375 | 526 | .12 | .14 | 2.18 |
| November | 6,433 | 350 | 1,258 | .28 | .31 | 3.77 |
| December | 8,541 | 843 | 2,816 | .63 | .73 | 4.20 |
| The year | 52,400 | 310 | 4,003 | .89 | 11.93 | 44.80 |
| 1901. | | | | | | |
| January | 7,120 | 1,600 | 3,048 | 0.68 | 0.78 | 2.47 |
| February | 4,850 | 1,560 | 2,659 | .59 | .61 | 1.68 |
| March | 28,050 | 1,200 | 4,209 | .94 | 1.08 | 3.88 |
| April | 49,065 | 2,440 | 9,624 | 2.14 | 2.39 | 5.34 |
| May | 71,625 | 1,560 | 11,502 | 2.56 | 2.95 | 8.75 |
| June | 11,800 | 1,760 | 4,352 | .97 | 1.08 | 5.68 |
| July | 37,675 | 1,520 | 8,072 | 1.80 | 2.08 | 8.11 |
| August | 43,450 | 1,440 | 13,965 | 3.11 | 3.59 | 11.85 |
| September | 41,350 | 1,600 | 7,296 | 1.62 | 1.81 | 5.47 |
| October | 4,450 | 1,400 | 2,342 | .52 | .60 | 1.13 |
| November | 2,440 | 1,400 | 1,555 | .35 | .39 | 1.34 |
| December | 27,200 | 1,440 | 3,828 | .85 | .98 | 5.18 |
| The year | 71,625 | 1,200 | 6,038 | 1.34 | 18.34 | 60.88 |

*Estimated monthly discharge of Cape Fear River at Fayetteville, N. C.*—Continued.

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | Inches. |
| 1902. | | | | | | |
| January | 27,200 | 2,180 | 5,353 | 1.19 | 1.37 | 2.35 |
| February | 35,575 | 2,872 | 11,746 | 2.61 | 2.72 | 5.73 |
| March | 37,825 | 3,048 | 9,612 | 2.14 | 2.47 | 3.16 |
| April | 7,890 | 2,140 | 3,695 | .82 | .91 | 3.18 |
| May | 2,960 | 1,540 | 2,159 | .48 | .55 | 2.63 |
| June | 3,400 | 870 | 1,466 | .33 | .37 | 3.46 |
| July | 1,860 | 600 | 965 | .21 | .24 | 2.88 |
| August | 1,460 | 660 | 961 | .21 | .24 | 3.59 |
| September | 3,700 | 450 | 1,074 | .24 | .27 | 5.24 |
| October | 3,400 | 780 | 1,633 | .36 | .42 | 3.26 |
| November | 4,400 | 810 | 1,540 | .34 | .38 | 3.64 |
| December | 10,890 | 2,220 | 4,956 | 1.10 | 1.27 | 3.67 |
| The year | 37,825 | 450 | 3,763 | .84 | 11.21 | 42.79 |

## ROCKFISH CREEK NEAR BRUNT, N. C.

This station was established on October 29, 1902, by B. S. Drane. The course of the creek is straight here for about 500 yards, Lower Rockfish Bridge crossing the creek near the middle of this straight stretch. The left side of the stream is shallow, most of the current flowing along the right bank. The banks of the creek, of sand, rise steeply on either side to a height of about 50 feet.

The gage rod is of pine, 12 feet long, well painted, and divided into tenths and half-tenths of a foot. It is firmly nailed on the outside of the downstream hand rail, between the two large posts, approximately over the center of the bridge. The distance from the zero of the gage to the outer rim of the pulley is 1 foot. The length of the wire, from the end of the weight to the pointer, is 51.80 feet. The gage reads zero when the weight touches the bottom.

The observer is C. L. Nunalee, a farmer and storekeeper; his post-office address is Brunt, N. C.

The station is reached by driving from Fayetteville, N. C., a distance of 7 miles.

The following discharge measurements were made during 1902 by B. S. Drane.

September 6: Rockfish Creek discharge, 318 second-feet.
September 6: Big Rockfish Creek discharge, 126 second-feet.
September 6: Little Rockfish Creek discharge, 161 second-feet.
October 16: Rockfish Creek discharge, 440 second-feet.

*Daily gage height, in feet, of Rockfish Creek near Brunt, N. C.*

| Day. | Oct. | Nov. | Dec. | Day. | Oct. | Nov. | Dec. | Day. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | 1902. | | | | 1902. | | | |
| 1 | ..... | 3.65 | 5.26 | 12 | ..... | 3.57 | 3.67 | 23 | ..... | 3.41 | 6.97 |
| 2 | ..... | 3.45 | (a) | 13 | ..... | 3.71 | 4.50 | 24 | ..... | 3.47 | 7.47 |
| 3 | ..... | 3.80 | ..... | 14 | ..... | 3.51 | 7.77 | 25 | ..... | 3.57 | 5.10 |
| 4 | ..... | 3.70 | ..... | 15 | ..... | 3.53 | 7.75 | 26 | ..... | 3.97 | 3.75 |
| 5 | ..... | 3.80 | ..... | 16 | ..... | 3.52 | 5.56 | 27 | ..... | 4.45 | 3.67 |
| 6 | ..... | 2.83 | 9.67 | 17 | ..... | 3.40 | 3.92 | 28 | ..... | 4.64 | 3.92 |
| 7 | ..... | 4.01 | 7.87 | 18 | ..... | 3.57 | 4.12 | 29 | ..... | 4.77 | 3.48 |
| 8 | ..... | 4.26 | 4.90 | 19 | ..... | 3.90 | 4.65 | 30 | 3.70 | 3.70 | 3.78 |
| 9 | ..... | 4.03 | 4.02 | 20 | ..... | 3.86 | 3.97 | 31 | 3.67 | ..... | 4.20 |
| 10 | ..... | 4.20 | 3.90 | 21 | ..... | 3.78 | 4.12 | | | | |
| 11 | ..... | 3.72 | 4.17 | 22 | ..... | 3.67 | 4.52 | | | | |

a Water over gage.

## DEEP RIVER AT CUMNOCK, N. C.

This station was established on June 29, 1900, by E. W. Myers. It is 300 yards northwest of the railroad station at Cumnock. The wire gage, which is graduated to feet and tenths, is nailed to the guard rail of the bridge. When the gage reads 3 feet the water surface is 37.41 feet below the top of the lower chord at the side of the tension rod supporting the floor beam opposite the gage. The initial point of sounding is at the northwest end of the bridge. The channel is straight for several hundred feet above and below the bridge, but the current is rather sluggish during low water. The bed of the stream is muddy, with some bowlders. The observer is J. A. Rollins, a watchman at Cumnock. The station was discontinued in June, 1902.

The following discharge measurements were made during 1902 by B. S. Drane:

July 11: Gage height, 1.91 feet; discharge, 224 second-feet.
August 18: Gage height, 1.81 feet; discharge, 228 second-feet.

*Daily gage height, in feet, of Deep River at Cumnock, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | Day. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | 1902. | | | | | | |
| 1 | 18.54 | 11.01 | 14.60 | 1.54 | 1.86 | 2.88 | 17 | 1.42 | 2.94 | 2.34 | 2.38 | 1.92 | 2.14 |
| 2 | 14.65 | 18.81 | 16.97 | 1.55 | 1.93 | 2.86 | 18 | 1.40 | 3.70 | 2.31 | 2.33 | 1.97 | 2.19 |
| 3 | 11.08 | 22.02 | 16.01 | 1.51 | 1.98 | 2.80 | 19 | 6.87 | 3.96 | 2.26 | 2.28 | 2.06 | 2.24 |
| 4 | 8.90 | 19.92 | 14.86 | 1.48 | 1.97 | 2.76 | 20 | 5.34 | 4.06 | 2.20 | 2.22 | 2.19 | 2.19 |
| 5 | 7.28 | 17.62 | 13.55 | 1.45 | 1.93 | 2.60 | 21 | 4.32 | 4.43 | 2.17 | 2.19 | 2.24 | 2.15 |
| 6 | 5.48 | 15.05 | 10.63 | 1.43 | 1.92 | 2.47 | 22 | 3.29 | 6.68 | 2.08 | 2.15 | 2.28 | 2.10 |
| 7 | 4.33 | 9.68 | 6.65 | 2.57 | 1.88 | 2.41 | 23 | 2.25 | 9.42 | 1.81 | 2.09 | 2.32 | 2.05 |
| 8 | 3.02 | 6.50 | 4.72 | 2.65 | 1.85 | 2.33 | 24 | 2.44 | 11.26 | 1.75 | 2.02 | 2.36 | 2.02 |
| 9 | 2.69 | 4.26 | 3.88 | 2.73 | 1.82 | 2.23 | 25 | 2.60 | 11.89 | 1.71 | 1.96 | 2.40 | 1.97 |
| 10 | 1.91 | 3.56 | 3.67 | 2.84 | 1.80 | 2.18 | 26 | 2.66 | 12.47 | 1.68 | 1.92 | 2.42 | 1.86 |
| 11 | 1.73 | 2.89 | 3.38 | 2.88 | 1.77 | 2.17 | 27 | 3.38 | 14.34 | 1.65 | 1.86 | 2.51 | 1.85 |
| 12 | 1.65 | 2.56 | 3.20 | 2.60 | 1.76 | 2.14 | 28 | 3.79 | 15.48 | 1.64 | 1.85 | 2.77 | 1.90 |
| 13 | 1.57 | 2.18 | 3.11 | 2.54 | 1.74 | 2.13 | 29 | 3.94 | ..... | 1.62 | 1.82 | 2.80 | ..... |
| 14 | 1.50 | 1.96 | 2.90 | 2.50 | 1.71 | 2.11 | 30 | 4.37 | ..... | 1.62 | 1.81 | 2.83 | ..... |
| 15 | 1.45 | 2.07 | 2.63 | 2.53 | 1.76 | 2.08 | 31 | 4.77 | ..... | 1.60 | ..... | 2.87 | ..... |
| 16 | 1.46 | 2.42 | 2.65 | 2.46 | 1.86 | 2.06 | | | | | | | |

*Rating table for Deep River at Cumnock, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.8 | 70 | 4.0 | 860 | 7.2 | 2,950 | 14.0 | 8,475 |
| 1.0 | 80 | 4.2 | 940 | 7.4 | 3,110 | 14.5 | 8,888 |
| 1.2 | 100 | 4.4 | 1,020 | 7.6 | 3,270 | 15.0 | 9,300 |
| 1.4 | 126 | 4.6 | 1,100 | 7.8 | 3,430 | 15.5 | 9,712 |
| 1.6 | 160 | 4.8 | 1,200 | 8.0 | 3,590 | 16.0 | 10,125 |
| 1.8 | 203 | 5.0 | 1,300 | 8.5 | 3,990 | 16.5 | 10,538 |
| 2.0 | 250 | 5.2 | 1,420 | 9.0 | 4,390 | 17.0 | 10,950 |
| 2.2 | 298 | 5.4 | 1,540 | 9.5 | 4,790 | 17.5 | 11,375 |
| 2.4 | 346 | 5.6 | 1,680 | 10.0 | 5,190 | 18.0 | 11,800 |
| 2.6 | 394 | 5.8 | 1,830 | 10.5 | 5,595 | 19.0 | 12,650 |
| 2.8 | 442 | 6.0 | 1,990 | 11.0 | 6,000 | 20.0 | 13,500 |
| 3.0 | 490 | 6.2 | 2,150 | 11.5 | 6,413 | 25.0 | 17,750 |
| 3.2 | 550 | 6.4 | 2,310 | 12.0 | 6,825 | 30.0 | 22,000 |
| 3.4 | 620 | 6.6 | 2,470 | 12.5 | 7,237 | 35.0 | 26,250 |
| 3.6 | 700 | 6.8 | 2,630 | 13.0 | 7,650 | | |
| 3.8 | 780 | 7.0 | 2,790 | 13.5 | 8,063 | | |

*Estimated monthly discharge of Deep River at Cumnock, N. C.*

[Drainage area, 1,110 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 12,268 | 126 | 1,653 | 1.49 | 1.72 |
| February | 15,200 | 238 | 4,597 | 4.14 | 4.31 |
| March | 10,908 | 160 | 2,058 | 1.85 | 2.13 |
| April | 466 | 134 | 286 | .26 | .29 |
| May | 454 | 181 | 276 | .25 | .29 |
| June 1 to 28 | 466 | 214 | [a]309 | [a].28 | [a].29 |

[a] Partial month; station discontinued.

MISCELLANEOUS MEASUREMENTS IN CAPE FEAR RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in the Cape Fear River drainage basin during 1902:

| Date. | Place. | Gage height. | Discharge. |
|---|---|---|---|
| | | *Feet.* | *Second-feet.* |
| Oct. 1 | Lower Little River, near Manchester, N. C. | 19.57 | 491 |
| Oct. 2 | do | 19.85 | 410 |

PRECIPITATION OVER THE DRAINAGE BASIN OF CAPE FEAR RIVER.

The precipitation over the area drained by Cape Fear River is comparatively large. For the period covered by the records given herewith it is 50.34 inches per annum, on an average, distributed approximately through the seasons as follows: Spring, 12.5 inches; summer, 16.1 inches; autumn, 10.2 inches; winter, 11.5 inches. This distribution is not very conducive to a large run-off, since the greatest precipitation occurs in the spring and summer, when the amounts lost by evaporation and by the demands of plant life are greatest; nor is it conducive to great regularity of flow.

While the table showing the average annual precipitation over the basin indicates that there may be a considerable range in this quantity, the actual variations are in all probability greater than are there indicated, since the table unavoidably covers only a period when most of the years were of less than normal rainfall. In several of these years there were periods of drought more severe than had ever been

experienced before on the basin, as is evidenced by the fact that many wells which had never before been known to fail became totally dry during these times.

The records at the Fayetteville station are probably more complete in certain respects than those at any other station in the basin. At this place the total range in precipitation has been between 102 and 37 inches. An approximately equal range will probably be found to obtain at all the other stations in the basin, when the records have been continued long enough to obtain the extremes; though it is very improbable that the range of precipitation over the basin as a whole will ever reach this amount.

The following table gives a list and the location of the rainfall stations in the drainage basin of Cape Fear River, and these are also indicated on the accompanying map of the area (see fig. 3).

*Location of rainfall stations in basin of Cape Fear River.*

| Station. | County. | State. | Latitude. | | Longitude. | | Elevation. |
|---|---|---|---|---|---|---|---|
| | | | ° | ′ | ° | ′ | *Feet.* |
| Fayetteville | Cumberland | North Carolina | 35 | 6 | 78 | 53 | 170 |
| Southern Pines | Moore | do | 35 | 13 | 79 | 22 | 400 |
| Moncure | Chatham | do | 35 | 39 | 79 | 00 | 300 |
| Pittsboro | do | do | 35 | 42 | 79 | 12 | 480 |
| Chapel Hill | Orange | do | 35 | 54 | 79 | 4 | 500 |
| Soapstone Mountain | Randolph | do | 35 | 46 | 79 | 37 | 900 |
| Greensboro | Guilford | do | 36 | 4 | 79 | 49 | 843 |
| Oak Ridge | do | do | 36 | 10 | 80 | 00 | 885 |

The eight following tables give for each precipitation station for the years 1889 to 1902, so far as covered by the observations, the monthly precipitation, the yearly total, and the mean monthly and yearly precipitation.

The next table, on page 56, gives for the entire drainage area the monthly and yearly precipitation for each year from 1889 to 1902, inclusive, and the mean monthly and yearly precipitation for the entire period. This table is based upon the eight preceding tables.

The next table, on page 57, gives a comparison for the years 1889 to 1902, inclusive, between the mean yearly run-off from the drainage area as determined by the observations at Cape Fear River station at Fayetteville, and the mean yearly precipitation as determined from the eight stations in the preceding tables.

The quantities in all the tables are given in inches.

The next table, on page 58, shows the relation of run-off, rainfall, and temperature.

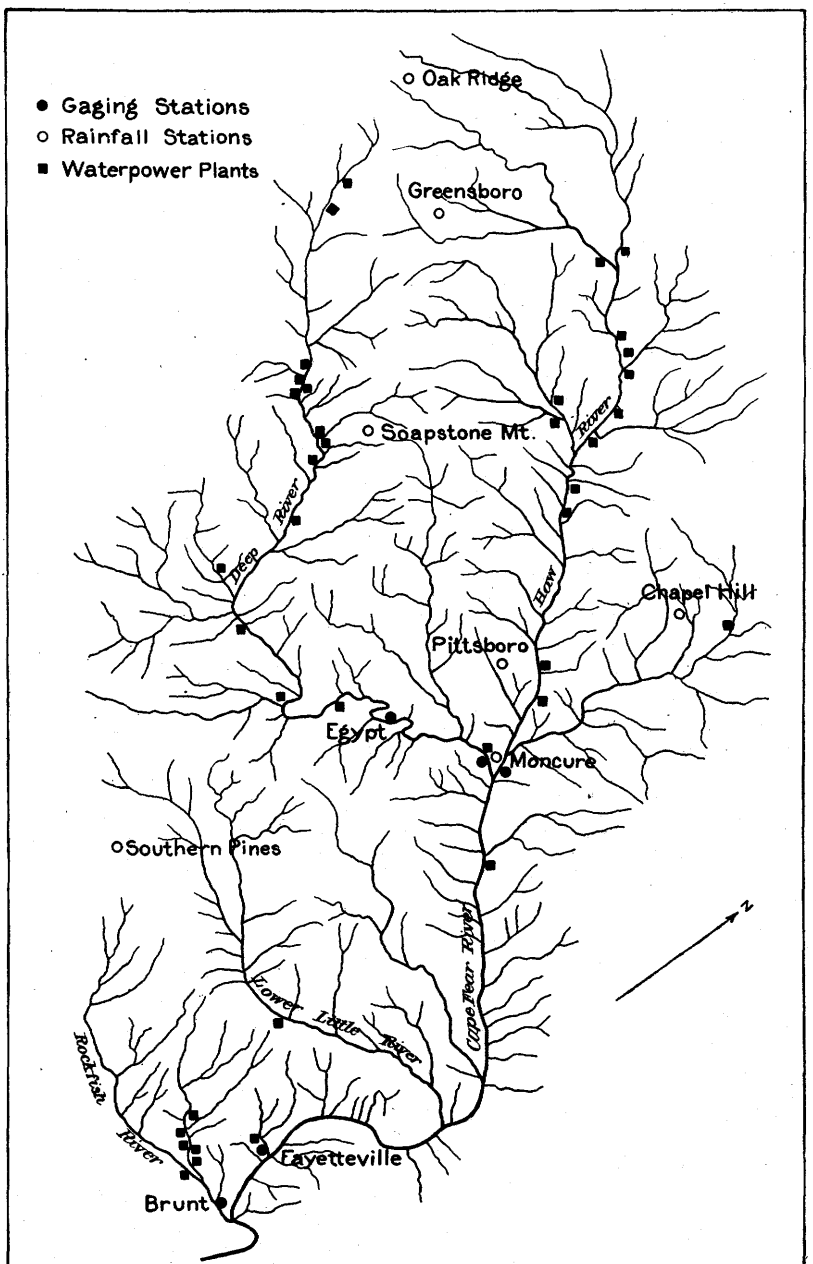


FIG. 3.—Drainage basin of Cape Fear River, showing gaging stations, rainfall stations, and water-power plants.

*Precipitation, in inches, at Fayetteville, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1891 | 4.50 | 3.80 | 7.84 | 2.74 | 4.56 | 3.15 | 6.05 | 9.57 | 1.84 | 4.51 | 2.52 | 2.04 | 53.12 |
| 1892 | 7.57 | 2.99 | 3.04 | 1.99 | 4.79 | 3.75 | 10.32 | 4.64 | 2.44 | .34 | 2.12 | 3.57 | 47.56 |
| 1893 | 3.15 | 4.60 | 2.08 | 1.63 | 7.67 | 5.77 | 3.39 | 7.36 | 5.10 | 4.73 | 2.39 | 3.44 | 51.31 |
| 1894 | 4.58 | 3.47 | 2.10 | 1.30 | 5.31 | 2.12 | 4.26 | 13.45 | 6.68 | 9.16 | 1.51 | 1.84 | 55.78 |
| 1895 | 7.67 | 2.41 | 6.07 | 9.21 | 4.12 | 1.89 | 5.61 | 6.56 | 2.47 | 2.50 | 2.21 | 2.30 | 53.02 |
| 1896 | 3.98 | 5.52 | 2.13 | 1.15 | 8.06 | 7.15 | 5.52 | 1.74 | 9.01 | 1.36 | 2.51 | 3.45 | 51.58 |
| 1897 | 1.31 | 3.63 | 4.05 | 2.77 | 5.88 | 2.94 | 11.11 | 5.41 | 1.42 | 2.17 | 3.43 | 2.13 | 46.25 |
| 1898 | 2.19 | 1.02 | 2.93 | 4.75 | 1.59 | 5.53 | 5.97 | 7.46 | 2.43 | 2.70 | 4.95 | 2.86 | 44.38 |
| 1899 | 3.60 | 10.10 | 5.32 | 3.40 | 2.35 | 4.03 | 8.35 | 3.76 | 5.29 | 3.81 | 1.90 | 2.76 | 54.67 |
| 1900 | 1.86 | 3.75 | 3.52 | 3.51 | 2.53 | 6.47 | 2.56 | 1.26 | 2.77 | 1.26 | 3.52 | 4.89 | 37.90 |
| 1901 | 2.62 | 1.91 | 3.78 | 3.46 | 7.98 | 4.31 | 7.81 | 7.80 | 5.47 | 1.21 | .73 | 5.34 | 52.42 |
| 1902 | 2.20 | 6.18 | 2.44 | 2.75 | 1.84 | 2.37 | 2.50 | 2.80 | 5.24 | 2.00 | 3.28 | 3.78 | 37.38 |
| Normals | 5.21 | 4.31 | 5.30 | 4.36 | 4.71 | 4.18 | 8.09 | 6.77 | 5.20 | 4.45 | 3.30 | 5.25 | 61.13 |

NOTE.—Observations have been made here for a much longer period than is given above. The normals, as given, are from the entire series of records.

*Precipitation, in inches, at Southern Pines, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | 5.50 | 3.65 | 3.65 | 5.56 | 5.00 | 3.90 | 9.00 | 8.50 | 2.50 | 4.00 | 4.20 | 1.00 | 56.46 |
| 1890 | No record. | | | | | | | | | | | | |
| 1891 | 3.70 | 5.70 | 7.18 | 1.26 | 11.08 | 3.70 | 7.32 | 10.58 | .68 | 2.11 | 2.86 | 1.26 | 57.43 |
| 1892 | 7.01 | 3.20 | 3.35 | 3.62 | 5.27 | 4.96 | 10.83 | 5.05 | 1.78 | .34 | 2.80 | 4.05 | 52.26 |
| 1893 | 2.75 | 7.10 | 1.70 | 2.10 | 3.90 | 7.10 | 7.06 | 5.12 | 3.71 | 5.81 | 1.40 | 5.84 | 53.59 |
| 1894 | 3.33 | 2.74 | 1.44 | 1.90 | 2.94 | 2.85 | 10.48 | 7.13 | 5.75 | 6.97 | 1.07 | 2.40 | 49.00 |
| 1895 | 7.60 | 2.39 | 8.78 | 6.83 | 2.07 | 4.79 | 4.93 | 5.99 | .11 | 1.87 | .55 | 3.54 | 49.45 |
| 1896 | 3.02 | [4.62] | .90 | .50 | 3.40 | [4.65] | 7.90 | [6.44] | 5.00 | 2.10 | 4.89 | 2.98 | 46.40 |
| 1897 | 1.39 | 6.79 | 4.50 | 4.07 | 2.52 | 4.83 | 7.96 | 4.01 | .83 | 1.87 | 3.25 | 1.68 | 43.70 |
| 1898 | 1.89 | 1.37 | 3.77 | 4.39 | 3.12 | 3.52 | 8.46 | 7.44 | 2.88 | 5.62 | 4.15 | 1.82 | 48.43 |
| 1899 | 3.79 | 9.33 | 6.93 | 3.97 | 3.02 | 6.92 | 10.65 | 1.76 | 4.84 | 7.78 | 2.86 | 2.28 | 64.13 |
| 1900 | 1.63 | 5.94 | 4.38 | 4.77 | 3.33 | 5.02 | 2.56 | 3.88 | 1.97 | 1.02 | 4.38 | 5.78 | 44.66 |
| 1901 | 3.17 | 1.81 | 5.35 | 5.73 | 8.88 | 5.59 | 13.23 | 13.43 | 9.59 | .46 | 1.93 | 4.86 | 74.03 |
| 1902 | 3.31 | 5.41 | 2.70 | 3.00 | 2.28 | 2.66 | 4.19 | 4.35 | 5.73 | 2.87 | 4.20 | 3.03 | 43.73 |
| Normals | 3.70 | 4.62 | 4.20 | 3.67 | 4.37 | 4.65 | 8.03 | 6.44 | 3.49 | 3.29 | 2.96 | 3.12 | 52.56 |

*Precipitation, in inches, at Moncure, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1894 | [2.87] | [4.27] | [4.04] | 1.24 | 5.32 | 1.30 | 6.47 | 5.00 | 3.95 | 6.13 | 1.99 | 2.69 | 45.27 |
| 1895 | 8.61 | 2.56 | 5.53 | 10.74 | 2.95 | 4.22 | 5.93 | 6.47 | .41 | 1.93 | 3.25 | 2.78 | 55.38 |
| 1896 | 1.53 | 6.37 | 2.30 | 1.61 | 3.72 | 5.13 | 6.77 | 2.63 | 6.78 | 1.60 | 4.04 | 1.68 | 44.16 |
| 1897 | 1.46 | 4.32 | 4.23 | 2.89 | 3.15 | 3.59 | 3.23 | 2.74 | 2.39 | 1.81 | 3.68 | 2.28 | 35.77 |
| 1898 | 1.75 | 1.00 | 4.98 | 2.90 | 3.81 | 1.35 | 3.81 | 6.94 | 4.09 | 2.68 | 2.53 | 1.33 | 37.17 |
| 1899 | 2.90 | 7.59 | 5.45 | 2.46 | 4.68 | 2.29 | 8.76 | 2.56 | 5.41 | 4.98 | 1.13 | 2.23 | 50.44 |
| 1900 | 1.75 | 3.85 | 3.94 | 4.43 | 2.42 | 6.74 | 2.27 | 3.64 | 2.21 | 1.35 | 3.35 | 3.95 | 39.90 |
| 1901 | 2.30 | 1.49 | 3.47 | 5.30 | 9.53 | 4.80 | 7.71 | 11.65 | 5.78 | 1.01 | 1.70 | 4.28 | 59.02 |
| 1902 | 2.65 | 6.98 | 2.45 | 3.80 | 2.37 | 3.11 | 2.97 | 2.26 | 4.83 | 2.45 | 2.79 | 4.84 | 41.50 |
| Normals | 2.87 | 4.27 | 4.04 | 3.93 | 4.22 | 3.62 | 5.32 | 4.88 | 3.98 | 2.66 | 2.72 | 2.90 | 45.40 |

*Precipitation, in inches, at Pittsboro, N. C.*

| Year. | Jan. | Feb. | Mar, | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | [3.64] | [4.07] | [3.88] | [3.86] | [4.93] | 4.38 | 8.50 | 4.70 | 2.50 | 3.10 | 4.30 | 0.40 | 48.26 |
| 1890 | .62 | 2.50 | 2.41 | 1.68 | 5.55 | 3.25 | 5.65 | 4.20 | 4.00 | 4.60 | .20 | 3.55 | 38.21 |
| 1891 | 4.30 | 3.80 | 7.00 | 1.70 | 7.00 | 3.60 | 7.10 | 8.80 | .80 | 1.50 | 2.55 | 1.00 | 49.15 |
| 1892 | 5.55 | 2.90 | 2.40 | 2.70 | 4.20 | 4.55 | 4.30 | .92 | .40 | .01 | 2.40 | 3.00 | 33.33 |
| 1893 | 3.75 | 6.16 | 1.05 | 2.45 | 3.15 | 3.35 | 2.03 | 5.10 | 6.06 | 5.70 | 1.32 | 3.40 | 43.52 |
| 1894 | 4.95 | 3.50 | 1.19 | 1.43 | 5.42 | 2.11 | 7.10 | 5.72 | 6.43 | 7.19 | 1.63 | 3.54 | 50.21 |
| 1895 | 9.21 | 1.85 | 4.80 | 13.40 | 2.61 | 7.00 | 5.60 | 5.36 | .70 | 2.35 | 6.57 | 4.10 | 63.55 |
| 1896 | 3.80 | 6.82 | 2.90 | 1.42 | 5.50 | 7.11 | 8.80 | 2.66 | 6.15 | 1.28 | 4.73 | 1.94 | 53.11 |
| 1897 | 4.53 | 5.61 | 5.82 | 3.70 | 5.09 | 4.51 | 6.62 | 3.05 | 3.25 | 2.40 | 3.28 | 2.54 | 50.40 |
| 1898 | 1.77 | .62 | 5.03 | 3.07 | 3.30 | 2.72 | 6.25 | 9.25 | 4.19 | 3.57 | 2.54 | 1.75 | 44.06 |
| 1899 | 3.42 | 7.38 | 6.27 | 3.55 | 4.91 | 2.19 | 7.79 | 4.55 | 3.71 | 6.39 | 1.49 | 1.86 | 53.51 |
| 1900 | 2.38 | 5.99 | 4.56 | 5.75 | 3.79 | 5.98 | 2.17 | 4.99 | 3.67 | 1.64 | 4.40 | 4.30 | 49.62 |
| 1901 | 1.76 | 1.90 | 3.77 | 4.64 | 8.66 | 6.01 | 7.39 | 9.55 | 7.86 | 1.99 | 1.37 | 3.57 | 58.47 |
| 1902 | 1.28 | 3.86 | 3.30 | 4.63 | [4.93] | 2.23 | 3.51 | 3.11 | 6.03 | 2.22 | 3.46 | 2.75 | 41.31 |
| Normals | 3.64 | 4.07 | 3.88 | 3.86 | 4.93 | 4.21 | 5.92 | 5.14 | 3.98 | 3.14 | 2.87 | 2.69 | 48.34 |

*Precipitation, in inches, at Chapel Hill, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | 6.71 | 4.24 | 2.33 | 3.75 | 6.02 | [3.84] | [5.04] | [5.90] | [4.04] | 3.35 | 3.23 | 0.46 | 48.91 |
| 1890 | 2.23 | 3.63 | 3.80 | 1.86 | 4.81 | 3.66 | [5.04] | [5.90] | 4.83 | 5.69 | [3.12] | 3.35 | 47.92 |
| 1891 | 4.59 | 5.70 | 7.75 | 2.13 | 8.75 | 4.61 | 5.40 | 11.71 | 1.38 | 1.58 | 3.12 | 1.47 | 58.19 |
| 1892 | 6.22 | 3.22 | 2.74 | 3.15 | 3.39 | 6.12 | 3.72 | .82 | 1.97 | .27 | 4.35 | 2.77 | 38.74 |
| 1893 | 3.04 | 5.41 | 1.48 | 1.49 | 4.04 | 4.21 | 2.09 | 9.13 | 6.40 | 6.75 | 1.54 | 3.48 | 49.06 |
| 1894 | 4.30 | 3.65 | 1.78 | 2.04 | 4.03 | 1.76 | 5.80 | 6.21 | 7.93 | 6.84 | 1.85 | 2.33 | 48.52 |
| 1895 | 8.90 | 2.33 | 5.12 | 11.42 | 3.99 | 4.60 | 3.19 | 4.46 | .62 | 1.13 | 4.67 | 3.63 | 54.06 |
| 1896 | 3.39 | 6.46 | 2.54 | 2.23 | 6.80 | 5.06 | 8.52 | 1.28 | 8.39 | 1.08 | 3.09 | 2.23 | 51.07 |
| 1897 | 2.66 | 5.66 | 4.52 | 3.31 | 6.98 | 1.69 | 6.68 | 2.74 | 1.15 | 3.32 | 3.77 | 2.72 | 45.20 |
| 1898 | 1.85 | 1.03 | 5.30 | 3.11 | 3.15 | 2.66 | 6.38 | 14.48 | 4.74 | 4.39 | 2.98 | 2.07 | 52.14 |
| 1899 | 3.71 | 7.79 | 6.79 | 3.68 | 4.51 | 2.26 | 4.95 | 1.34 | 2.47 | 5.96 | 2.14 | 2.24 | 47.84 |
| 1900 | 3.23 | 5.08 | 4.99 | 6.09 | 2.62 | 4.45 | 6.38 | 3.61 | 3.40 | 1.10 | 5.00 | 4.31 | 50.26 |
| 1901 | 2.39 | 1.52 | 3.72 | 5.89 | 1.38 | 5.69 | 6.12 | 11.25 | 4.75 | 2.13 | 1.94 | 4.56 | 61.34 |
| 1902 | 2.30 | 6.92 | 2.95 | 3.38 | 2.23 | 3.10 | 1.25 | 3.71 | 4.51 | 3.83 | 2.94 | 4.88 | 42.00 |
| Normals | 3.97 | 4.47 | 3.99 | 3.82 | 5.19 | 3.84 | 5.04 | 5.90 | 4.04 | 3.39 | 3.12 | 2.89 | 49.66 |

*Precipitation, in inches, at Soapstone Mountain, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | [3.51] | [4.72] | [4.61] | [3.53] | [4.55] | 3.75 | 10.00 | 6.25 | 4.12 | 3.00 | 5.50 | 0.50 | 54.04 |
| 1890 | 1.80 | 4.25 | [4.61] | [3.53] | [4.55] | 3.62 | 6.50 | [5.21] | 6.25 | 6.25 | .25 | 6.75 | 53.57 |
| 1891 | 9.62 | 5.80 | 10.50 | 2.70 | 7.50 | 3.25 | 8.00 | 6.88 | 2.00 | .50 | 3.50 | 2.30 | 62.55 |
| 1892 | [3.51] | [4.72] | [4.61] | 2.24 | 4.24 | 6.65 | 2.37 | 5.88 | 3.71 | .99 | 4.51 | 2.31 | 45.74 |
| 1893 | 2.33 | 6.03 | 1.43 | 2.20 | 4.43 | 5.88 | 3.46 | 6.89 | 6.11 | 6.89 | 2.02 | 2.74 | 50.41 |
| 1894 | 3.90 | 4.01 | 1.76 | 1.53 | 2.56 | 1.71 | 4.91 | 2.59 | 5.09 | 7.36 | 2.18 | 3.22 | 40.82 |
| 1895 | 6.19 | 1.81 | 4.86 | 7.49 | 3.08 | 3.54 | 5.20 | 5.54 | .28 | 1.97 | 2.71 | 5.49 | 48.16 |
| 1896 | 2.57 | 6.30 | 2.76 | 1.45 | 5.10 | 5.52 | 10.19 | 1.44 | 8.11 | 1.47 | 4.39 | 1.80 | 51.10 |
| 1897 | 2.93 | 6.65 | 4.90 | 3.61 | 3.87 | 3.61 | 6.88 | 2.84 | 1.31 | 3.14 | 3.99 | 3.11 | 46.84 |
| 1898 | 2.15 | 2.95 | 5.42 | 3.24 | 2.28 | 2.51 | 6.13 | 8.17 | 3.83 | 4.57 | 3.12 | 1.81 | 44.18 |
| 1899 | 3.72 | 7.51 | 6.44 | 3.20 | 4.78 | 2.93 | 3.57 | .65 | 2.67 | 5.79 | 1.85 | 3.38 | 46.49 |
| 1900 | 2.58 | 5.89 | 5.09 | 5.76 | 5.71 | 4.97 | 1.95 | 3.32 | 1.47 | 3.43 | 3.71 | 4.29 | 48.17 |
| 1901 | 2.22 | 1.58 | 4.08 | 6.04 | 7.25 | 5.84 | 7.57 | 14.69 | 4.49 | 1.05 | 1.03 | 6.03 | 61.87 |
| 1902 | 2.11 | 5.80 | 3.42 | 2.90 | 3.80 | 4.34 | 2.12 | 2.53 | 6.61 | 4.23 | 5.15 | 3.70 | 46.71 |
| Normals | 3.51 | 4.72 | 4.61 | 3.53 | 4.55 | 4.15 | 5.63 | 5.21 | 4.00 | 3.62 | 3.14 | 3.39 | 50.05 |

*Precipitation, in inches, at Greensboro, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1892 | [2.78] | [4.78] | [4.56] | 1.13 | 3.14 | 8.46 | 3.64 | 0.83 | 2.28 | 0.60 | 4.26 | [3.16] | 39.62 |
| 1893 | [2.78] | [4.78] | [4.56] | [3.00] | 6.60 | 4.92 | 2.46 | 10.75 | 6.55 | 8.78 | 1.55 | [3.16] | 59.89 |
| 1894 | [2.78] | [4.78] | [4.56] | [3.00] | 6.32 | 4.35 | 5.07 | 2.48 | 5.04 | 5.37 | 2.87 | 2.41 | 49.03 |
| 1895 | 4.38 | [4.78] | [4.56] | [3.00] | 4.00 | 2.80 | 5.46 | 5.37 | .23 | .81 | 3.65 | 4.37 | 43.41 |
| 1896 | 2.16 | 5.53 | 1.91 | 2.74 | 2.85 | 8.51 | 9.55 | 1.18 | 7.73 | 1.20 | 4.11 | 1.34 | 48.81 |
| 1897 | 2.15 | 5.66 | 5.07 | 3.38 | 3.58 | 2.82 | 5.35 | 4.47 | 2.06 | 1.51 | 3.63 | 3.05 | 42.73 |
| 1898 | 1.96 | .76 | 4.42 | 2.68 | 6.35 | 2.94 | 2.71 | 3.30 | 2.30 | 5.34 | 2.45 | 2.67 | 37.88 |
| 1899 | 3.55 | 8.63 | 7.94 | 2.57 | 4.45 | 3.65 | 5.77 | 1.42 | 1.76 | 3.14 | 2.47 | 2.34 | 47.69 |
| 1900 | 3.16 | 5.97 | 5.79 | 3.44 | 2.30 | 5.65 | 6.00 | 1.69 | 2.34 | 3.21 | 2.72 | 3.12 | 45.39 |
| 1901 | 2.72 | 1.95 | 2.82 | 5.66 | 7.71 | 7.45 | 5.70 | 13.04 | 3.50 | .86 | .82 | 5.72 | 57.95 |
| 1892 | 2.17 | 4.95 | 3.94 | 2.41 | 2.51 | 5.76 | 2.30 | 5.61 | 3.24 | 5.61 | 3.08 | 3.38 | 44.96 |
| Normals | 2.78 | 4.78 | 4.56 | 3.00 | 4.53 | 5.21 | 4.91 | 4.56 | 3.37 | 3.31 | 2.87 | 3.16 | 47.03 |

*Precipitation, in inches, at Oak Ridge, N. C.*

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1890 | 1.05 | 4.70 | 1.93 | 3.07 | 4.44 | [4.57] | [6.16] | 2.10 | 6.29 | 4.68 | [2.69] | 3.45 | 45.13 |
| 1891 | 4.09 | 5.92 | 7.06 | 4.46 | 8.26 | 2.35 | 10.99 | 7.26 | 1.46 | 1.35 | 3.33 | 2.96 | 59.49 |
| 1892 | 6.07 | 3.70 | 3.10 | 3.08 | 3.29 | 6.84 | 4.94 | 2.49 | 3.71 | .78 | 4.78 | 1.98 | 44.76 |
| 1893 | 1.86 | 7.35 | 1.07 | 2.29 | 7.35 | 6.42 | 1.44 | 8.26 | 6.75 | 7.26 | 1.66 | 1.60 | 53.31 |
| 1894 | 3.10 | 4.67 | .78 | 1.84 | 3.92 | 2.45 | 6.64 | 1.45 | 4.68 | 5.09 | .93 | 3.25 | 38.80 |
| 1895 | 6.31 | 3.28 | 4.83 | 5.37 | 6.29 | 3.83 | 6.16 | 3.62 | .11 | 1.05 | 2.43 | 4.84 | 48.12 |
| 1896 | 1.82 | 9.40 | 2.75 | 1.88 | 3.63 | 10.08 | 8.75 | .73 | 9.57 | 1.26 | 4.44 | 1.67 | 55.98 |
| 1897 | 1.87 | 5.12 | 5.21 | 3.96 | 5.53 | 2.71 | 5.18 | 4.70 | 1.05 | 1.76 | 3.91 | 2.93 | 43.93 |
| 1898 | 2.42 | .60 | 3.20 | 2.88 | 4.68 | 2.15 | 5.82 | 5.32 | 5.08 | 5.57 | 2.53 | 3.09 | 43.34 |
| 1899 | 7.44 | 8.17 | 9.64 | 2.55 | 3.39 | 2.68 | 4.45 | 1.12 | 2.48 | 2.14 | 1.32 | 2.52 | 47.90 |
| 1900 | 3.17 | 5.15 | 4.00 | 3.66 | 1.58 | 4.69 | 4.02 | 1.60 | 4.10 | 2.26 | 3.05 | 2.95 | 41.23 |
| 1901 | 2.56 | 1.30 | 4.02 | 5.98 | 8.63 | 5.72 | 9.39 | 13.41 | 2.29 | .34 | 1.18 | 7.13 | 61.95 |
| 1902 | 1.86 | 5.91 | 4.59 | 2.73 | 3.71 | 4.89 | [6.16] | [4.34] | [3.96] | [2.80] | [2.69] | [3.20] | 46.84 |
| Normals | 3.36 | 5.02 | 4.01 | 3.37 | 4.99 | 4.57 | 6.16 | 4.34 | 3.96 | 2.80 | 2.69 | 3.20 | 48.52 |

*Precipitation, in inches, over the drainage basin of Cape Fear River.*[a]

| Year. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1889 | 6.11 | 3.94 | 2.99 | 3.69 | 4.85 | 4.27 | 10.38 | 6.60 | 3.20 | 3.36 | 4.31 | 0.59 | 51.92 |
| 1890 | 1.93 | 3.77 | 2.71 | 2.20 | 4.93 | 3.51 | 6.08 | 3.18 | 5.34 | 5.31 | .22 | 4.15 | 46.21 |
| 1891 | 5.13 | 5.12 | 7.89 | 2.50 | 7.86 | 3.43 | 7.31 | 9.13 | 1.36 | 1.93 | 2.98 | 1.84 | 56.66 |
| 1892 | 6.28 | 3.20 | 2.93 | 2.56 | 4.05 | 5.90 | 5.75 | 2.95 | 2.33 | .46 | 3.60 | 2.95 | 43.14 |
| 1893 | 2.81 | 6.11 | 1.48 | 2.03 | 5.31 | 5.38 | 3.13 | 7.52 | 5.81 | 6.56 | 1.70 | 2.93 | 51.58 |
| 1894 | 4.03 | 3.67 | 1.51 | 1.61 | 4.48 | 2.33 | 6.34 | 5.50 | 5.69 | 6.76 | 1.75 | 2.85 | 47.18 |
| 1895 | 7.36 | 2.38 | 5.71 | 9.21 | 3.64 | 4.08 | 5.66 | 5.29 | .62 | 1.70 | 3.26 | 3.88 | 51.89 |
| 1896 | 2.78 | 6.63 | 2.27 | 1.62 | 4.88 | 6.94 | 7.11 | 1.67 | 7.59 | 1.42 | 4.03 | 2.14 | 50.28 |
| 1897 | 2.29 | 5.23 | 4.79 | 3.46 | 4.58 | 3.34 | 6.63 | 3.74 | 1.68 | 2.25 | 3.82 | 2.56 | 44.35 |
| 1898 | 2.00 | .92 | 4.38 | 3.37 | 3.69 | 2.92 | 5.68 | 7.79 | 3.79 | 4.31 | 3.16 | 2.17 | 43.95 |
| 1899 | 4.02 | 8.31 | 6.85 | 3.17 | 4.01 | 3.37 | 6.79 | 2.14 | 3.58 | 4.65 | 1.89 | 3.24 | 51.58 |
| 1900 | 2.47 | 5.20 | 4.53 | 4.68 | 3.04 | 5.50 | 3.49 | 3.00 | 2.74 | 2.18 | 3.77 | 4.20 | 44.64 |
| 1901 | 2.47 | 1.68 | 3.88 | 5.34 | 8.75 | 5.68 | 8.11 | 11.85 | 5.47 | 1.13 | 1.34 | 5.18 | 60.88 |
| 1902 | 2.35 | 5.73 | 3.16 | 3.18 | 2.63 | 3.46 | 2.88 | 3.59 | 5.24 | 3.26 | 3.64 | 3.67 | 43.05 |
| Mean | 3.72 | 4.42 | 3.94 | 3.47 | 4.76 | 4.29 | 6.10 | 5.28 | 3.89 | 3.23 | 2.82 | 3.03 | 50.34 |

[a] The precipitation for each month and the mean monthly precipitation were obtained directly from the available observations. The results for annual and mean annual precipitation include values interpolated in incomplete years.

*Comparison of yearly rainfall and run-off from the drainage basin of Cape Fear River.*

| Station. | Normal. | 1889. | 1890. | 1891. | 1892. | 1893. | 1894. | 1895. |
|---|---|---|---|---|---|---|---|---|
| RAINFALL. | | | | | | | | |
| Fayetteville, N. C.[a] | 61.13 | ..... | ..... | 53.12 | 47.56 | 51.31 | 55.78 | 53.02 |
| Moncure, N. C | 45.40 | ..... | ..... | ..... | ..... | ..... | 45.27 | 55.38 |
| Pittsboro, N. C | 48.34 | 48.26 | 38.21 | 49.15 | 33.33 | 43.52 | 50.21 | 63.55 |
| Chapel Hill, N. C | 49.66 | 48.91 | 47.92 | 58.19 | 38.74 | 49.06 | 48.52 | 54.06 |
| Southern Pines, N. C | 52.56 | 56.46 | ..... | 57.43 | 52.26 | 53.59 | 49.00 | 49.45 |
| Soapstone Mountain, N. C | 50.05 | 54.04 | 53.57 | 62.55 | 45.74 | 50.41 | 40.82 | 48.16 |
| Greensboro, N. C | 47.03 | ..... | ..... | ..... | 39.62 | 59.89 | 49.03 | 43.41 |
| Oak Ridge, N. C | 48.52 | ..... | 45.13 | 59.49 | 44.76 | 53.31 | 38.80 | 48.12 |
| Mean | 50.34 | 51.92 | 46.21 | 56.66 | 43.14 | 51.58 | 47.18 | 51.89 |
| RUN-OFF. | | | | | | | | |
| Cape Fear at Fayetteville | 15.74 | 27.14 | 13.04 | 21.67 | 13.60 | 16.28 | 13.40 | 19.50 |
| Percentage of rainfall | 31.3 | 52.3 | 28.2 | 38.2 | 31.5 | 31.6 | 28.4 | 37.6 |

| Station. | 1896. | 1897. | 1898. | 1899. | 1900. | 1901. | 1902. |
|---|---|---|---|---|---|---|---|
| RAINFALL. | | | | | | | |
| Fayetteville, N. C.[a] | 51.58 | 46.25 | 44.38 | 54.67 | 37.90 | 52.42 | 37.38 |
| Moncure, N. C | 44.16 | 35.77 | 37.17 | 50.44 | 39.90 | 59.02 | 41.50 |
| Pittsboro, N. C | 53.11 | 50.40 | 44.06 | 53.51 | 49.62 | 58.47 | 41.31 |
| Chapel Hill, N. C | 51.07 | 45.20 | 52.14 | 47.84 | 50.26 | 61.34 | 42.00 |
| Southern Pines, N. C | 46.40 | 43.70 | 48.43 | 64.13 | 44.66 | 74.03 | 43.73 |
| Soapstone Mountain, N. C | 51.10 | 46.84 | 44.18 | 46.49 | 48.17 | 61.87 | 46.71 |
| Greensboro, N. C | 48.81 | 42.73 | 37.88 | 47.69 | 45.39 | 57.95 | 44.96 |
| Oak Ridge, N. C | 55.98 | 43.93 | 43.34 | 47.90 | 41.23 | 61.95 | 46.84 |
| Mean | 50.28 | 44.35 | 43.95 | 51.58 | 44.64 | 60.88 | 43.05 |
| RUN-OFF. | | | | | | | |
| Cape Fear at Fayetteville | 14.26 | 12.44 | 8.90 | 18.65 | 11.93 | 18.34 | 11.21 |
| Percentage of rainfall | 28.4 | 28.0 | 20.2 | 36.2 | 26.7 | 30.1 | 26.0 |

[a] The normal at Fayetteville includes observations previous to 1889. The other normals include the above data only.

*Average monthly run-off and average rainfall, showing their difference and the effect of temperature, for the Cape Fear River Basin.*

| Month. | Average run-off. | | Average rain. | Difference. | Average mean temperature. |
|---|---|---|---|---|---|
| | *Second-feet.* | *Inches.* | *Inches.* | *Inches.* | ° |
| January | 7,084 | 1.82 | 3.72 | 1.90 | 39.8 |
| February | 10,886 | 2.53 | 4.42 | 1.89 | 42.7 |
| March | 8,314 | 2.13 | 3.94 | 1.81 | 49.7 |
| April | 6,582 | 1.64 | 3.47 | 1.83 | 59.1 |
| May | 4,142 | 1.05 | 4.76 | 3.71 | 67.9 |
| June | 3,271 | .81 | 4.29 | 3.48 | 74.9 |
| July | 4,958 | 1.27 | 6.10 | 4.83 | 77.5 |
| August | 5,744 | 1.47 | 5.28 | 3.81 | 75.9 |
| September | 3,157 | .78 | 3.89 | 3.11 | 74.6 |
| October | 2,926 | .72 | 3.23 | 2.51 | 58.7 |
| November | 2,610 | .65 | 2.82 | 2.17 | 49.2 |
| December | 3,461 | .89 | 3.03 | 2.14 | 42.3 |
| For the average year | 5,261 | 15.74 | 48.95 | 2.77 | 59.4 |

In order to present the facts regarding the flow of this stream with a greater degree of clearness the following graphical representations of the data given in the foregoing tables have been made.

Fig. 4 shows the relation between the average rainfall over the drainage basin of Cape Fear River and the average discharge of this basin at the gaging station at Fayetteville, N. C., in inches per month over the entire basin. The portion in black represents the average run-offs, the total precipitation being represented by the entire length of each block. The total average run-off is 15.74 inches. The total average precipitation over the basin is 50.34 inches.

This figure may be taken as representing the average condition of affairs on the basin, and it is seen by reference to it that in February, May, July, and August, large amounts of rainfall are to be expected, and that for these months the average run-off of the stream is also large; that for February being the greatest of the year.

Fig. 5 shows the effect on the run-off when the February rains do not occur. This causes a period of low discharge throughout the spring, and though the precipitation in July is greater than the average, and the entire precipitation for the year not abnormally low, the run-off is considerably less than in any other year covered by the records. This figure represents the conditions over the drainage basin in 1898.

The portion in black represents run-off, the precipitation for each month being represented by the entire length of the block for that month. Total run-off, 8.90 inches. Total precipitation, 43.95 inches.

Fig. 6 shows the amount and distribution of rainfall and run-off in inches over the basin of Cape Fear River above Fayetteville, N. C., for 1900. During this year occurred the minimum actual discharge, and the period of minimum discharge for the years 1889 to 1902, inclusive. The total rainfall was 44.64 inches, and the total run-off

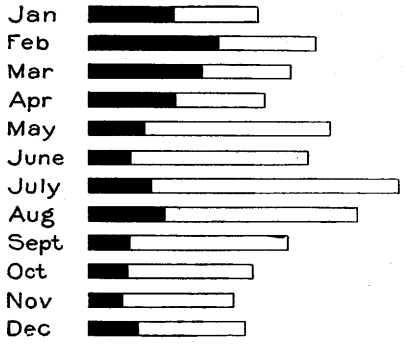


FIG. 4.—Relation of rainfall to run-off, 1889 to 1902, inclusive, in Cape Fear drainage basin.

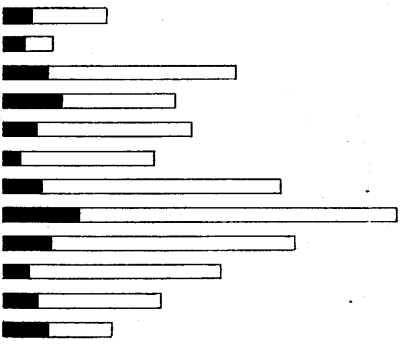

FIG. 5.—Relation of rainfall to run-off for 1898 in Cape Fear drainage basin.

was 11.93 inches. This figure shows also the effect upon the run-off of the absence of the usual rains of May, July, and August, which gave rise to the period of least flow ever recorded.

Fig. 7 shows the relation between that portion of the rainfall not appearing as run-off, and the mean monthly temperatures for the basin of Cape Fear River above Fayetteville, N. C. The portion in

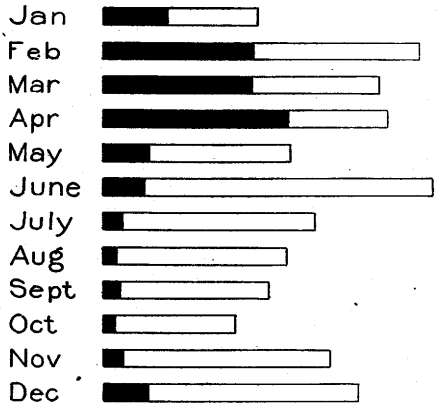


FIG. 6.—Relation of rainfall to run-off for 1900 in Cape Fear drainage basin.

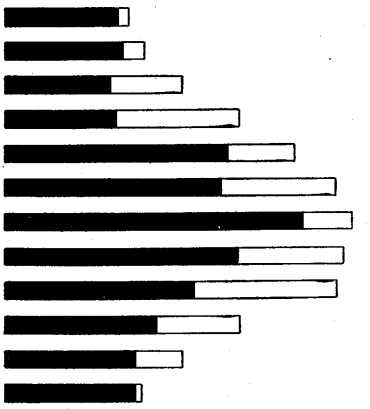

FIG. 7.—Effect of temperature on run-off in Cape Fear drainage basin.

black represents the retained water in inches over the basin; the entire length of block represents to scale the mean monthly temperatures over the basin in degrees. The actual values of these quantities will be found in the table on page 58.

It is evident from the tables and figures preceding, that only a small portion of the rainfall over the drainage basin of the Cape Fear

River appears as run-off in the stream. The remainder of the precipitation has disappeared in various ways. A portion is taken up by the vegetable life of the basin, and a portion disappears through evaporation. In some instances another portion may disappear by subterranean flow. It is, however, improbable that this is the case in the drainage basin of Cape Fear River, and, therefore, the difference between the average run-off and the average precipitation represents the amount taken up by plant life and the loss through evaporation. Both these agencies are to a certain extent dependent upon the temperatures which prevail, and fig. 7 following is the graphical representation of this fact.

The mean monthly temperatures over the basin were calculated from the records kept by the United States Weather Bureau for the period covered by the rainfall and flow observations, so that they are directly comparable.

## PEDEE OR YADKIN RIVER DRAINAGE BASIN.

The Yadkin River, or, as it is called below the junction of the Uharie, the Pedee, rises on the eastern slope of the Blue Ridge in Caldwell and Watauga counties, N. C., and flows at first to the southeast, then turns abruptly to the northeast and flows in this direction for about 60 miles, then bends again abruptly and flows toward the south and southeast across North Carolina and South Carolina, emptying into Winyah Bay at Georgetown, S. C. The total length of the stream, from source to mouth, following its general direction, is from 275 to 300 miles, while it is probably 400 miles or more if all the windings be followed.

The Pedee drains a total area of about 17,000 square miles, of which about 9,700 square miles lie in North Carolina and 7,300 in South Carolina. The stream crosses the fall line near Cheraw, S. C., in a series of rapids extending over a number of miles, with no very great fall at any one place or in any short distance.

Small amounts of power may be developed on some of the tributaries of this stream in South Carolina, but the power possibilities of the basin in this State are unimportant. In North Carolina the stream can be made to furnish power in large quantities at a number of places, and large amounts may be secured on many of the tributaries. This stream and its tributaries form one of the most important power regions in the Southern States.

Below the great bend, where the river turns to the south, the valley of the stream averages about 50 miles in width. At many points the river is bordered by wide expanses of bottom lands, which are at times subject to overflow, and which are fertile and very productive. At other places the river is confined between bold and abrupt banks, and in one case it flows for several miles in a very narrow channel, only

60 feet wide in places, in a deep ravine between the flanking hills, forming the noted "Narrows." Above the great bend the valley is only from 15 to 20 miles wide, and the elevations of the divides which separate the basin of the Yadkin from those adjacent are much higher, so that the tributary streams have a large fall.

The upper part of the drainage basin is rough and mountainous and largely forest covered, and throughout this part of its course the flow of the stream is more constant than would be expected.

The average rainfall over the part of the basin in North Carolina is probably between 48 and 51 inches, approximating the lower figure over the lower portions, and possibly exceeding 51 inches over the higher and more mountainous portions, the precipitation increasing as the stream is ascended. This total amount is rather evenly distributed among the seasons. Such a distribution is conducive to considerable variations in flow, and as a consequence the river is subject to freshets; but as a rule these are not so violent as those occurring on many of the other South Atlantic streams, neither rising to such heights nor lasting so long. Freshets on this stream rarely last more than from thirty-six to forty-eight hours. The highest flood ever known at Wilkesboro, it is stated, occurred in March, 1899, the stream at this place rising 28 feet above low water. The greatest flood recorded at the gaging station at Salisbury, N. C., occurred in December, 1901, the stream reaching an extreme height on the gage of 19.7 feet and having a probable discharge of about 130,000 second-feet, or about 38 second-feet per square mile. The flood of March, 1899, produced a rise of about 1 foot less than this flood of December. The most destructive flood ever experienced on the stream occurred in May 1901, but the recorded gage height at the Salisbury station was less for this flood than for either of the others mentioned, and the general testimony of those living along the banks is to the same effect.

The minimum recorded flow at the Salisbury station occurred in September, October, and November, 1897, when the basin of the stream experienced the most severe drouth in its history. The flow fell to 900 second-feet several times during this period; or the basin above the station was discharging at an average rate of 0.26 second-foot per square mile. The maximum flow is thus about 144 times the minimum.

As stated, there are a number of localities where power may be developed.

During 1902, the United States Geological Survey received data for the following stations from E. W. Myers, resident hydrographer: On the Yadkin, near Salisbury, N. C., and at Siloam, N. C.

### YADKIN RIVER NEAR SALISBURY, N. C.

The original station was established by C. C. Babb, September 24, 1895, and was located at the Southern Railway bridge near Holtsburg,

near the mouth of Grant Creek, and about 6 miles from Salisbury, N. C. The length of the wire gage was 55.10 feet. The station is easily reached by private conveyance from Salisbury. Discharge measurements were made from the lower side of the deck bridge, the zero point being on the left bank. The channel is obstructed by three piers with large rafts of driftwood lodged against each and sand bars below each. The channel is straight, the current swift, and the bed rough and rocky. The banks are rather low, but all the water passes beneath the bridge during floods.

Owing to the inconvenient location of the railroad bridge from which the measurements were made, and its height above the water, the gaging station was moved June 1, 1899, to the new iron highway bridge about 300 yards above the railroad bridge, the new gage reading the same as the old. In its new position the 10-foot mark on the rod is opposite the center of the first strut from the west end of the second span from the west end of the bridge, on the downstream side. The rod is of pine, 3 inches wide, well painted, graduated to feet and tenths, and securely nailed to the inner surface of the guard rail, the top of the rod being flush with the top of the rail. The distance between the zero of the rod and the outer rim of the pulley is 2.13 feet, and between the end of the weight and the pointer on the wire 26.75 feet. The observer is J. T. Yarbrough, keeper of the bridge. The stream here is of about the same width as at the railroad bridge, and the section is a fairly good one for gaging purposes, the bottom for the greater part of the width of the stream being hard and rocky. At times the current is very materially modified by large quantities of driftwood lodging against the piers, but it is thought better results can be obtained than at the old station. Although this stream is subject to periods of comparatively low flow, the minimum run-off is large.

*Discharge measurements of Yadkin River near Salisbury, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| May 12 | J. S. Henderson | 2.75 | 4,139 |
| June 13 | do | 2.56 | 3,467 |
| July 18 | B. S. Drane | 2.20 | 2,788 |
| August 14 | do | 3.30 | 7,301 |
| August 29 | do | 2.07 | 2,411 |
| September 16 | do | 2.00 | 2,119 |
| October 18 | do | 2.05 | 2,277 |
| December 3 | do | 6.52 | 16,894 |

*Daily gage height, in feet, of Yadkin River near Salisbury, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 2.60 | 3.95 | 9.45 | 4.20 | 2.90 | 2.50 | 2.85 | 2.00 | 1.95 | 2.05 | 2.10 | 5.00 |
| 2 | 2.60 | 5.75 | 7.03 | 3.70 | 2.80 | 2.50 | 2.80 | 2.80 | 1.85 | 2.05 | 2.15 | 4.50 |
| 3 | 2.55 | 6.17 | 5.35 | 3.45 | 2.80 | 2.50 | 2.35 | 2.70 | 1.80 | 2.15 | 2.18 | 6.00 |
| 4 | 2.95 | 4.95 | 4.65 | 3.35 | 2.85 | 2.35 | 2.30 | 2.50 | 2.05 | 2.10 | 2.08 | 5.82 |
| 5 | 3.55 | 3.90 | 4.10 | 3.35 | 2.80 | 2.25 | 2.30 | 2.05 | 2.45 | 2.18 | 2.25 | 4.60 |
| 6 | 3.40 | 3.40 | 4.05 | 3.40 | 2.80 | 2.15 | 2.30 | 2.00 | 2.20 | 3.52 | 2.10 | 5.30 |
| 7 | 3.30 | 3.25 | 3.80 | 3.25 | 2.85 | 2.25 | 2.40 | 2.00 | 1.90 | 4.55 | 2.80 | 3.98 |
| 8 | 3.25 | 3.20 | 3.50 | 3.35 | 2.85 | 2.40 | 2.20 | 2.10 | 1.85 | 2.90 | 2.55 | 3.34 |
| 9 | 3.20 | 3.10 | 3.50 | 3.80 | 2.85 | 2.70 | 2.40 | 2.05 | 2.10 | 2.50 | 2.30 | 2.95 |
| 10 | 3.15 | 3.05 | 3.55 | 3.45 | 2.75 | 2.40 | 2.40 | 2.00 | 4.50 | 2.30 | 2.30 | 2.70 |
| 11 | 3.15 | 3.00 | 3.40 | 3.25 | 2.55 | 2.35 | 3.00 | 2.10 | 3.30 | 2.30 | 2.08 | 2.65 |
| 12 | 3.15 | 2.90 | 3.30 | 3.15 | 2.75 | 2.88 | 2.60 | 2.10 | 2.50 | 2.95 | 2.05 | 2.60 |
| 13 | 3.00 | 2.90 | 3.25 | 3.20 | 2.65 | 2.60 | 2.40 | 2.10 | 2.15 | 3.50 | 2.08 | 2.95 |
| 14 | 2.90 | 2.85 | 3.25 | 3.10 | 2.70 | 2.50 | 2.40 | 3.42 | 2.00 | 2.75 | 2.08 | 3.15 |
| 15 | 2.85 | 2.80 | 3.20 | 3.10 | 2.70 | 2.65 | 2.25 | 4.25 | 2.00 | 2.44 | 2.00 | 2.85 |
| 16 | 2.95 | 2.90 | 3.20 | 3.10 | 3.20 | 6.21 | 2.05 | 3.45 | 2.00 | 2.25 | 2.10 | 2.70 |
| 17 | 2.95 | 2.90 | 5.65 | 3.10 | 2.90 | 12.48 | 2.15 | 3.15 | 1.97 | 2.12 | 2.15 | 3.45 |
| 18 | 2.95 | 2.85 | 5.00 | 3.30 | 2.90 | 9.57 | 2.05 | 2.50 | 1.85 | 2.10 | 3.67 | 4.52 |
| 19 | 2.90 | 2.85 | 3.95 | 3.35 | 3.00 | 4.95 | 1.95 | 2.15 | 1.90 | 2.25 | 4.90 | 3.50 |
| 20 | 2.85 | 2.85 | 3.50 | 3.20 | 2.90 | 3.30 | 2.10 | 2.00 | 1.85 | 2.15 | 3.80 | 3.05 |
| 21 | 2.85 | 2.90 | 3.30 | 3.20 | 2.95 | 2.90 | 2.20 | 2 00 | 1.85 | 2.25 | 2.80 | 2.88 |
| 22 | 3.90 | 3.45 | 3.30 | 3.10 | 2.80 | 2.75 | 2.40 | 2.10 | 2.00 | 2.05 | 2.45 | 3.97 |
| 23 | 3.85 | 4.20 | 3.30 | 3.00 | 2.80 | 2.62 | 2.50 | 2.55 | 1.85 | 1.70 | 2.40 | 4.50 |
| 24 | 3.30 | 3.80 | 3.20 | 3.00 | 2.65 | 2.50 | 2.10 | 2.20 | 1.80 | 1.70 | 2.35 | 3.60 |
| 25 | 3.15 | 6.23 | 3.25 | 2.95 | 2.65 | 2.50 | 2.00 | 2.10 | 1.95 | 1.90 | 2.20 | 3.15 |
| 26 | 3.10 | 8.37 | 3.10 | 2.95 | 2.85 | 2.60 | 2.00 | 1.90 | 1.90 | 2.10 | 3.00 | 2.90 |
| 27 | 3.00 | 6.40 | 3.05 | 2.90 | 2.85 | 2.60 | 1.95 | 1.85 | 3.85 | 2.05 | 3.30 | 2.75 |
| 28 | 3.35 | 4.95 | 3.05 | 2.95 | 2.70 | 3.85 | 2.20 | 1.95 | 3.00 | 2.95 | 2.90 | 2.60 |
| 29 | 3.35 | ..... | 4.00 | 2.90 | 2.60 | 4.30 | 2.15 | 1.90 | 2.40 | 2.95 | 2.50 | 2.60 |
| 30 | 3.40 | ..... | 7.80 | 2.95 | 2.50 | 3.25 | 2.00 | 1.88 | 2.00 | 2.65 | 2.50 | 2.65 |
| 31 | 3.55 | ..... | 5.75 | ..... | 2.45 | ..... | 2.00 | 1.75 | ..... | 2.20 | ..... | 2.75 |

*Rating table for Yadkin River near Salisbury, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.7 | 1,350 | 4.4 | 10,240 | 7.2 | 22,000 | 13.0 | 55,700 |
| 1.8 | 1,580 | 4.6 | 11,000 | 7.4 | 22,900 | 13.5 | 59,700 |
| 2.0 | 2,120 | 4.8 | 11,800 | 7.6 | 23,810 | 14.0 | 63,700 |
| 2.2 | 2,720 | 5.0 | 12,600 | 7.8 | 24,730 | 14.5 | 67,900 |
| 2.4 | 3,320 | 5.2 | 13,420 | 8.0 | 25,650 | 15.0 | 72,400 |
| 2.6 | 3,940 | 5.4 | 14,240 | 8.5 | 28,000 | 15.5 | 77,150 |
| 2.8 | 4,580 | 5.6 | 15,070 | 9.0 | 30,400 | 16.0 | 82,000 |
| 3.0 | 5,220 | 5.8 | 15,910 | 9.5 | 33,000 | 16.5 | 87,400 |
| 3.2 | 5,900 | 6.0 | 16,750 | 10.0 | 35,750 | 17.0 | 93,000 |
| 3.4 | 6,580 | 6.2 | 17,610 | 10.5 | 38,650 | 17.5 | 99,000 |
| 3.6 | 7,280 | 6.4 | 18,470 | 11.0 | 41,700 | 18.0 | 105,000 |
| 3.8 | 8,000 | 6.6 | 19,340 | 11.5 | 44,900 | 19.0 | 117,400 |
| 4.0 | 8,720 | 6.8 | 20,220 | 12.0 | 48,300 | | |
| 4.2 | 9,480 | 7.0 | 21,100 | 12.5 | 51,900 | | |

*Estimated monthly discharge of Yadkin River near Salisbury, N. C.*

[Drainage area, 3,399 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 8,360 | 3,780 | 5,678 | 1.67 | 1.93 |
| February | 27,295 | 4,580 | 8,763 | 2.58 | 2.69 |
| March | 32,740 | 5,390 | 9,759 | 2.87 | 3.31 |
| April | 9,480 | 4,900 | 6,031 | 1.77 | 1.97 |
| May | 5,900 | 3,470 | 4,530 | 1.33 | 1.53 |
| June | 55,700 | 2,570 | 7,700 | 2.27 | 2.53 |
| July | 5,220 | 1,980 | 2,974 | 0.88 | 1.01 |
| August | 9,670 | 1,465 | 3,108 | 0.91 | 1.05 |
| September | 10,620 | 1,580 | 2,871 | 0.84 | 0.94 |
| October | 10,810 | 1,350 | 3,512 | 1.03 | 1.19 |
| November | 12,200 | 2,120 | 3,833 | 1.13 | 1.26 |
| December | 16,750 | 3,940 | 7,273 | 2.14 | 2.47 |
| The year | 55,700 | 1,350 | 5,502 | 1.62 | 21.88 |

YADKIN RIVER AT SILOAM, N. C.

This station was established on August 2, 1900, by N. C. Curtis and Cleveland Abbe, jr., as an aid to the study of the hydrographic conditions of the area which it was proposed to incorporate within the limits of the projected Appalachian Forest Reserve.

This station was located at a ferry across the river at Siloam, a small station on the Wilkesboro branch of the Southern Railway, the measurements being made from the ferryboat. The gage rod was securely braced and nailed to an overhanging tree about 50 yards above the ferry, and was referred to a bench mark on the south bank. This bench mark consisted of a notch cut in the outermost of a group of three sycamore trees standing at the water's edge, about 25 feet above the ferry landing, the notch being about 8 feet from the ground.

When the gage was established the reading was 2.7 feet, and the water level stood 9.6 feet below the bench mark. This gage was insecurely fastened and was washed away by a freshet on September 16, and was not replaced until October 1. The zero of the second gage was made to read 0.5 foot lower than the first. This second gage rod was destroyed by flood on April 19, 1901, and was replaced April 29, 1901. The two former gages had failed by the breaking off of the lower end by logs and drift. The lower end of the new gage was

therefore braced and wedged among the rocks of the bed of the river, and was also braced by means of guy wires to the adjacent trees. The zero of this gage was for this reason made to read 1 foot below the reading of the original gage.

The gage heights printed herewith have been adjusted to the gage as originally established.

The rise of the stream in ordinary freshets is not more than 9 feet, but in 1898, as shown by flood marks and according to verbal accounts, the rise was about 16 feet on the gage, and in 1901 on two occasions the extreme rise was more than 20 feet, the flood waters extending across the bottom land for one-third of a mile or more and touching the railway tracks at Siloam.

The initial point for soundings was on the right bank at the outer edge of a mooring stake at the ferry landing. The section at ordinary stages of the stream is good, the bed being of compact sand and gravel, shifting slightly, if at all, and the banks are high and are rarely submerged. Gagings can not be made in time of flood because of the impossibility of handling a boat in the swift current.

The station was abandoned on December 31, 1901.

*Discharge measurements of Yadkin River at Siloam, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| July 11 | N. C. Curtis | 2.90 | 1,367 |
| August 3 | do | 2.60 | 1,218 |
| October 31 | do | 3.10 | 1,469 |
| 1901. | | | |
| April 15 | N. C. Curtis | 5.00 | 5,237 |

*Daily gage height, in feet, of Yadkin River at Siloam, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | | | | | | |
| 1 | | | | | | | | | 2.00 | 2.60 | 3.00 | 3.10 |
| 2 | | | | | | | | | 2.00 | 2.60 | 3.00 | 3.10 |
| 3 | | | | | | | | 2.10 | 2.00 | 2.70 | 3.30 | 3.20 |
| 4 | | | | | | | | 2.05 | 2.00 | 2.70 | 3.10 | 3.20 |
| 5 | | | | | | | | 2.00 | 2.00 | 2.80 | 2.90 | 3.10 |
| 6 | | | | | | | | 1.95 | 2.00 | 2.80 | 2.90 | 3.10 |
| 7 | | | | | | | | 1.90 | 2.00 | 2.80 | 2.90 | 3.10 |
| 8 | | | | | | | | 1.90 | 2.00 | 2.90 | 3.00 | 3.10 |
| 9 | | | | | | | | 1.90 | 2.00 | 2.80 | 3.00 | 3.10 |
| 10 | | | | | | | | 1.80 | 2.00 | 2.80 | 2.90 | 3.20 |
| 11 | | | | | | | | 1.80 | 2.00 | 2.80 | 2.90 | 3.20 |
| 12 | | | | | | | | 1.80 | 2.00 | 2.80 | 2.90 | 3.20 |

*Daily gage height, in feet, of Yadkin River at Siloam, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | | | | | | |
| 13 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1.85 | 2.00 | 3.10 | 2.90 | 3.10 |
| 14 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.05 | 2.05 | 2.90 | 2.90 | 3.10 |
| 15 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | 2.20 | 2.80 | 2.90 | 3.10 |
| 16 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | ..... | 2.80 | 3.00 | 3.10 |
| 17 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | ..... | 2.80 | 3.00 | 3.10 |
| 18 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | ..... | 2.80 | 3.00 | 3.10 |
| 19 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | ..... | 2.80 | 3.00 | 3.10 |
| 20 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | ..... | 2.80 | 3.00 | 3.10 |
| 21 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.60 | ..... | 2.80 | 3.10 | 3.20 |
| 22 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3.05 | ..... | 3.10 | 3.10 | 3.20 |
| 23 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.95 | ..... | 3.60 | 3.00 | 3.20 |
| 24 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3.00 | ..... | 11.70 | 3.00 | 3.20 |
| 25 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.90 | ..... | 5.00 | 3.30 | 3.10 |
| 26 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.75 | ..... | 4.10 | 11.80 | 3.10 |
| 27 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.70 | ..... | 3.90 | 11.30 | 3.20 |
| 28 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.00 | ..... | 3.70 | 11.10 | 3.20 |
| 29 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.00 | ..... | 3.10 | 9.50 | 3.20 |
| 30 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.00 | ..... | 3.10 | 3.30 | 3.60 |
| 31 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.00 | ..... | 3.10 | ..... | 3.70 |
| 1901. | | | | | | | | | | | | |
| 1 | 3.20 | 3.30 | 3.10 | 3.30 | 4.50 | 4.60 | 8.60 | 4.60 | 4.70 | 4.60 | 4.60 | 4.60 |
| 2 | 3.20 | 3.30 | 3.10 | 3.30 | 4.50 | 4.50 | 8.60 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 |
| 3 | 3.30 | 3.30 | 3.10 | 3.20 | 4.60 | 4.50 | 4.70 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 |
| 4 | 3.20 | 3.30 | 3.10 | 3.20 | 4.60 | 4.50 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 | 4.90 |
| 5 | 3.20 | 3.30 | 3.30 | 3.30 | 4.50 | 4.60 | 5.10 | 4.60 | 4.70 | 4.60 | 4.60 | 4.80 |
| 6 | 3.30 | 3.30 | 3.20 | 3.30 | 4.50 | 4.60 | 5.80 | 4.60 | 4.70 | 4.60 | 4.60 | 4.60 |
| 7 | 3.30 | 3.40 | 3.20 | 3.30 | 4.50 | 4.50 | 4.60 | 4.70 | 4.60 | 4.70 | 4.60 | 4.60 |
| 8 | 3.20 | 3.30 | 3.20 | 3.30 | 4.60 | 4.50 | 4.70 | 4.70 | 4.60 | 4.70 | 4.60 | 4.60 |
| 9 | 3.20 | 3.40 | 3.40 | 3.20 | 4.50 | 4.60 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 |
| 10 | 3.40 | 3.40 | 3.60 | 3.20 | 4.50 | 4.60 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 |
| 11 | 3.70 | 3.30 | 3.50 | 3.30 | 4.60 | 4.70 | 4.70 | 6.30 | 4.60 | 4.60 | 4.60 | 4.60 |
| 12 | 4.60 | 3.30 | 3.50 | 3.30 | 4.60 | 4.70 | 4.70 | 7.40 | 4.60 | 4.70 | 4.60 | 4.60 |
| 13 | 3.70 | 3.30 | 3.30 | 3.40 | 4.60 | 4.60 | 4.90 | 12.20 | 4.60 | 4.80 | 4.60 | 4.60 |
| 14 | 3.50 | 3.30 | 3.30 | 3.40 | 4.60 | 4.90 | 7.80 | 11.50 | 4.70 | 4.60 | 4.70 | 4.90 |
| 15 | 3.30 | 3.30 | 3.20 | 3.30 | 4.50 | 11.70 | 6.10 | 11.80 | 4.60 | 4.60 | 4.60 | 12.60 |
| 16 | 3.30 | 3.30 | 3.20 | 3.30 | 4.50 | 11.90 | 4.60 | 11.30 | 4.60 | 4.60 | 4.60 | 9.30 |
| 17 | 3.30 | 3.30 | 3.20 | 3.30 | 5.60 | 11.80 | 4.60 | 12.60 | 4.60 | 4.60 | 4.60 | 8.20 |
| 18 | 3.30 | 3.30 | 3.20 | 3.30 | 5.00 | 11.30 | 5.30 | 10.30 | 4.60 | 4.60 | 4.60 | 4.80 |
| 19 | 3.30 | 3.20 | 3.20 | 3.70 | 4.90 | 8.40 | 4.70 | 5.10 | 4.60 | 4.60 | 4.60 | 4.70 |
| 20 | 3.30 | 3.20 | 3.20 | (a) | 4.90 | 8.60 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 |
| 21 | 3.30 | 3.20 | 3.30 | ..... | 5.30 | 10.30 | 4.60 | 4.60 | 4.70 | 4.60 | 4.60 | 4.60 |
| 22 | 3.40 | 3.30 | 3.30 | ..... | b14.50 | 10.40 | 4.60 | 4.70 | 4.70 | 4.60 | 4.60 | 4.60 |
| 23 | 3.40 | 3.30 | 3.20 | ..... | 8.00 | 9.60 | 4.60 | 7.30 | 4.60 | 4.60 | 4.70 | 4.60 |
| 24 | 3.30 | 3.30 | 3.20 | ..... | 6.00 | 8.80 | 4.60 | ..... | 4.60 | 4.60 | 4.80 | 4.60 |
| 25 | 3.30 | 3.20 | 3.30 | ..... | 5.50 | 8.40 | 4.70 | 7.40 | 4.60 | 4.60 | 4.60 | 4.60 |
| 26 | 3.20 | 3.20 | 10.90 | ..... | 5.60 | 4.80 | 4.60 | 4.70 | 4.60 | 4.60 | 4.60 | 4.60 |
| 27 | 3.20 | 3.10 | 9.10 | ..... | 5.60 | 4.80 | 4.70 | 4.70 | 4.70 | 4.60 | 4.60 | 4.70 |
| 28 | 3.20 | 3.10 | 3.70 | ..... | 5.10 | 5.20 | 4.60 | 4.60 | 4.70 | 4.60 | 4.60 | 5.30 |
| 29 | 3.20 | ..... | 6.80 | ..... | 4.50 | 8.40 | 4.70 | 4.60 | 4.80 | 4.60 | 4.60 | 12.90 |
| 30 | 3.30 | ..... | 3.40 | 4.50 | 4.60 | 9.90 | 4.70 | 4.60 | 4.70 | 4.60 | 4.60 | 10.20 |
| 31 | 3.30 | ..... | 3.30 | ..... | 4.60 | ..... | 4.60 | 4.80 | ..... | 4.60 | ..... | 8.40 |

a Gage carried away; replaced April 30.

b Flood estimated.

*Rating table for Yadkin River, at Siloam, N. C., for 1900–1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.7 | 850 | 4.3 | 3,450 | 6.9 | 10,180 | 9.5 | 16,940 |
| 1.8 | 870 | 4.4 | 3,700 | 7.0 | 10,440 | 9.6 | 17,200 |
| 1.9 | 900 | 4.5 | 3,950 | 7.1 | 10,700 | 9.7 | 17,460 |
| 2.0 | 930 | 4.6 | 4,200 | 7.2 | 10,960 | 9.8 | 17,720 |
| 2.1 | 975 | 4.7 | 4,460 | 7.3 | 11,220 | 9.9 | 17,980 |
| 2.2 | 1,020 | 4.8 | 4,720 | 7.4 | 11,480 | 10.0 | 18,240 |
| 2.3 | 1,070 | 4.9 | 4,980 | 7.5 | 11,740 | 10.1 | 18,500 |
| 2.4 | 1,120 | 5.0 | 5,240 | 7.6 | 12,000 | 10.2 | 18,760 |
| 2.5 | 1,170 | 5.1 | 5,500 | 7.7 | 12,260 | 10.3 | 19,020 |
| 2.6 | 1,220 | 5.2 | 5,760 | 7.8 | 12,520 | 10.4 | 19,280 |
| 2.7 | 1,270 | 5.3 | 6,020 | 7.9 | 12,780 | 10.5 | 19,540 |
| 2.8 | 1,320 | 5.4 | 6,280 | 8.0 | 13,040 | 10.6 | 19,800 |
| 2.9 | 1,370 | 5.5 | 6,540 | 8.1 | 13,300 | 10.7 | 20,060 |
| 3.0 | 1,420 | 5.6 | 6,800 | 8.2 | 13,560 | 10.8 | 20,320 |
| 3.1 | 1,470 | 5.7 | 7,060 | 8.3 | 13,820 | 10.9 | 20,580 |
| 3.2 | 1,540 | 5.8 | 7,320 | 8.4 | 14,080 | 11.0 | 20,840 |
| 3.3 | 1,630 | 5.9 | 7,580 | 8.5 | 14,340 | 11.1 | 21,100 |
| 3.4 | 1,740 | 6.0 | 7,840 | 8.6 | 14,600 | 11.2 | 21,360 |
| 3.5 | 1,880 | 6.1 | 8,100 | 8.7 | 14,860 | 11.3 | 21,620 |
| 3.6 | 2,020 | 6.2 | 8,360 | 8.8 | 15,120 | 11.4 | 21,880 |
| 3.7 | 2,180 | 6.3 | 8,620 | 8.9 | 15,380 | 11.5 | 22,140 |
| 3.8 | 2,350 | 6.4 | 8,880 | 9.0 | 15,640 | 11.6 | 22,400 |
| 3.9 | 2,540 | 6.5 | 9,140 | 9.1 | 15,900 | 11.7 | 22,660 |
| 4.0 | 2,740 | 6.6 | 9,400 | 9.2 | 16,160 | 11.8 | 22,920 |
| 4.1 | 2,960 | 6.7 | 9,660 | 9.3 | 16,420 | 11.9 | 23,180 |
| 4.2 | 3,200 | 6.8 | 9,920 | 9.4 | 16,680 | 12.0 | 23,440 |

*Estimated monthly discharge of Yadkin River at Siloam, N. C.*

[Drainage area, 1,219 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | |
| 1900. | | | | | | *Inches.* |
| August 3 to 31 | ..... | ..... | 1,031 | 0.85 | 0.91 | 2.56 |
| September 1 to 15 | ..... | ..... | 937 | .77 | .44 | 3.52 |
| October | 22,660 | 1,220 | 2,295 | 1.88 | 2.17 | 5.62 |
| November | 22,920 | 1,370 | 3,994 | 3.28 | 3.65 | ..... |
| December | 2,180 | 1,470 | 1,538 | 1.26 | 1.45 | 4.11 |
| 1901. | | | | | | |
| January | 4,200 | 1,540 | 1,738 | 1.43 | 1.65 | 3.18 |
| February | 1,740 | 1,470 | 1,614 | 1.32 | 1.38 | 1.45 |
| March | 20,580 | 1,470 | 2,970 | 2.40 | 2.77 | 5.11 |
| April 1 to 19[a] | ..... | ..... | 1,762 | 1.45 | 1.08 | 8.04 |
| May | 29,940 | 3,950 | 5,864 | 4.81 | 5.54 | 7.69 |
| June | 23,180 | 3,950 | 10,329 | 8.47 | 9.45 | 7.79 |
| July | 14,600 | 4,200 | 5,601 | 4.59 | 5.29 | 5.37 |
| August | 25,000 | 4,200 | 8,552 | 7.02 | 8.09 | 17.05 |
| September | 4,720 | 4.200 | 4,295 | 3.52 | 3.93 | 3.98 |
| October | 4,720 | 4,200 | 4,242 | 3.48 | 4.01 | 1.01 |
| November | 4,720 | 4,200 | 4,235 | 3.47 | 3.88 | 1.15 |
| December | 25,780 | 4,200 | 7,211 | 5.92 | 6.82 | 9.94 |
| The year | 29,940 | 1,470 | 4,868 | 3.99 | 53.89 | 71.76 |

[a] Gage washed out by flood April 20.

MISCELLANEOUS MEASUREMENTS IN PEDEE OR YADKIN DRAINAGE BASIN.

The following miscellaneous measurement was made in the Pedee or Yadkin drainage basin in 1902:

October 20: Pedee River at S. A. L. R. R. crossing, near Rockingham, N. C., discharge, 3,476 second-feet.

## SANTEE RIVER DRAINAGE BASIN.

Santee River is formed by the junction of Congaree and Wateree rivers in the central part of South Carolina, and flows toward the southeast into the Atlantic Ocean about 10 miles north of Cape Romain, having a total length of about 180 miles (following the course of the river) and draining an area of about 15,000 square

miles. It is a navigable stream for its entire length, and of course offers no opportunities for the development of power.

Wateree River, the more northerly of the two parent streams, rises on the eastern slope of the Blue Ridge in McDowell County, N. C., and flows first to the northeast and then to the east, then bends abruptly to the southeast and flows in this general direction across the southern central portion of North Carolina and across the northern central part of South Carolina to its junction with the Congaree, practically paralleling the course of the Yadkin and Pedee rivers. This stream is known throughout its course in North Carolina as Catawba River, and also through that part of its course in South Carolina above the mouth of Wateree Creek. The total length of the stream is about 270 miles in a straight line, and about 450 miles when all the windings are followed.

The Wateree is navigable as far as Camden, but above this point the fall becomes too great and navigation is impracticable. In 1826 and following years the State of South Carolina spent large sums in the attempt to render the river navigable by means of locks and dams. Some large and important works were constructed at great expense, but the undertaking was abandoned before their completion.

The drainage basin resembles that of the Yadkin in many respects, the upper portion of the stream flowing between parallel ranges of mountains from which it receives many tributaries affording much power. The average width of the valley of the main stream in North Carolina is only from 15 to 20 miles, and the fall in the main stream is very considerable. The greater part of the drainage basin is hilly, and the upper portions are mountainous. A number of the tributary streams rise and flow for almost their entire length in high mountains. About 65 per cent of the upper part of the basin is in forest. Linville River and John River, the principal tributaries in North Carolina, flow in country of this character, and their basins are almost entirely forested.

Wateree River crosses the fall line about 5 miles above Camden, S. C., in rapids about 5 miles in length, with a total fall of about 52 feet. The Great Falls of the Catawba are some distance above. This is the largest power in South Carolina, and one of the largest in the Southern States, the available fall being 173 feet.

The average rainfall on the basin is about 50 inches, the annual total increasing as the stream is ascended. The maximum flood ever experienced on the river was in May, 1901, the gage reading at the Rockhill station being 24.15 feet and the measured discharge nearly 151,000 second-feet, or nearly 50 second-feet per square mile from the drainage basin above the station. The greatest flood previously experienced on the stream was in 1865. This was only about 2 feet

lower than the flood of May on the lower part of the river, but the May rise exceeded all previous records on the upper portion of the river by from 8 to 15 feet.

The minimum flow recorded for the Rockhill station is 1,300 second-feet, or about 0.43 second-foot per square mile. The maximum flow is about 116 times the minimum.

The Congaree, the second and more southerly of the two streams which by their union form the Santee, is formed by the junction of Broad and Saluda rivers between Lexington and Richland counties, S. C., whence it flows in a general southeasterly direction, but in a very tortuous channel, for about 60 miles to its junction with the Wateree. The stream is navigable to Columbia, the capital of the State. There it crosses the fall line, giving rise to a very fine water power, the only one on the stream, which is being extensively used in the manufacturing enterprises of Columbia.

Broad River rises on the eastern slope of the Blue Ridge near Hickory Nut Gap, in the southwestern part of McDowell County and the northeastern part of Henderson County, N. C., and flows in a general southeasterly direction across a portion of southern-central North Carolina and of northern-central South Carolina to its junction with the Saluda at Columbia. The length of the river in a straight line is about 128 miles, but it is much greater if the course of the river is followed.

In general character the drainage basin closely resembles those of the Yadkin and the Catawba. It lies entirely above the fall line, is without lakes, and is well wooded, especially in the upper portion, and the soil is generally loose and porous.

The rainfall of the basin averages about 51 inches, of which about 13 inches fall in spring, the same in summer, about 10 in autumn, and about 15 in winter. It is probable that the precipitation in the region about the headwaters is much greater than these amounts indicate.

The maximum flood recorded at the Alston station on this stream, 25 miles above Columbia, occurred in May, 1901, the estimated discharge being 131,000 second-feet, equivalent to about 28 second-feet per square mile. The minimum flow recorded at the same place is 1,660 second-feet, equivalent to 0.36 second-foot per square mile. The maximum flow is therefore about 79 times the minimum.

Saluda River is formed in western South Carolina by the junction of the north, south, and middle forks, and flows southeast to its junction with Broad River, the length of the stream being about 110 miles in a straight line. The three forks are mountain streams, and the character of the drainage basin is similar to that of Broad River.

The average rainfall over the basin of the stream is 51 inches, the amount and seasonal distribution being similar to that on the Broad.

The maximum flood recorded at the Waterloo station on this stream occurred in February, 1902, the rise being 23 feet above low water, and the estimated discharge being about 18,500 second-feet, equivalent to about 18 second-feet per square mile. The minimum discharge so far recorded is 290 second-feet, or about 0.28 second-foot per square mile. The maximum discharge is therefore about 64 times the minimum.

The United States Geological Survey has maintained the following stations in this basin, under the direction of E. W. Myers: On the Catawba, near Rockhill, S. C.; at Catawba, N. C., and near Morgantown, N. C.; on the John, near Morgantown, N. C.; on the Linville, near Bridgewater, N. C.; on the Broad (of the Carolinas), near Alston, S. C.; on the Saluda, near Waterloo, S. C.

### CATAWBA RIVER NEAR ROCKHILL, S. C.

This station was established by C. C. Babb on September 3, 1895. It is located at the bridge of the Southern Railway, 3 miles south of Fort Mill, S. C., and is about 60 miles below the Catawba station, now abandoned. The gage, a wire gage of the ordinary type, is fastened to the upstream guard rail on the upper side, the 2-foot mark on the rod being over the center of the second vertical compression member of the second truss from the south end of the bridge. The distance from the zero of the rod to the outside edge of the pulley wheel is 1.3 feet, and from the end of the weight to the pointer on the wire is 52.96 feet.

The length of the gage was frequently verified during 1902 and was found correct. The station is reached from Rockhill by private conveyance. The channel of the stream is curved above and below the bridge, which crosses at the head of a bend. The current flows at an angle with the bridge and is swift; the water is shallow at ordinary stages of the stream, and the bottom rough. Altogether, the station is a poor one. The observer is D. A. Morris, a farmer living near the bridge.

The following discharge measurements were made during 1902 by J. S. Henderson and B. S. Drane:

May 13: Gage height, 2.20 feet; discharge, 4,013 second-feet.
August 8: Gage height, 1.70 feet; discharge, 3,086 second-feet.
August 29: Gage height, 1.62 feet; discharge, 2,504 second-feet.

*Daily gage height, in feet, of Catawba River near Rockhill, S. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 7.50 | 4.00 | 15.30 | 4.10 | 2.30 | 2.00 | 2.20 | 2.10 | 1.60 | 1.90 | 1.80 | 4.25 |
| 2 | 4.70 | 9.00 | 11.90 | 3.90 | 2.30 | 2.00 | 2.10 | 2.10 | 1.60 | 2.30 | 1.75 | 2.90 |
| 3 | 3.70 | 6.20 | 6.30 | 3.50 | 2.30 | 2.00 | 2.00 | 2.10 | 1.60 | 2.00 | 1.70 | 5.60 |
| 4 | 3.40 | 4.50 | 5.60 | 3.10 | 2.30 | 2.00 | 2.00 | 1.90 | 2.70 | 1.80 | 1.70 | 5.10 |
| 5 | 3.20 | 3.40 | 4.00 | 3.00 | 2.30 | 1.90 | 1.90 | 1.90 | 2.80 | 1.90 | 1.70 | 4.00 |
| 6 | 2.90 | 3.20 | 4.00 | 3.00 | 2.30 | 1.90 | 2.00 | 1.80 | 2.40 | 3.20 | 1.70 | 3.60 |
| 7 | 2.90 | 3.00 | 4.00 | 2.90 | 2.20 | 2.10 | 1.90 | 1.80 | 1.70 | 3.10 | 2.00 | 3.40 |
| 8 | 2.80 | 3.00 | 3.40 | 3.00 | 2.20 | 1.90 | 1.90 | 1.70 | 1.60 | 2.20 | 2.45 | 2.75 |
| 9 | 2.80 | 2.80 | 3.50 | 3.20 | 2.20 | 2.20 | 1.90 | 1.70 | 3.20 | 1.90 | 2.00 | 2.50 |
| 10 | 2.80 | 2.70 | 3.40 | 3.10 | 2.20 | 2.10 | 2.40 | 1.70 | 5.50 | 1.80 | 1.80 | 2.30 |
| 11 | 2.70 | 2.60 | 3.20 | 2.90 | 2.20 | 2.00 | 2.60 | 1.70 | 3.50 | 1.90 | 1.80 | 2.15 |
| 12 | 2.70 | 2.60 | 3.00 | 2.70 | 2.20 | 1.90 | 2.50 | 2.00 | 2.40 | 2.40 | 1.80 | 2.15 |
| 13 | 2.70 | 2.60 | 3.30 | 2.60 | 2.20 | 1.90 | 2.50 | 2.10 | 1.90 | 2.20 | 1.75 | 2.40 |
| 14 | 2.60 | 2.60 | 3.10 | 2.60 | 2.20 | 1.90 | 2.40 | 6.00 | 1.80 | 2.70 | 1.70 | 2.40 |
| 15 | 2.60 | 2.70 | 3.00 | 2.50 | 2.30 | 2.00 | 2.30 | 3.50 | 1.60 | 2.30 | 1.70 | 2.30 |
| 16 | 2.60 | 2.70 | 3.00 | 2.50 | 2.40 | 6.60 | 2.20 | 2.40 | 1.60 | 2.00 | 1.70 | 2.15 |
| 17 | 2.50 | 2.70 | 3.40 | 2.40 | 2.30 | 16.40 | 2.10 | 1.85 | 1.60 | 1.80 | 1.70 | 2.65 |
| 18 | 2.50 | 2.70 | 5.30 | 2.70 | 2.40 | 7.40 | 2.00 | 1.80 | 1.60 | 1.80 | 6.10 | 3.20 |
| 19 | 2.50 | 2.70 | 3.90 | 2.60 | 2.40 | 4.10 | 1.90 | 1.70 | 1.60 | 1.60 | 2.50 | 2.90 |
| 20 | 2.50 | 2.70 | 3.40 | 2.60 | 2.60 | 2.60 | 1.90 | 1.70 | 1.60 | 1.60 | 2.60 | 2.50 |
| 21 | 2.50 | 2.70 | 3.10 | 2.60 | 2.50 | 2.50 | 1.90 | 1.70 | 1.60 | 1.60 | 2.10 | 2.30 |
| 22 | 3.20 | 3.20 | 3.10 | 2.60 | 2.50 | 2.40 | 1.90 | 1.70 | 1.60 | 1.60 | 1.90 | 3.80 |
| 23 | 2.90 | 4.70 | 3.00 | 2.60 | 2.50 | 2.40 | 2.10 | 1.70 | 1.60 | 1.60 | 1.90 | 3.20 |
| 24 | 2.90 | 4.90 | 2.90 | 2.60 | 2.40 | 2.40 | 1.90 | 1.70 | 1.60 | 1.60 | 1.80 | 3.00 |
| 25 | 2.50 | 5.40 | 2.80 | 2.50 | 2.30 | 2.40 | 1.90 | 1.70 | 1.60 | 1.60 | 1.80 | 2.60 |
| 26 | 2.50 | 5.80 | 2.80 | 2.50 | 2.70 | 2.30 | 2.10 | 1.60 | 1.60 | 1.60 | 2.40 | 2.40 |
| 27 | 2.50 | 6.30 | 2.80 | 2.50 | 2.50 | 2.20 | 1.90 | 1.60 | 1.60 | 2.00 | 2.40 | 2.25 |
| 28 | 2.60 | 7.60 | 2.70 | 2.40 | 2.50 | 2.20 | 1.90 | 1.60 | 1.60 | 3.80 | 2.20 | 2.15 |
| 29 | 2.80 | ..... | 3.80 | 2.40 | 2.40 | 2.20 | 1.90 | 1.60 | 1.60 | 2.70 | 2.10 | 2.10 |
| 30 | 2.90 | ..... | 9.90 | 2.30 | 2.10 | 2.20 | 2.00 | 1.60 | 1.70 | 2.70 | 1.80 | 2.10 |
| 31 | 3.00 | ..... | 6.20 | ..... | 2.00 | ..... | 2.10 | 1.60 | ..... | 2.00 | ..... | 2.30 |

*Rating table for Catawba River near Rockhill, S. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.6 | 2,700 | 3.2 | 6,300 | 4.8 | 10,800 | 8.5 | 26,500 |
| 1.8 | 3,100 | 3.4 | 6,800 | 5.0 | 11,500 | 9.0 | 29,000 |
| 2.0 | 3,550 | 3.6 | 7,300 | 5.5 | 13,275 | 9.5 | 31,500 |
| 2.2 | 4,000 | 3.8 | 7,800 | 6.0 | 15,250 | 10.0 | 34,000 |
| 2.4 | 4,450 | 4.0 | 8,300 | 6.5 | 17,275 | 10.5 | 36,750 |
| 2.6 | 4,900 | 4.2 | 8,900 | 7.0 | 19,500 | 11.0 | 39,500 |
| 2.8 | 5,350 | 4.4 | 9,500 | 7.5 | 21,750 | 11.5 | 42,500 |
| 3.0 | 5,800 | 4.6 | 10,100 | 8.0 | 24,000 | 12.0 | 45,500 |

*Estimated monthly discharge of Catawba River near Rockhill, S. C.*

[Drainage area, 2,987 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 21,750 | 4,675 | 6,019 | 2.02 | 2.33 |
| February | 29,000 | 4,900 | 8,846 | 2.96 | 3.08 |
| March | 70,400 | 5,125 | 11,724 | 3.93 | 4.53 |
| April | 8,600 | 4,225 | 5,368 | 1.80 | 2.01 |
| May | 5,125 | 3,550 | 4,290 | 1.44 | 1.66 |
| June | 79,400 | 3,325 | 7,580 | 2.54 | 2.93 |
| July | 4,900 | 3,325 | 3,717 | 1.24 | 1.43 |
| August | 15,250 | 2,700 | 3,634 | 1.22 | 1.41 |
| September | 13,275 | 2,700 | 3,651 | 1.22 | 1.36 |
| October | 7,800 | 2,700 | 3,804 | 1.27 | 1.46 |
| November | 15,650 | 2,900 | 3,830 | 1.28 | 1.43 |
| December | 13,650 | 3,775 | 5,686 | 1.90 | 2.19 |
| The year | 79,400 | 2,700 | 5,512 | 1.90 | 25.82 |

## CATAWBA RIVER AT CATAWBA, N. C.

This river rises in the western part of North Carolina, flows east, then south to the central part of South Carolina, where it unites with the Congaree to form the Santee River. At a number of points along this river there are water powers which may be developed. Near its source Catawba River flows through a mountainous country, which becomes flatter as the South Carolina line is approached. The greater part of its drainage basin is covered with woodland or forest. The station at Catawba was originally established by E. W. Myers in July, 1896, but was abandoned on December 31, 1899. It was located at the Southern Railway bridge, about one-half mile from Catawba, N. C. The river is straight above and below the bridge; the current is swift and evenly distributed across the stream. The channel is obstructed by three piers. At time of highest water the west bank overflows slightly and the sandy bed cuts out in places. The observer is C. A. Reed, jr., a clerk in the post-office at Catawba, N. C. Discharge measurements were made from the plank walk underneath the bridge. The railway bridge here is a deck bridge, and the gage was located on a footway which was laid along the lower system of bracing. When the station was visited in October, 1899, it was discovered that the span

on which the gage was located was to be removed, so it became necessary to move the gage rod, which was done as follows:

A small temporary gage was installed to discover any change in the stage of the river while the gage was being removed. The distance from the weight to the pointer on the wire was measured and found to be correct when the gage reading was taken and recorded, as was also the reading of the temporary gage. The rod was then moved to the position which was chosen for it and securely fastened to the guard rail on the downstream side and on the second span of the bridge from the west. The zero of the rod is over the center of the second floor beam from the west end of the second span from the west end of the bridge. From the zero of the rod to the outer rim of the pulley wheel is 2.6 feet. The small temporary gage was then read, and it was found that the reading was unchanged; so the gage in its new position was given the same reading which it had before. The length of the wire rope from the end of the weight to the pointer on the wire was then measured and found to be 55.25 feet. On June 13, 1900, the station was reestablished as a temporary station to assist in the study of the hydrography of the southern Appalachian region. The wire gage was suspended from the bridge and was referred to a painted gage rod, which was divided into feet and tenths and nailed to the guard rail. The initial point of sounding was on the west end of the bridge.

The station was again abandoned in April, 1902, as the section had been so badly injured by floods and by repairs to the bridge that it was almost worthless as a point of measurement. The drainage area above this station is 1,535 square miles.

*Daily gage height, in feet, of Catawba River at Catawba, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | Day. | Jan. | Feb. | Mar. | Apr. |
|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | 1902. | | | | |
| 1 | ..... | 3.35 | 11.80 | 5.35 | 17 | 2.55 | 2.60 | 6.50 | ..... |
| 2 | ..... | 3.35 | 8.20 | 4.60 | 18 | 2.50 | 2.60 | 4.20 | ..... |
| 3 | ..... | 4.60 | 6.50 | 3.85 | 19 | 2.50 | 2.60 | 3.95 | ..... |
| 4 | ..... | 4.35 | 5.25 | 3.25 | 20 | 2.50 | 2.60 | 3.80 | ..... |
| 5 | 3.25 | 4.05 | 4.40 | 3.00 | 21 | 2.50 | 2.85 | 3.55 | ..... |
| 6 | 3.20 | 4.05 | 3.85 | 3.00 | 22 | 2.50 | 3.60 | 3.25 | ..... |
| 7 | 3.20 | 3.80 | 3.60 | 3.00 | 23 | 2.50 | 3.35 | 3.10 | ..... |
| 8 | 3.15 | 3.60 | 3.45 | 3.20 | 24 | 2.50 | 3.10 | 3.00 | ..... |
| 9 | 3.05 | 2.85 | 3.30 | 3.05 | 25 | 2.50 | 8.20 | 2.90 | ..... |
| 10 | 2.90 | 2.60 | 3.15 | 3.00 | 26 | 2.50 | 6.70 | 2.85 | ..... |
| 11 | 2.80 | 2.60 | 3.10 | 3.00 | 27 | 2.50 | 4.75 | 2.85 | ..... |
| 12 | 2.80 | 2.60 | 3.00 | ..... | 28 | 3.25 | 19.00 | 3.90 | ..... |
| 13 | 2.75 | 2.60 | 3.00 | ..... | 29 | 4.10 | ..... | 13.25 | ..... |
| 14 | 2.70 | 2.60 | 3.15 | ..... | 30 | 3.80 | ..... | 6.70 | ..... |
| 15 | 2.70 | 2.60 | 4.10 | ..... | 31 | 3.50 | ..... | 6.10 | ..... |
| 16 | 2.60 | 2.60 | 4.90 | ..... | | | | | |

## CATAWBA RIVER NEAR MORGANTON, N. C.

This station was established on June 19, 1900, in connection with the hydrographic investigation of the southern Appalachian area which was then in progress, and was located on the highway bridge on the road from Morganton to Hartland. A wire gage of the usual type was established, with a horizontal scale board graduated to feet and tenths.

The river is straight for a considerable distance below the bridge, but there is a bend of nearly a right angle about 200 to 300 feet above. The banks of the stream are very high, having never been overflowed.

Previous to the establishment of this station the highest known flood in this stream rose to the level of the bridge floor, a height of about 28 feet; but in May, 1901, the river rose throughout this part of its course from 8 to 15 feet higher than ever before known, and the bridge and gage were destroyed.

The bed of the river is of sand and mud, with some loose rock, and will probably shift to a very slight extent during severe floods. This station was maintained only during 1900 and was abandoned at the end of that year.

During 1900 the following discharge measurements were made at this station:

June 13: Gage height, 1.33 feet; discharge, 1,393 second-feet.
June 18: Gage height, 2.50 feet; discharge, 4,030 second-feet.
July 6: Gage height, 1.30 feet; discharge, 1,164 second-feet.
August 8: Gage height, 0.60 foot; discharge, 558 second-feet.
September 24: Gage height, 0.50 foot; discharge, 525 second-feet.
November 7: Gage height, 1.50 feet; discharge, 1,374 second-feet.

*Daily gage height, in feet, of Catawba River near Morganton, N. C.*

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | |
| 1 | ..... | 1.53 | 0.97 | 0.60 | 0.50 | 1.25 | 1.35 |
| 2 | ..... | 1.78 | .83 | .55 | .50 | 1.25 | 1.25 |
| 3 | ..... | 1.60 | .78 | .60 | .58 | 2.70 | 1.65 |
| 4 | ..... | 1.48 | .75 | .53 | 1.00 | 1.70 | 2.40 |
| 5 | ..... | 1.43 | .75 | .55 | 1.20 | 1.45 | 2.30 |
| 6 | ..... | 1.30 | .70 | .50 | 1.10 | 1.70 | 1.97 |
| 7 | ..... | 1.23 | .70 | .45 | .80 | 1.55 | 1.60 |
| 8 | ..... | 1.20 | .65 | .50 | .85 | 1.25 | 1.45 |
| 9 | ..... | 1.10 | .63 | .45 | .80 | 1.35 | 1.50 |
| 10 | ..... | 1.50 | .60 | .45 | .75 | 1.20 | 1.40 |
| 11 | ..... | 1.00 | .58 | .33 | .65 | 1.20 | 1.25 |
| 12 | ..... | 1.00 | .57 | .35 | .60 | 1.20 | 1.20 |
| 13 | ..... | 1.25 | .65 | .33 | .55 | 1.10 | 1.10 |
| 14 | ..... | 1.00 | .65 | 1.55 | .58 | 1.25 | 1.05 |
| 15 | ..... | .95 | .63 | 2.50 | .53 | 1.25 | ..... |

*Daily gage height, in feet, of Catawba River near Morganton, N. C.*—Continued.

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | |
| 16 | ..... | 0.90 | 0.55 | 2.15 | 0.53 | 1.25 | ..... |
| 17 | ..... | .87 | .63 | 1.25 | .53 | 1.25 | ..... |
| 18 | ..... | .87 | .63 | 1.15 | .53 | 1.00 | ..... |
| 19 | 2.50 | .83 | .53 | .80 | .53 | 1.50 | ..... |
| 20 | 1.60 | .85 | .45 | .68 | .53 | 1.25 | ..... |
| 21 | 1.60 | .87 | .45 | .63 | .50 | 1.00 | ..... |
| 22 | 3.37 | .83 | .65 | .43 | .50 | 1.50 | ..... |
| 23 | 3.05 | .80 | .73 | .55 | 8.55 | .95 | ..... |
| 24 | 3.87 | .93 | .58 | .53 | 6.48 | 1.50 | ..... |
| 25 | 3.60 | 1.23 | .80 | .55 | 4.15 | 1.90 | ..... |
| 26 | 3.00 | 1.25 | .60 | .53 | 2.95 | 4.30 | ..... |
| 27 | 2.30 | 2.63 | .53 | .53 | 1.80 | 3.20 | ..... |
| 28 | 2.28 | 1.05 | .63 | .48 | 1.60 | 2.30 | ..... |
| 29 | 1.95 | 1.10 | .55 | .55 | 1.60 | 1.60 | ..... |
| 30 | 1.70 | 1.45 | .60 | .53 | 1.40 | 1.52 | ..... |
| 31 | ..... | 1.43 | .55 | ..... | 1.35 | ..... | ..... |

*Rating table for Catawba River near Morganton, N. C., for 1900.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.3 | 455 | 2.2 | 2,310 | 4.1 | 5,470 | 6.0 | 8,700 |
| .4 | 490 | 2.3 | 2,470 | 4.2 | 5,640 | 6.5 | 9,550 |
| .5 | 525 | 2.4 | 2,630 | 4.3 | 5,810 | 7.0 | 10,400 |
| .6 | 560 | 2.5 | 2,790 | 4.4 | 5,980 | 7.5 | 11,250 |
| .7 | 620 | 2.6 | 2,950 | 4.5 | 6,150 | 8.0 | 12,100 |
| .8 | 690 | 2.7 | 3,110 | 4.6 | 6,320 | 8.5 | 12,950 |
| .9 | 770 | 2.8 | 3,270 | 4.7 | 6,490 | 9.0 | 13,800 |
| 1.0 | 860 | 2.9 | 3,430 | 4.8 | 6,660 | 9.5 | 14,650 |
| 1.1 | 955 | 3.0 | 3,600 | 4.9 | 6,830 | 10.0 | 15,500 |
| 1.2 | 1,055 | 3.1 | 3,770 | 5.0 | 7,000 | 10.5 | 16,350 |
| 1.3 | 1,160 | 3.2 | 3,940 | 5.1 | 7,170 | 11.0 | 17,200 |
| 1.4 | 1,265 | 3.3 | 4,110 | 5.2 | 7,340 | 11.5 | 18,050 |
| 1.5 | 1,375 | 3.4 | 4,280 | 5.3 | 7,510 | 12.0 | 18,900 |
| 1.6 | 1,485 | 3.5 | 4,450 | 5.4 | 7,680 | 12.5 | 19,750 |
| 1.7 | 1,600 | 3.6 | 4,620 | 5.5 | 7,850 | 13.0 | 20,600 |
| 1.8 | 1,725 | 3.7 | 4,790 | 5.6 | 8,020 | 13.5 | 21,450 |
| 1.9 | 1,860 | 3.8 | 4,960 | 5.7 | 8,190 | 14.0 | 22,300 |
| 2.0 | 2,000 | 3.9 | 5,130 | 5.8 | 8,360 | | |
| 2.1 | 2,150 | 4.0 | 5,300 | 5.9 | 8,530 | | |

*Estimated monthly discharge of Catawba River near Morganton, N. C.*

[Drainage area, 758 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall in inches. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | |
| 1900. | | | | | | |
| June [a] | ..... | ..... | 2,948 | 3.89 | 1.74 | 9.01 |
| July | 3,000 | 690 | 1,092 | 1.440 | 1.66 | 4.24 |
| August | 815 | 507 | 597 | .797 | .91 | 1.96 |
| September | 2,790 | 473 | 734 | .96 | 1.08 | 4.23 |
| October | 13,035 | 525 | 1,698 | 2.24 | 2.59 | 9.76 |
| November | 5,810 | 815 | 1,562 | 2.06 | 2.30 | ..... |
| December [b] | ..... | ..... | 1,462 | 1.93 | 1.00 | 4.58 |

[a] 12 days. [b] 14 days.

## JOHN RIVER NEAR MORGANTON, N. C.

This station, like the one on the Catawba River near Morganton, was established in connection with the hydrographic investigation of the southern Appalachian area. It was located on the highway bridge on the road from Morganton to Lenoir.

A wire gage was established similar to that at the Morganton station, the gage rod being nailed to the guard rail on the downstream side of the bridge.

The section presented at this station is fairly good at all times, though for a part of the way the bottom is rough and rocky. The river banks are high and are never overflowed, the bed is permanent, and the course of the stream is straight for some distance above and below the station.

This station was abandoned on December 31, 1901.

*Discharge measurements of John River near Morganton, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| June 13 | E. W. Myers | 2.64 | 465 |
| June 19 | do | 3.50 | 1,202 |
| July 6 | do | 2.63 | 511 |
| August 8 | do | 1.90 | 135 |
| September 24 | do | 1.90 | 148 |
| November 7 | do | 2.32 | 367 |

*Daily gage height, in feet, of John River near Morganton, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | | | | | | |
| 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | ..... | 1.80 | 2.30 | 2.32 |
| 2 | ..... | ..... | ..... | ..... | ..... | ..... | 2.60 | 2.03 | ..... | 1.83 | 2.30 | ..... |
| 3 | ..... | ..... | ..... | ..... | ..... | ..... | 2.55 | 2.00 | ..... | 1.93 | 2.50 | 2.32 |
| 4 | ..... | ..... | ..... | ..... | ..... | ..... | 2.58 | 2.15 | ..... | 2.43 | ..... | 3.38 |
| 5 | ..... | ..... | ..... | ..... | ..... | ..... | 2.70 | 1.90 | ..... | 2.38 | 2.60 | 3.20 |
| 6 | ..... | ..... | ..... | ..... | ..... | ..... | 2.58 | 1.88 | ..... | 2.28 | 2.35 | 2.85 |
| 7 | ..... | ..... | ..... | ..... | ..... | ..... | 2.45 | 1.93 | ..... | 2.10 | 2.35 | 2.67 |
| 8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1.90 | ..... | 2.03 | 2.30 | 2.62 |
| 9 | ..... | ..... | ..... | ..... | ..... | ..... | 2.38 | 1.90 | ..... | 1.93 | 2.25 | 2.00 |
| 10 | ..... | ..... | ..... | ..... | ..... | ..... | 2.30 | 1.90 | 1.70 | 1.90 | 2.25 | 2.50 |
| 11 | ..... | ..... | ..... | ..... | ..... | ..... | 2.25 | 1.90 | 1.70 | 1.90 | ..... | 2.35 |
| 12 | ..... | ..... | ..... | ..... | ..... | ..... | 2.25 | ..... | 1.70 | 1.95 | 2.20 | 2.32 |
| 13 | ..... | ..... | ..... | ..... | ..... | ..... | 2.30 | 1.98 | 1.70 | 1.90 | 2.20 | 2.35 |
| 14 | ..... | ..... | ..... | ..... | ..... | ..... | 2.25 | 1.88 | 1.80 | ..... | 2.15 | 2.30 |
| 15 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1.93 | 2.90 | 1.90 | 2.15 | 2.28 |
| 16 | ..... | ..... | ..... | ..... | ..... | ..... | 2.15 | 1.93 | ..... | 1.88 | 2.10 | ..... |
| 17 | ..... | ..... | ..... | ..... | ..... | ..... | 2.13 | 1.93 | 2.30 | 1.83 | 2.05 | 2.25 |
| 18 | ..... | ..... | ..... | ..... | ..... | ..... | 2.10 | 1.93 | 2.03 | 1.78 | ..... | 2.20 |
| 19 | ..... | ..... | ..... | ..... | ..... | 3.50 | 2.10 | ..... | 1.95 | 1.73 | 2.12 | 2.18 |
| 20 | ..... | ..... | ..... | ..... | ..... | 3.25 | 2.15 | ..... | 1.90 | 1.73 | 2.15 | 2.22 |
| 21 | ..... | ..... | ..... | ..... | ..... | 2.80 | 2.45 | ..... | 1.90 | ..... | 2.12 | 3.08 |
| 22 | ..... | ..... | ..... | ..... | ..... | 3.28 | ..... | ..... | 1.90 | 1.88 | 2.10 | 2.92 |
| 23 | ..... | ..... | ..... | ..... | ..... | 3.20 | 2.10 | ..... | ..... | 14.72 | 2.08 | ..... |
| 24 | ..... | ..... | ..... | ..... | ..... | ..... | 2.28 | ..... | 1.90 | 5.60 | 2.08 | 2.78 |
| 25 | ..... | ..... | ..... | ..... | ..... | 3.75 | 2.35 | ..... | 1.85 | 3.45 | ..... | 2.68 |
| 26 | ..... | ..... | ..... | ..... | ..... | 3.58 | 2.30 | ..... | 1.83 | 2.98 | 4.55 | 2.48 |
| 27 | ..... | ..... | ..... | ..... | ..... | 3.23 | 2.23 | ..... | 1.83 | 2.70 | 3.00 | 2.32 |
| 28 | ..... | ..... | ..... | ..... | ..... | 3.20 | 2.20 | ..... | 1.80 | ..... | 2.65 | 2.32 |
| 29 | ..... | ..... | ..... | ..... | ..... | 2.95 | ..... | ..... | 1.83 | 2.45 | 2.52 | 2.28 |
| 30 | ..... | ..... | ..... | ..... | ..... | 2.85 | 2.20 | ..... | ..... | 2.30 | 2.42 | ..... |
| 31 | ..... | ..... | ..... | ..... | ..... | ..... | 2.13 | ..... | ..... | 2.30 | ..... | 2.90 |
| 1901. | | | | | | | | | | | | |
| 1 | 2.62 | 2.23 | 2.20 | 3.05 | 2.95 | 3.63 | 3.45 | 2.60 | 5.15 | 3.08 | 2.52 | 2.35 |
| 2 | 2.52 | 2.28 | 2.15 | 8.85 | 2.90 | ..... | 3.30 | 2.50 | 4.05 | 3.00 | 2.53 | 2.40 |
| 3 | 2.42 | ..... | ..... | 8.20 | 2.90 | 3.42 | 3.15 | 2.40 | 3.90 | 2.90 | 2.53 | 2.43 |
| 4 | 2.32 | 2.65 | 2.15 | 4.15 | 2.80 | 3.33 | 3.10 | ..... | 3.80 | 2.80 | 2.53 | 2.43 |
| 5 | 2.30 | 2.33 | 2.13 | 3.90 | ..... | 3.25 | 3.00 | 2.60 | 3.60 | 2.75 | 2.53 | 2.33 |
| 6 | 2.32 | 2.33 | 2.13 | 3.25 | 2.80 | 3.50 | 3.00 | 17.02 | 3.50 | 2.70 | 2.53 | 2.33 |
| 7 | 2.32 | 2.33 | 2.13 | ..... | 2.73 | 3.70 | ..... | 6.00 | 3.40 | 2.70 | 2.53 | 2.33 |
| 8 | 2.32 | 2.28 | 2.13 | 3.18 | 3.85 | 3.45 | 3.00 | 3.85 | 3.20 | 2.73 | 2.53 | 2.35 |
| 9 | 2.32 | 2.53 | 2.08 | 2.95 | 3.05 | ..... | 3.00 | 3.38 | 3.20 | 2.72 | 2.53 | 2.40 |
| 10 | 2.37 | ..... | ..... | 2.70 | 3.08 | 3.13 | 2.93 | 3.05 | 3.20 | 2.70 | 2.53 | 3.50 |
| 11 | 2.80 | 2.43 | 3.25 | 2.68 | 3.05 | 3.08 | 2.90 | ..... | 3.17 | 2.70 | 2.53 | 3.10 |
| 12 | 5.65 | 2.43 | 2.45 | 2.60 | ..... | 3.00 | 2.95 | 3.27 | 3.17 | 2.68 | 2.50 | 2.90 |
| 13 | ..... | 2.38 | 2.33 | 2.70 | 2.78 | 2.90 | 3.00 | 4.35 | 3.10 | 2.70 | 2.53 | 2.80 |
| 14 | 3.02 | 2.33 | 2.30 | ..... | 2.70 | 8.95 | ..... | 6.10 | 3.08 | 2.95 | 2.50 | 3.10 |
| 15 | 2.88 | 2.35 | 2.28 | 2.85 | 2.70 | 4.60 | 2.95 | 10.30 | ..... | 2.80 | 2.50 | 19.00 |
| 16 | 2.68 | 2.35 | 2.25 | 2.68 | 2.63 | ..... | 3.25 | 5.75 | 3.60 | 2.78 | 2.45 | 6.58 |
| 17 | 2.58 | ..... | ..... | 2.60 | 2.57 | 5.55 | 3.05 | 5.00 | 3.15 | 2.72 | 2.47 | 4.70 |
| 18 | 2.50 | 2.30 | 2.23 | 2.70 | 2.50 | 4.35 | 2.90 | ..... | 3.10 | 2.68 | 2.48 | 3.75 |
| 19 | 2.48 | 2.33 | 2.20 | 5.20 | ..... | 3.92 | 3.15 | 5.15 | 3.00 | 2.65 | 2.47 | 3.05 |
| 20 | ..... | 2.28 | 2.20 | 17.70 | 3.18 | 4.45 | 3.05 | 4.48 | 3.00 | 2.60 | 2.48 | 2.95 |
| 21 | 2.43 | 2.28 | 2.72 | 6.60 | 10.25 | 4.27 | ..... | 4.50 | 2.95 | 2.60 | 2.42 | 2.87 |
| 22 | 2.43 | 2.28 | 2.32 | 4.60 | 20.50 | 7.90 | 2.77 | 7.15 | ..... | 2.60 | 2.43 | ..... |

*Daily gage height, in feet, of John River near Morganton, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 23 | 2.40 | 2.23 | 2.25 | 4.15 | 6.15 | ..... | 2.70 | 6.11 | 2.90 | 2.60 | 2.47 | 2.90 |
| 24 | 2.33 | ..... | ..... | 3.70 | 4.80 | 4.70 | 2.70 | 4.40 | 2.87 | 2.55 | 2.50 | 2.90 |
| 25 | 2.33 | 2.20 | 2.90 | 3.53 | 4.40 | 4.15 | 2.63 | ..... | 2.88 | 2.55 | 2.50 | 3.00 |
| 26 | 2.30 | 2.23 | 13.60 | 3.38 | ..... | 3.80 | 2.60 | 4.55 | 2.80 | 2.50 | 2.43 | 3.42 |
| 27 | ..... | 2.23 | 6.15 | 3.27 | 6.55 | 3.65 | 2.57 | 4.60 | 2.70 | 2.50 | 2.42 | 2.90 |
| 28 | 2.28 | 2.23 | 4.05 | ..... | 5.00 | 3.60 | ..... | 4.48 | 3.60 | 2.53 | 2.35 | 2.85 |
| 29 | 2.28 | ..... | 3.35 | 3.08 | 4.20 | 3.50 | 2.60 | 4.43 | 3.10 | 2.50 | 2.38 | 15.00 |
| 30 | 2.33 | ..... | 3.75 | 3.00 | 3.90 | ..... | 8.60 | 6.15 | 3.15 | 2.55 | 2.30 | 9.00 |
| 31 | 2.33 | ..... | ..... | ..... | ..... | ..... | 2.73 | 5.90 | ..... | 2.50 | ..... | 6.45 |

*Rating table for John River near Morganton, N. C., for 1900 and 1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.7 | 80 | 3.6 | 1,075 | 5.5 | 2,215 | 7.4 | 3,355 |
| 1.8 | 110 | 3.7 | 1,135 | 5.6 | 2,275 | 7.5 | 3,415 |
| 1.9 | 140 | 3.8 | 1,195 | 5.7 | 2,335 | 7.6 | 3,475 |
| 2.0 | 185 | 3.9 | 1,255 | 5.8 | 2,395 | 7.7 | 3,535 |
| 2.1 | 233 | 4.0 | 1,315 | 5.9 | 2,455 | 7.8 | 3,595 |
| 2.2 | 281 | 4.1 | 1,375 | 6.0 | 2,515 | 7.9 | 3,655 |
| 2.3 | 329 | 4.2 | 1,435 | 6.1 | 2,575 | 8.0 | 3,715 |
| 2.4 | 377 | 4.3 | 1,495 | 6.2 | 2,635 | 8.1 | 3,775 |
| 2.5 | 425 | 4.4 | 1,555 | 6.3 | 2,695 | 8.2 | 3,835 |
| 2.6 | 475 | 4.5 | 1,615 | 6.4 | 2,755 | 8.3 | 3,895 |
| 2.7 | 535 | 4.6 | 1,675 | 6.5 | 2,815 | 8.4 | 3,955 |
| 2.8 | 595 | 4.7 | 1,735 | 6.6 | 2,875 | 8.5 | 4,015 |
| 2.9 | 655 | 4.8 | 1,795 | 6.7 | 2,935 | 8.6 | 4,075 |
| 3.0 | 715 | 4.9 | 1,855 | 6.8 | 2,995 | 8.7 | 4,135 |
| 3.1 | 775 | 5.0 | 1,915 | 6.9 | 3,055 | 8.8 | 4,195 |
| 3.2 | 835 | 5.1 | 1,975 | 7.0 | 3,115 | 8.9 | 4,255 |
| 3.3 | 895 | 5.2 | 2,035 | 7.1 | 3,175 | 9.0 | 4,315 |
| 3.4 | 955 | 5.3 | 2,095 | 7.2 | 3,235 | | |
| 3.5 | 1,015 | 5.4 | 2,155 | 7.3 | 3,295 | | |

*Estimated monthly discharge of John River near Morganton, N. C.*

[Drainage area, 213 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | |
| 1900. | | | | | | *Inches.* |
| June [a] | ..... | ..... | 869 | 4.08 | 1.82 | 8.26 |
| July | 535 | 233 | 330 | 1.55 | 1.79 | 4.95 |
| August [b] | ..... | ..... | 169 | .79 | .53 | 1.22 |
| September [c] | ..... | ..... | 177 | .83 | .65 | 2.49 |
| October | 7,735 | 95 | 567 | 2.71 | 3.13 | 9.83 |
| November | 1,645 | 209 | 391 | 1.84 | 2.05 | ..... |
| December | 955 | 281 | 455 | 2.14 | 2.47 | 4.74 |
| 1901. | | | | | | |
| January | 2,305 | 329 | 502 | 2.36 | 2.72 | 3.09 |
| February | 505 | 281 | 352 | 1.65 | 1.72 | 2.26 |
| March | 6,075 | 233 | 709 | 3.33 | 3.71 | 6.77 |
| April | 9,535 | 475 | 1,447 | 6.79 | 7.59 | 9.21 |
| May | 11,215 | 425 | 1,485 | 6.97 | 8.04 | 9.28 |
| June | 4,285 | 655 | 1,426 | 6.69 | 7.47 | 9.13 |
| July | 4,075 | 450 | 783 | 3.68 | 4.24 | 1.80 |
| August | 9,115 | 377 | 1,923 | 9.03 | 10.40 | 19.44 |
| September | 2,005 | 535 | 853 | 4.00 | 4.46 | 4.35 |
| October | 775 | 425 | 531 | 2.49 | 2.87 | .97 |
| November | 450 | 329 | 419 | 1.97 | 2.19 | .87 |
| December | 10,315 | 353 | 1,458 | 6.48 | 7.48 | 8.42 |
| The year | 11,215 | 233 | 991 | 4.62 | 62.89 | 75.59 |

[a] 12 days. [b] 18 days. [c] 21 days.

## LINVILLE RIVER NEAR BRIDGEWATER, N. C.

This station, one of the temporary stations established in connection with the hydrographic investigations of the southern Appalachian region, was established on July 3, 1900, and was located at Poole's mill, just above the ford on the road from Morganton to Marion, the gage being near the tailrace of the mill. The gagings were made about 200 feet below the site of the gage.

Owing to the construction of the gage it was placed so that a rise in the stage of the water surface was indicated by a decrease in the recorded figures, and vice versa, the effect being the same as if the stage of the water surface had been determined by direct measurement down from a fixed point, the gage being placed upside down.

This peculiarity of the gage was not noted in the previous publication of the gage heights and discharge measurements in Water-Supply Paper No. 48, page 142; but the gage heights here given are rectified by subtracting each reading from 12 feet, the rod being 12 feet long, and the rating table for this station is made out for the rectified gage heights.

The bed of the river is extremely rough and rocky throughout its entire course, and a section perfectly suitable for making discharge measurements could not be discovered. There are no bridges, so that it was necessary to make the gagings by wading, and as the rise is considerable and the current velocity very great at high water no measurements of flood discharge were possible.

The bench mark to which the gage was referred is a cross cut in the rock cliff on the left bank of the stream, at the point of gaging; and the initial point of sounding was the end of a log which is sunk in the sand of the right bank. The drainage area above this station is rough, mountainous, and largely forest covered.

*Discharge measurements of Linville River near Bridgewater, N. C.*

| Date. | Gage height. | Discharge. | Date. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| 1900. | *Feet.* | *Second-feet.* | 1900. | *Feet.* | *Sec.-feet.* |
| June 14 | 2.08 | 104 | August 17 | 1.85 | 78 |
| July 3 | 2.46 | 216 | September 21 | 2.20 | 55 |
| July 10 | 2.10 | 116 | | | |

*Daily gage height, in feet, of Linville River near Bridgewater, N. C.*

| Day. | July. | Aug. | Sept. | Oct. | Day. | July. | Aug. | Sept. | Oct. |
|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | 1900. | | | | |
| 1 | ..... | 2.17 | 1.83 | 2.25 | 17 | 2.17 | 1.87 | 2.33 | ..... |
| 2 | ..... | 2.08 | 1.83 | 2.33 | 18 | 2.17 | 1.87 | 2.33 | ..... |
| 3 | 2.46 | 2.12 | 1.79 | 2.42 | 19 | 1.96 | 1.92 | 2.00 | ..... |
| 4 | 2.64 | 2.17 | 1.79 | 2.50 | 20 | 2.00 | 1.92 | 2.00 | ..... |
| 5 | 2.42 | 2.08 | 1.75 | 2.42 | 21 | 2.25 | 1.87 | 2.08 | ..... |
| 6 | 2.46 | 1.92 | 1.75 | 2.42 | 22 | 2.08 | 1.83 | 2.08 | ..... |
| 7 | 2.37 | 2.00 | 1.75 | 2.37 | 23 | 2.08 | 1.83 | 2.08 | ..... |
| 8 | 2.42 | 1.92 | 1.71 | 2.37 | 24 | 2.08 | 1.83 | 2.08 | ..... |
| 9 | 2.29 | 1.92 | 1.71 | 2.37 | 25 | 2.17 | 1.79 | 2.00 | ..... |
| 10 | 2.42 | 1.92 | 1.71 | 2.37 | 26 | 2.08 | 1.83 | 1.92 | ..... |
| 11 | 2.37 | 1.92 | 1.71 | 2.42 | 27 | 2.25 | 1.79 | 1.92 | ..... |
| 12 | 2.33 | 1.92 | 1.67 | 2.50 | 28 | 2.25 | 1.79 | 1.87 | ..... |
| 13 | 2.37 | 1.92 | 1.67 | 2.56 | 29 | 2.08 | 1.79 | 2.25 | ..... |
| 14 | 2.33 | 1.87 | 1.71 | 2.56 | 30 | 2.17 | 1.79 | 2.25 | ..... |
| 15 | 2.29 | 1.92 | 1.79 | ..... | 31 | 2.08 | 1.79 | ..... | ..... |
| 16 | 2.33 | 1.92 | 4.50 | ..... | | | | | |

*Rating table for Linville River near Bridgewater, N. C., for 1900.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.6 | 55 | 2.4 | 194 | 3.2 | 515 | 4.0 | 835 |
| 1.7 | 63 | 2.5 | 235 | 3.3 | 555 | 4.1 | 875 |
| 1.8 | 78 | 2.6 | 275 | 3.4 | 595 | 4.2 | 915 |
| 1.9 | 84 | 2.7 | 315 | 3.5 | 635 | 4.3 | 955 |
| 2.0 | 97 | 2.8 | 355 | 3.6 | 675 | 4.4 | 995 |
| 2.1 | 112 | 2.9 | 395 | 3.7 | 715 | 4.5 | 1,035 |
| 2.2 | 132 | 3.0 | 435 | 3.8 | 755 | | |
| 2.3 | 160 | 3.1 | 475 | 3.9 | 795 | | |

*Estimated monthly discharge of Linville River near Bridgewater, N. C.*

[Drainage area, 86 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. | |
| 1900. | | | | | | *Inches.* |
| July | 295 | 90 | 154 | 1.79 | 2.06 | 3.75 |
| August | 122 | 73 | 83 | .96 | 1.11 | 3.20 |
| September | 1,035 | 59 | 122 | 1.41 | 1.57 | 2.79 |
| October[a] | ..... | ..... | 191 | 2.22 | 1.16 | 11.54 |

[a] Fourteen days' record.

## BROAD RIVER (OF THE CAROLINAS) NEAR ALSTON, S. C.

This station was established by E. W. Myers on July 3, 1896, and is located at the Southern Railway bridge, near Alston, S. C., about 25 miles above Columbia. The length of the wire gage is 42.65 feet. The section here is not a good one, being broken by the foundations of an old bridge crossing at the same place as the present one. The bed is flat, muddy, and somewhat shifting. The river is straight for a long distance above and below the station. The current is swift and the velocity fairly uniform across the section. The observer is G. M. Heron, a farmer, of Alston, S. C.

The following discharge measurements were made during 1902 by B. S. Drane:

June 14: Gage height, 2.60 feet; discharge, 4,224 second-feet.
July 19: Gage height, 3.40 feet; discharge, 3,757 second-feet.
August 9: Gage height, 3.10 feet; discharge, 3,143 second-feet.

*Daily gage height, in feet, of Broad River near Alston, S. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 15.32 | 13.70 | 19.55 | 7.30 | 4.75 | 3.70 | 3.65 | 3.65 | 3.15 | 4.25 | 3.80 | 10.80 |
| 2 | 9.50 | 21.17 | 20.30 | 6.50 | 4.85 | 3.25 | 3.45 | 4.15 | 3.05 | 4.20 | 3.80 | 7.53 |
| 3 | 7.10 | 20.88 | 16.15 | 6.08 | 4.60 | 4.10 | 3.25 | 3.70 | 3.05 | 3.40 | 3.60 | 13.28 |
| 4 | 6.45 | 14.07 | 9.98 | 5.90 | 5.15 | 3.65 | 3.25 | 4.20 | 2.95 | 3.30 | 3.40 | 12.13 |
| 5 | 5.90 | 8.70 | 7.82 | 5.75 | 4.70 | 3.55 | 3.45 | 3.40 | 4.70 | 4.10 | 3.60 | 8.90 |
| 6 | 5.40 | 6.50 | 7.07 | 5.70 | 4.50 | 3.40 | 3.25 | 3.60 | 4.55 | 4.90 | 3.50 | 7.40 |
| 7 | 5.40 | 6.10 | 6.60 | 5.40 | 4.40 | 3.35 | 3.30 | 3.35 | 3.40 | 5.90 | 4.90 | 6.35 |
| 8 | 5.30 | 5.80 | 6.10 | 6.20 | 4.40 | 4.10 | 2.90 | 3.30 | 3.20 | 4.60 | 4.70 | 5.50 |
| 9 | 5.20 | 5.50 | 6.40 | 6.05 | 4.35 | 3.87 | 3.55 | 3.10 | 3.45 | 3.80 | 4.10 | 5.00 |
| 10 | 5.05 | 5.15 | 6.25 | 5.60 | 4.25 | 3.55 | 3.80 | 3.25 | 10.35 | 3.60 | 3.90 | 4.65 |
| 11 | 4.90 | 5.10 | 5.95 | 5.30 | 4.35 | 3.45 | 3.75 | 3.50 | 9.00 | 4.90 | 3.40 | 4.55 |
| 12 | 4.85 | 5.00 | 5.75 | 5.20 | 5.05 | 3.30 | 4.15 | 3.15 | 5.10 | 4.30 | 3.80 | 4.10 |
| 13 | 4.55 | 4.90 | 5.85 | 5.20 | 4.15 | 3.25 | 4.15 | 3.45 | 4.05 | 4.90 | 3.50 | 6.15 |
| 14 | 4.45 | 4.80 | 6.35 | 5.15 | 4.20 | 2.40 | 4.25 | 3.20 | 3.75 | 4.40 | 3.45 | 4.55 |
| 15 | 4.55 | 4.70 | 5.70 | 5.05 | 4.05 | 4.35 | 3.75 | 4.65 | 3.45 | 5.10 | 3.40 | 4.40 |
| 16 | 4.50 | 4.90 | 7.50 | 5.15 | 4.70 | 10.23 | 4.40 | 5.05 | 3.20 | 4.30 | 3.55 | 4.30 |
| 17 | 4.70 | 5.45 | 12.25 | 5.25 | 4.15 | 14.67 | 3.90 | 5.05 | 3.30 | 3.90 | 3.60 | 5.35 |
| 18 | 4.50 | 5.15 | 10.98 | 6.10 | 4.45 | 9.55 | 3.60 | 3.95 | 3.20 | 3.60 | 4.50 | 7.20 |
| 19 | 4.40 | 5.20 | 7.85 | 5.70 | 4.45 | 5.80 | 3.45 | 3.20 | 3.20 | 3.00 | 5.50 | 6.00 |
| 20 | 4.45 | 5.30 | 6.75 | 7.55 | 4.90 | 4.55 | 3.35 | 3.15 | 3.10 | 3.70 | 4.60 | 6.20 |
| 21 | 4.70 | 5.75 | 6.35 | 6.00 | 5.70 | 4.35 | 3.45 | 3.00 | 3.45 | 3.40 | 4.05 | 4.80 |
| 22 | 6.35 | 8.35 | 6.10 | 5.55 | 4.25 | 4.35 | 2.95 | 2.95 | 3.35 | 3.50 | 3.95 | 9.65 |
| 23 | 5.60 | 9.60 | 5.90 | 5.25 | 4.25 | 4.15 | 3.70 | 3.15 | 3.10 | 3.70 | 3.95 | 7.70 |
| 24 | 5.00 | 8.50 | 5.70 | 5.10 | 4.05 | 4.55 | 3.35 | 3.85 | 3.20 | 3.30 | 3.70 | 6.05 |
| 25 | 4.75 | 9.00 | 5.50 | 5.05 | 4.10 | 4.75 | 4.25 | 3.45 | 3.05 | 3.40 | 3.30 | 5.30 |
| 26 | 4.70 | 11.35 | 5.50 | 4.90 | 4.15 | 4.00 | 4.15 | 3.05 | 3.10 | 3.40 | 7.13 | 4.95 |
| 27 | 4.50 | 8.80 | 5.35 | 4.85 | 4.25 | 4.57 | 3.40 | 3.15 | 3.25 | 3.40 | 5.80 | 4.70 |
| 28 | 4.70 | 13.90 | 5.60 | 4.75 | 3.85 | 5.20 | 3.85 | 3.15 | 3.80 | 12.60 | 4.75 | 4.30 |
| 29 | 7.45 | ..... | 7.15 | 4.70 | 3.75 | 4.35 | 3.85 | 3.90 | 3.55 | 7.60 | 4.15 | 4.25 |
| 30 | 6.80 | ..... | 12.77 | 4.75 | 3.70 | 3.75 | 4.25 | 3.55 | 3.25 | 4.40 | 3.90 | 5.20 |
| 31 | 10.75 | ..... | 10.15 | ..... | 3.60 | ..... | 4.15 | 3.25 | ..... | 4.20 | ..... | 4.90 |

*Rating table for Broad River near Alston, S. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.4 | 2,010 | 4.4 | 5,760 | 8.5 | 18,000 | 13.5 | 37,875 |
| 2.6 | 2,340 | 4.6 | 6,320 | 9.0 | 19,500 | 14.0 | 40,500 |
| 2.8 | 2,670 | 4.8 | 6,900 | 9.5 | 21,000 | 14.5 | 43,125 |
| 3.0 | 3,000 | 5.0 | 7,500 | 10.0 | 22,500 | 15.0 | 45,750 |
| 3.2 | 3,340 | 5.5 | 9,000 | 10.5 | 24,250 | 16.0 | 52,500 |
| 3.4 | 3,680 | 6.0 | 10,500 | 11.0 | 26,250 | 17.0 | 60,750 |
| 3.6 | 4,020 | 6.5 | 12,000 | 11.5 | 28,500 | 18.0 | 70,000 |
| 3.8 | 4,360 | 7.0 | 13,500 | 12.0 | 30,750 | 19.0 | 79,250 |
| 4.0 | 4,730 | 7.5 | 15,000 | 12.5 | 33,000 | 20.0 | 88,500 |
| 4.2 | 5,200 | 8.0 | 16,500 | 13.0 | 35,250 | | |

*Estimated monthly discharge of Broad River near Alston, S. C.*

[Drainage area, 4,609 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 47,910 | 5,760 | 10,424 | 2.26 | 2.61 |
| February | 99,323 | 6,610 | 21,190 | 4.60 | 4.79 |
| March | 91,275 | 8,550 | 20,322 | 4.41 | 5.08 |
| April | 15,150 | 6,610 | 9,204 | 2.00 | 2.23 |
| May | 9,600 | 4,020 | 5,798 | 1.26 | 1.45 |
| June | 44,018 | 2,010 | 7,413 | 1.61 | 1.80 |
| July | 5,760 | 2,835 | 4,200 | .91 | 1.05 |
| August | 7,650 | 2,917 | 4,067 | .88 | 1.01 |
| September | 23,725 | 2,917 | 5,060 | 1.10 | 1.23 |
| October | 33,450 | 3,000 | 6,305 | 1.37 | 1.58 |
| November | 13,890 | 3,510 | 5,275 | 1.14 | 1.27 |
| December | 36,720 | 4,965 | 11,737 | 2.55 | 2.94 |
| The year | 99,323 | 2,010 | 9,250 | 2.01 | 27.04 |

## SALUDA RIVER NEAR WATERLOO, S. C.

Saluda River rises in the mountains between North and South Carolina, flows in a southeasterly direction, and unites, near Columbia, S. C., with the Broad, to form the Congaree. Measurements have been made on the Saluda to determine the available water power. The station was established by E. W. Myers on August 30, 1896. It is 1 mile below the mouth of Reedy River, at the Charleston and Western Carolina Railway bridge, about 3 miles from Coronaca station, South Carolina. The river is straight for several hundred yards above and below the bridge. The flow is probably influenced by dams some miles above. The bed of the stream is of sand and mud and liable to change during high water. The banks are low, the right bank being subject to overflow. The observer is R. N. Cunningham, storekeeper and farmer at Waterloo, S. C. The locality is reached by private conveyance from Greenwood, S. C. The discharge measurements are made from the railraod bridge.

The gage was changed July 20, 1902, so that the readings are 1.5 feet higher. The following table of 1902 gage heights gives the heights on the new gage:

The following discharge measurements were made during 1902 by J. S. Henderson and B. S. Drane:

June 14: Gage height, 5.60 feet; discharge, 745 second-feet.
July 19: Gage height, 5.47 feet; discharge, 845 second-feet.
August 9: Gage height, 5.32 feet; discharge, 844 second-feet.
August 25: Gage height, 4.80 feet; discharge, 487 second-feet.

*Daily gage height, in feet, of Saluda River near Waterloo, S. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 12.50 | 18.85 | 21.10 | 8.90 | 6.90 | 7.15 | 5.75 | 6.65 | 5.05 | 6.85 | 6.65 | 8.50 |
| 2 | 9.70 | 24.90 | 19.45 | 8.45 | 6.80 | 5.05 | 6.75 | 6.60 | 5.40 | 5.90 | 5.60 | 7.65 |
| 3 | 9.10 | 19.60 | 13.10 | 8.25 | 6.90 | 5.70 | 5.60 | 6.75 | 6.20 | 5.70 | 5.50 | 13.15 |
| 4 | 8.80 | 12.75 | 10.40 | 8.15 | 8.10 | 5.55 | 5.30 | 5.05 | 6.45 | 6.60 | 6.50 | 12.10 |
| 5 | 8.45 | 9.65 | 9.70 | 8.10 | 5.50 | 5.45 | 5.65 | 6.40 | 5.60 | 7.40 | 5.80 | 9.85 |
| 6 | 7.85 | 8.90 | 9.10 | 8.95 | 6.40 | 5.45 | 5.85 | 6.40 | 6.40 | 7.75 | 6.35 | 8.75 |
| 7 | 7.85 | 8.60 | 8.85 | 6.75 | 6.30 | 6.65 | 5.45 | 5.25 | 5.30 | 6.80 | 5.80 | 7.75 |
| 8 | 7.30 | 8.15 | 8.60 | 8.05 | 6.35 | 6.65 | 5.50 | 5.25 | 5.35 | 6.65 | 6.80 | 7.35 |
| 9 | 7.55 | 7.95 | 8.95 | 7.85 | 6.25 | 5.00 | 6.85 | 5.30 | 8.85 | 6.65 | 6.00 | 6.70 |
| 10 | 7.35 | 7.90 | 8.55 | 7.65 | 7.15 | 5.85 | 5.80 | 6.00 | 12.20 | 5.75 | 6.05 | 6.60 |
| 11 | 7.45 | 7.50 | 8.10 | 7.55 | 7.75 | 5.45 | 6.05 | 4.50 | 8.40 | 6.50 | 5.60 | 6.80 |
| 12 | 7.80 | 7.25 | 8.15 | 7.45 | 6.10 | 5.35 | 6.15 | 5.20 | 6.25 | 6.70 | 6.60 | 6.90 |
| 13 | 7.10 | 7.25 | 9.40 | 7.65 | 7.00 | 5.35 | 8.00 | 5.30 | 6.70 | 5.80 | 5.70 | 7.45 |
| 14 | 6.95 | 7.15 | 8.40 | 7.30 | 6.60 | 6.55 | 5.50 | 5.35 | 5.50 | 6.10 | 5.70 | 7.20 |
| 15 | 6.80 | 7.20 | 8.15 | 7.20 | 6.40 | 7.50 | 5.70 | 5.25 | 5.45 | 6.90 | 6.60 | 6.10 |
| 16 | 6.75 | 7.25 | 12.85 | 7.20 | 6.40 | 13.05 | 7.90 | 5.70 | 6.50 | 5.95 | 5.85 | 6.35 |
| 17 | 6.70 | 7.30 | 14.00 | 7.30 | 6.85 | 11.85 | 6.25 | 6.75 | 5.85 | 5.90 | 5.20 | 8.70 |
| 18 | 6.65 | 7.50 | 10.95 | 7.70 | 7.20 | 7.00 | 5.50 | 5.05 | 6.30 | 6.55 | 6.00 | 9.30 |
| 19 | 7.50 | 7.40 | 9.20 | 7.60 | 6.15 | 6.40 | 6.00 | 5.25 | 6.45 | 5.80 | 6.20 | 7.70 |
| 20 | 6.25 | 7.70 | 8.60 | 8.35 | 7.50 | 6.20 | 6.80 | 5.25 | 7.05 | 5.85 | 6.60 | 7.15 |
| 21 | 7.30 | 8.90 | 8.45 | 7.40 | 6.90 | 6.90 | 5.00 | 5.30 | 5.95 | 5.60 | 5.75 | 7.75 |
| 22 | 7.40 | 9.20 | 8.20 | 7.20 | 6.05 | 6.65 | 6.07 | 5.10 | 5.85 | 5.70 | 6.55 | 9.65 |
| 23 | 7.10 | 9.00 | 8.80 | 6.65 | 5.95 | 6.70 | 5.30 | 6.05 | 6.50 | 5.65 | 5.95 | 8.80 |
| 24 | 6.60 | 8.70 | 6.95 | 7.35 | 6.90 | 5.80 | 5.40 | 6.80 | 6.55 | 5.65 | 5.50 | 7.65 |
| 25 | 6.80 | 9.30 | 8.00 | 6.90 | 7.20 | 5.95 | 5.25 | 4.80 | 5.75 | 6.40 | 5.80 | 7.45 |
| 26 | 7.40 | 8.80 | 7.95 | 6.60 | 5.05 | 5.80 | 6.30 | 6.25 | 7.00 | 5.80 | 7.40 | 7.20 |
| 27 | 6.20 | 8.20 | 7.65 | 6.75 | 5.80 | 7.35 | 5.15 | 5.40 | 7.30 | 8.20 | 7.00 | 6.75 |
| 28 | 6.95 | 23.15 | 7.60 | 5.75 | 5.65 | 7.25 | 7.70 | 5.85 | 8.15 | 7.00 | 6.00 | 6.40 |
| 29 | 8.15 | ..... | 11.60 | 6.50 | 5.65 | 6.45 | 7.90 | 5.70 | 5.05 | 6.95 | 6.45 | 6.45 |
| 30 | 7.80 | ..... | 12.10 | 6.50 | 5.55 | 5.65 | 6.20 | 5.50 | 5.70 | 6.80 | 8.55 | 6.75 |
| 31 | 11.60 | ..... | 10.10 | ..... | 6.10 | ..... | 5.65 | 6.25 | ..... | 5.95 | ..... | 7.05 |

*Rating table for Saluda River near Waterloo, S. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 4.4 | 320 | 8.0 | 2,250 | 11.6 | 5,245 | 17.0 | 10,600 |
| 4.6 | 400 | 8.2 | 2,400 | 11.8 | 5,435 | 17.5 | 11,100 |
| 4.8 | 485 | 8.4 | 2,550 | 12.0 | 5,625 | 18.0 | 11,600 |
| 5.0 | 571 | 8.6 | 2,705 | 12.2 | 5,815 | 18.5 | 12,100 |
| 5.2 | 657 | 8.8 | 2,865 | 12.4 | 6,005 | 19.0 | 12,600 |
| 5.4 | 751 | 9.0 | 3,025 | 12.6 | 6,200 | 19.5 | 13,100 |
| 5.6 | 850 | 9.2 | 3,195 | 12.8 | 6,400 | 20.0 | 13,600 |
| 5.8 | 950 | 9.4 | 3,365 | 13.0 | 6,600 | 20.5 | 14,100 |
| 6.0 | 1,050 | 9.6 | 3,535 | 13.2 | 6,800 | 21.0 | 14,600 |
| 6.2 | 1,154 | 9.8 | 3,705 | 13.4 | 7,000 | 21.5 | 15,100 |
| 6.4 | 1,260 | 10.0 | 3,875 | 13.6 | 7,200 | 22.0 | 15,600 |
| 6.6 | 1,372 | 10.2 | 4,045 | 13.8 | 7,400 | 22.5 | 16,100 |
| 6.8 | 1,486 | 10.4 | 4,215 | 14.0 | 7,600 | 23.0 | 16,600 |
| 7.0 | 1,600 | 10.6 | 4,385 | 14.5 | 8,100 | 23.5 | 17,100 |
| 7.2 | 1,720 | 10.8 | 4,555 | 15.0 | 8,600 | 24.0 | 17,600 |
| 7.4 | 1,840 | 11.0 | 4,725 | 15.5 | 9,100 | 24.5 | 18,100 |
| 7.6 | 1,970 | 11.2 | 4,895 | 16.0 | 9,600 | 25.0 | 18,600 |
| 7.8 | 2,110 | 11.4 | 5,065 | 16.5 | 10,100 | | |

*Estimated monthly discharge of Saluda River near Waterloo, S. C.*

[Drainage area, 1,056 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 6,100 | 1,154 | 2,148 | 2.03 | 2.34 |
| February | 18,500 | 1,690 | 4,352 | 4.12 | 4.29 |
| March | 14,700 | 1,571 | 4,098 | 3.88 | 4.47 |
| April | 2,945 | 925 | 1,919 | 1.82 | 2.03 |
| May | 2,325 | 592 | 1,333 | 1.26 | 1.45 |
| June | 6,650 | 571 | 1,485 | 1.41 | 1.57 |
| July | 2,250 | 571 | 1,099 | 1.04 | 1.20 |
| August | 1,486 | 360 | 905 | .86 | .99 |
| September | 5,815 | 592 | 1,400 | 1.33 | 1.48 |
| October | 2,400 | 850 | 1,269 | 1.20 | 1.38 |
| November | 2,665 | 657 | 1,173 | 1.11 | 1.24 |
| December | 6,750 | 1,102 | 2,268 | 2.15 | 2.48 |
| The year | 18,500 | 360 | 1,954 | 1.85 | 24.92 |

## SAVANNAH RIVER DRAINAGE BASIN.

Savannah River is formed by Tugaloo and Seneca rivers, which unite about 100 miles above Augusta. It flows in a southerly direction, forming a portion of the boundary between South Carolina and Georgia, and empties into the Atlantic Ocean at Savannah, Ga.

The Tugaloo River is formed by Tallulah and Chatooga rivers, which unite near Tallulah Falls, in the northeastern part of Georgia. It also forms a portion of the boundary between South Carolina and Georgia. Broad River is formed by the junction of the North and Middle forks, in northeastern Georgia. After uniting with South Fork near Carlton, Ga., it flows east into Savannah River.

The United States Geological Survey during 1902 maintained the following stations in this basin, under the direction of B. M. Hall: On the Savannah, at Augusta and Calhoun Falls; on the Broad (of Georgia), at Carlton.

### SAVANNAH RIVER AT AUGUSTA, GA.

Observations of river height have been maintained since 1875 by the city of Augusta at the city highway bridge. The results have been printed in a volume entitled Stages of Water at River Stations, prepared by the United States Weather Bureau. Those for 1875 to 1889 are given in part 3, those for 1890 to 1892 in part 4, and those for 1893 to 1895 in part 5 of this publication. The gage consists of a vertical timber fastened to the pier and graduated to feet and inches. Readings are made four times a day by J. M. Youngblood, keeper of the city bridge, usually at 6 a. m., 12 m., 6 p. m., and 9 p. m. The 6 a. m. readings are those used by the Weather Bureau, but in the publications of the United States Geological Survey from 1900 to the present, inclusive, the average of all four of the daily readings is used and is reduced to feet and tenths of feet.

Discharge measurements are made at North Augusta highway bridge, which is a through iron bridge in three spans, 206½ feet, 209 feet, and 206½ feet in length, respectively, not including approaches from street to each end. There are two piers in the water and one on each bank. The stream at gage height 6.67 is 572 feet wide, including the two piers. It has a maximum depth of 10 feet and an average depth of 6.5 feet, the mean velocity being 1.24 feet per second. The initial point is the center of the first sidewalk floor beam at the right bank on the downstream side of the bridge.

Bench mark No. 1 is the top of the second iron floor beam from the right bank, downstream side; it corresponds to a gage height of 48.60 feet. Bench mark No. 2 is the top of the plank guard rail at the same point; it corresponds to a gage height of 50.97 feet.

The channel is straight and without obstructions. The banks are moderately high, but are liable to overflow at highest floods. The bed is fairly constant. The observer is paid by the city of Augusta.

The following discharge measurements were made during 1902:

June 20: Gage height, 8.85 feet; discharge, 7,497 second-feet.
July 25: Gage height, 7.85 feet; discharge, 5,246 second-feet.
September 5: Gage height, 7.90 feet; discharge, 5,239 second-feet.

*Daily gage height, in feet, of Savannah River at Augusta, Ga., for 1902.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 23.90 | 19.30 | 33.80 | 18.60 | 9.80 | 8.30 | 7.30 | 7.80 | 7.70 | 8.70 | 7.50 | 11.80 |
| 2 | 16.60 | 29.50 | 33.30 | 14.50 | 10.60 | 8.50 | 7.20 | 8.10 | 7.40 | 9.90 | 7.20 | 13.20 |
| 3 | 13.60 | 32.40 | 28.60 | 13.10 | 10.80 | 8.90 | 7.10 | 9.00 | 7.30 | 9.20 | 7.10 | 17.40 |
| 4 | 12.40 | 28.50 | 21.50 | 12.80 | 10.20 | 8.50 | 7.00 | 8.50 | 7.20 | 8.50 | 7.30 | 21.10 |
| 5 | 11.50 | 21.10 | 17.40 | 12.50 | 9.90 | 8.40 | 6.90 | 7.80 | 7.80 | 9.20 | 7.10 | 17.40 |
| 6 | 11.00 | 15.60 | 15.10 | 12.00 | 9.80 | 8.30 | 6.80 | 7.70 | 7.70 | 10.90 | 7.40 | 14.30 |
| 7 | 10.50 | 13.20 | 13.90 | 12.00 | 9.70 | 8.30 | 6.90 | 7.70 | 7.10 | 10.30 | 7.50 | 11.80 |
| 8 | 10.50 | 12.20 | 13.20 | 13.40 | 9.40 | 8.50 | 7.00 | 7.60 | 7.10 | 8.70 | 9.20 | 10.50 |
| 9 | 10.40 | 11.60 | 12.70 | 13.60 | 9.60 | 8.80 | 7.40 | 7.20 | 7.10 | 8.30 | 8.30 | 9.50 |
| 10 | 10.20 | 11.00 | 13.10 | 12.30 | 10.10 | 8.60 | 8.00 | 7.10 | 12.30 | 8.10 | 8.00 | 9.10 |
| 11 | 9.90 | 10.70 | 12.50 | 11.60 | 10.60 | 8.10 | 8.00 | 7.40 | 13.10 | 8.00 | 7.50 | 9.00 |
| 12 | 9.80 | 10.40 | 12.30 | 11.10 | 9.60 | 8.10 | 8.30 | 8.60 | 9.90 | 8.00 | 7.40 | 8.90 |
| 13 | 9.60 | 10.20 | 12.30 | 10.60 | 9.10 | 8.10 | 9.60 | 8.80 | 8.30 | 8.80 | 7.50 | 10.70 |
| 14 | 9.40 | 10.20 | 13.70 | 11.10 | 9.10 | 8.10 | 9.40 | 8.00 | 7.70 | 9.40 | 7.40 | 10.60 |
| 15 | 9.30 | 10.30 | 13.50 | 10.60 | 9.70 | 8.40 | 8.70 | 9.50 | 8.90 | 8.90 | 7.30 | 9.70 |
| 16 | 9.40 | 10.70 | 18.50 | 10.80 | 9.40 | 13.00 | 10.00 | 10.40 | 8.00 | 9.20 | 7.20 | 8.90 |
| 17 | 9.20 | 11,40 | 27.90 | 11.20 | 9.30 | 15.00 | 9.20 | 9.40 | 7.70 | 8.40 | 7.40 | 9.20 |
| 18 | 9.20 | 11.10 | 25.60 | 13.10 | 9.20 | 11.40 | 8.70 | 9.20 | 7.40 | 8.00 | 8.00 | 14.00 |
| 19 | 9.20 | 10.90 | 19.50 | 13.40 | 9.20 | 10.40 | 7.60 | 8.30 | 7.40 | 7.30 | 8.70 | 11.50 |
| 20 | 9.20 | 10.60 | 16.00 | 12.70 | 9.20 | 9.40 | 7.10 | 8.90 | 8.00 | 7.50 | 8.80 | 10.20 |
| 21 | 9.50 | 11.80 | 13.80 | 12.10 | 9.20 | 9.30 | 6.90 | 8.10 | 9.20 | 7.90 | 8.00 | 9.40 |
| 22 | 10.20 | 14.50 | 13.10 | 11.10 | 9.40 | 8.90 | 6.90 | 7.30 | 8.40 | 7.40 | 7.90 | 12.20 |
| 23 | 10.20 | 13.70 | 12.50 | 10.70 | 9.50 | 8.60 | 6.90 | 7.40 | 8.10 | 7.20 | 7.40 | 14.60 |
| 24 | 9.70 | 12.60 | 12.40 | 10.50 | 9.20 | 8.50 | 7.00 | 7.40 | 7.80 | 7.20 | 7.50 | 12.20 |
| 25 | 9.50 | 16.70 | 11.90 | 10.20 | 8.90 | 8.40 | 7.50 | 7.30 | 7.90 | 7.20 | 7.70 | 10.40 |
| 26 | 9.30 | 18.10 | 12.00 | 10.20 | 8.80 | 8.30 | 7.60 | 7.40 | 13.60 | 7.00 | 10.10 | 9.90 |
| 27 | 9.30 | 16.20 | 11.60 | 10.00 | 8.60 | 7.90 | 7.60 | 7.40 | 13.80 | 7.40 | 12.40 | 9.40 |
| 28 | 9.20 | 25.50 | 11.90 | 10.10 | 8.50 | 7.80 | 7.00 | 7.40 | 12.80 | 8.90 | 10.80 | 8.90 |
| 29 | 9.90 | ..... | 19.60 | 9.80 | 8.40 | 7.50 | 7.00 | 8.70 | 10.90 | 8.90 | 9.10 | 8.60 |
| 30 | 11.60 | ..... | 28.20 | 9.90 | 8.30 | 7.60 | 7.80 | 8.40 | 9.30 | 8.20 | 8.40 | 8.90 |
| 31 | 11.40 | ..... | 24.60 | ..... | 8.20 | ..... | 8.00 | 7.50 | ..... | 7.80 | ..... | 9.70 |

*Rating table for Savannah River at Augusta, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 6.8 | 3,400 | 10.8 | 11,200 | 14.8 | 19,660 | 23.0 | 45,800 |
| 7.0 | 3,740 | 11.0 | 11,600 | 15.0 | 20,100 | 23.5 | 48,900 |
| 7.2 | 4,100 | 11.2 | 12,020 | 15.2 | 20,560 | 24.0 | 52,000 |
| 7.4 | 4,460 | 11.4 | 12,440 | 15.4 | 21,020 | 24.5 | 56,000 |
| 7.6 | 4,840 | 11.6 | 12,860 | 15.6 | 21,480 | 25.0 | 60,000 |
| 7.8 | 5,220 | 11.8 | 13,280 | 15.8 | 21,940 | 25.5 | 64,400 |
| 8.0 | 5,600 | 12.0 | 13,700 | 16.0 | 22,400 | 26.0 | 68,800 |
| 8.2 | 6,000 | 12.2 | 14,120 | 16.5 | 23,600 | 26.5 | 73,200 |
| 8.4 | 6,400 | 12.4 | 14,540 | 17.0 | 24,800 | 27.0 | 77,600 |
| 8.6 | 6,800 | 12.6 | 14,960 | 17.5 | 26,050 | 27.5 | 82,000 |
| 8.8 | 7,200 | 12.8 | 15,380 | 18.0 | 27,300 | 28.0 | 86,400 |
| 9.0 | 7,600 | 13.0 | 15,800 | 18.5 | 28,700 | 28.5 | 90,800 |
| 9.2 | 8,000 | 13.2 | 16,220 | 19.0 | 30,100 | 29.0 | 95,200 |
| 9.4 | 8,400 | 13.4 | 16,640 | 19.5 | 31,700 | 29.5 | 99,600 |
| 9.6 | 8,800 | 13.6 | 17,060 | 20.0 | 33,300 | 30.0 | 104,000 |
| 9.8 | 9,200 | 13.8 | 17,480 | 20.5 | 35,100 | 30.5 | 108,400 |
| 10.0 | 9,600 | 14.0 | 17,900 | 21.0 | 36,900 | 31.0 | 112,800 |
| 10.2 | 10,000 | 14.2 | 18,340 | 21.5 | 38,950 | 31.5 | 117,200 |
| 10.4 | 10,400 | 14.4 | 18,780 | 22.0 | 41,000 | 32.0 | 121,600 |
| 10.6 | 10,800 | 14.6 | 19,220 | 22.5 | 43,400 | 33.0 | 130,400 |

*Estimated monthly discharge of Savannah River at Augusta, Ga.*

[Drainage area, 7,294 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 51,380 | 8,000 | 11,689 | 1.60 | 1.84 |
| February | 125,120 | 10,000 | 27,595 | 3.78 | 3.94 |
| March | 137,440 | 12,860 | 36,025 | 4.94 | 5.69 |
| April | 28,980 | 9,200 | 13,466 | 1.85 | 2.06 |
| May | 11,200 | 6,000 | 8,394 | 1.15 | 1.33 |
| June | 20,100 | 4,650 | 7,489 | 1.03 | 1.15 |
| July | 9,600 | 3,400 | 5,059 | .69 | .80 |
| August | 10,400 | 3,920 | 5,843 | .80 | .92 |
| September | 17,480 | 3,920 | 7,458 | 1.02 | 1.14 |
| October | 11,400 | 3,740 | 6,423 | .88 | 1.01 |
| November | 14,540 | 3,920 | 5,851 | .80 | .89 |
| December | 37,310 | 6,800 | 12,700 | 1.74 | 2.01 |
| The year | 137,440 | 3,400 | 12,333 | 1.69 | 22.78 |

## SAVANNAH RIVER NEAR CALHOUN FALLS, S. C.

Savannah River is formed by the junction of Seneca and Tugalo rivers about 100 miles above Augusta, Ga. The tributaries have their sources in the Blue Ridge Mountains in North and South Carolina and Georgia, where more than one-fifth of the territory is in original oak forest. A large number of fine water powers occur on the tributaries and along the main river, the most noted being at Tallulah Falls, on Tallulah River, 335 feet in height, with a total fall of 525 feet in a distance of $2\frac{2}{3}$ miles. In order to determine the value of these water powers, systematic measurements were begun at Calhoun Falls, S. C., on August 4, 1896.

This station is at the Seaboard Air Line Railway bridge across Savannah River, above the mouth of Beaverdam Creek and below Rocky River, and about 3 miles west of the town of Calhoun Falls, S. C. The river is here divided into two channels by a large island, containing several hundred acres. The east channel is a good section at ordinary stages, but at lowest water the current is very sluggish. The west channel, which is the main river, is obstructed by some very small islands and old cofferdams about the two piers; otherwise the section is fairly good. Peter Pfeiffer, a farmer, is the observer.

The chain gage is on the west channel, center span. The rod is nailed to the guard rail on the east side of the pulley, on the downstream side of the bridge. The center of the $2\frac{1}{2}$-inch pulley is 193 feet from the initial point and is at a gage height of 55.26 feet. The zero point on the rod is 10 feet from the center of the pulley. The chain, from the bottom of the weight to the index, is 65.40 feet. One bench mark on the top of the iron stringer under the cross-ties near the gage is 54.0 feet above the datum of the gage. The other is on the top of the east end pier of the east channel, and is 29.87 feet above the zero of the gage.

This station is situated at the head of Trotters Shoal, the largest shoal on the main river. The observer is paid by the United States Weather Bureau.

The following discharge measurements were made during 1902:

July 19: Gage height, 2.50 feet; discharge, 2,517 second-feet.
October 1: Gage height, 3.45 feet; discharge, 6,844 second-feet.

*Daily gage height, in feet, of Savannah River near Calhoun Falls, S. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 7.00 | 8.00 | 16.00 | 4.00 | 2.10 | 1.80 | 2.00 | 3.00 | 2.50 | 3.50 | 3.10 | 3.10 |
| 2 | 5.00 | 16.30 | 9.00 | 3.90 | 2.70 | 1.70 | 2.00 | 3.50 | 2.40 | 3.20 | 3.00 | 3.00 |
| 3 | 3.90 | 12.00 | 6.00 | 3.80 | 2.40 | 1.70 | 1.90 | 3.70 | 2.40 | 3.00 | 2.80 | 6.90 |
| 4 | 3.80 | 7.50 | 4.60 | 3.80 | 2.20 | 1.70 | 1.90 | 3.00 | 2.50 | 2.90 | 2.70 | 6.70 |
| 5 | 3.70 | 5.00 | 4.20 | 3.70 | 2.20 | 1.70 | 1.90 | 2.80 | 2.50 | 3.20 | 2.70 | 4.50 |
| 6 | 3.70 | 4.50 | 4.10 | 3.70 | 2.10 | 1.60 | 1.90 | 2.60 | 2.50 | 3.40 | 2.60 | 4.20 |
| 7 | 3.60 | 4.20 | 4.00 | 3.60 | 2.30 | 1.60 | 2.00 | 2.30 | 2.40 | 3.20 | 2.70 | 4.00 |
| 8 | 3.60 | 4.00 | 3.90 | 3.60 | 2.30 | 1.60 | 2.00 | 2.20 | 2.30 | 3.00 | 2.90 | 3.80 |
| 9 | 3.50 | 3.90 | 3.90 | 3.50 | 2.20 | 1.50 | 2.40 | 2.10 | 3.20 | 2.90 | 2.60 | 3.80 |
| 10 | 3.50 | 3.90 | 3.80 | 3.50 | 3.00 | 1.50 | 2.40 | 2.00 | 6.00 | 2.80 | 2.40 | 3.70 |
| 11 | 3.40 | 3.80 | 3.80 | 3.40 | 2.80 | 1.40 | 2.70 | 2.00 | 4.90 | 2.80 | 2.20 | 3.50 |
| 12 | 3.40 | 3.80 | 3.70 | 3.40 | 2.70 | 1.40 | 3.00 | 2.00 | 4.00 | 2.70 | 2.10 | 3.40 |
| 13 | 3.30 | 3.70 | 4.00 | 3.30 | 2.50 | 1.40 | 3.00 | 2.30 | 3.90 | 2.60 | 2.00 | 3.90 |
| 14 | 3.30 | 3.70 | 3.90 | 3.20 | 2.40 | 1.40 | 3.40 | 3.00 | 3.80 | 3.00 | 1.90 | 3.70 |
| 15 | 3.20 | 3.70 | 3.90 | 3.10 | 2.30 | 1.50 | 3.70 | 2.50 | 3.50 | 2.90 | 1.90 | 3.60 |
| 16 | 3.20 | 3.80 | 4.90 | 3.00 | 2.20 | 5.00 | 4.00 | 2.40 | 3.30 | 2.80 | 1.80 | 3.50 |
| 17 | 3.10 | 3.80 | 8.90 | 3.00 | 2.20 | 4.00 | 3.90 | 2.70 | 3.10 | 2.70 | 1.80 | 3.60 |
| 18 | 3.10 | 3.80 | 6.00 | 3.20 | 2.00 | 3.30 | 3.80 | 2.60 | 2.90 | 2.50 | 1.80 | 4.90 |
| 19 | 3.20 | 3.90 | 4.50 | 3.10 | 2.00 | 3.00 | 3.70 | 2.50 | 3.70 | 2.30 | 1.70 | 4.00 |
| 20 | 3.20 | 3.90 | 4.20 | 3.00 | 2.00 | 2.80 | 2.60 | 2.30 | 3.20 | 2.30 | 1.70 | 3.80 |
| 21 | 3.20 | 4.00 | 4.00 | 3.00 | 2.10 | 2.80 | 2.60 | 2.20 | 3.00 | 2.30 | 1.70 | 3.70 |
| 22 | 3.30 | 3.90 | 3.90 | 2.90 | 2.20 | 2.50 | 2.60 | 2.10 | 3.00 | 2.20 | 1.60 | 3.90 |
| 23 | 3.30 | 3.80 | 3.80 | 2.80 | 2.00 | 2.40 | 2.50 | 2.00 | 3.00 | 2.20 | 1.70 | 3.80 |
| 24 | 3.20 | 3.80 | 3.80 | 2.70 | 2.00 | 2.40 | 2.50 | 2.40 | 2.90 | 2.10 | 1.70 | 3.60 |
| 25 | 3.10 | 3.90 | 3.80 | 2.60 | 2.00 | 2.30 | 2.40 | 2.10 | 4.00 | 2.10 | 1.90 | 3.50 |
| 26 | 3.00 | 3.80 | 3.70 | 2.50 | 2.00 | 2.20 | 2.40 | 2.00 | 4.90 | 2.00 | 3.90 | 3.50 |
| 27 | 3.00 | 3.80 | 3.70 | 2.40 | 1.90 | 2.20 | 2.30 | 2.20 | 4.00 | 4.00 | 3.00 | 3.40 |
| 28 | 3.20 | 16.40 | 4.20 | 2.30 | 1.90 | 2.10 | 3.00 | 3.00 | 3.90 | 3.90 | 2.90 | 3.40 |
| 29 | 3.50 | ..... | 9.30 | 2.20 | 1.90 | 2.00 | 3.00 | 3.10 | 3.50 | 3.70 | 2.70 | 3.50 |
| 30 | 4.00 | ..... | 7.00 | 2.20 | 1.80 | 2.00 | 3.20 | 2.80 | 3.20 | 3.40 | 2.90 | 3.90 |
| 31 | 4.10 | ..... | 5.50 | ..... | 1.80 | ..... | 3.40 | 2.60 | ..... | 3.30 | ..... | 3.70 |

*Rating table for Savannah River near Calhoun Falls, S. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.4 | 1,175 | 3.4 | 5,640 | 5.4 | 14,340 | 9.5 | 32,175 |
| 1.6 | 1,350 | 3.6 | 6,510 | 5.6 | 15,210 | 10.0 | 34,350 |
| 1.8 | 1,545 | 3.8 | 7,380 | 5.8 | 16,080 | 11.0 | 38,700 |
| 2.0 | 1,760 | 4.0 | 8,250 | 6.0 | 16,950 | 12.0 | 43,050 |
| 2.2 | 1,990 | 4.2 | 9,120 | 6.5 | 19,125 | 13.0 | 47,400 |
| 2.4 | 2,280 | 4.4 | 9,990 | 7.0 | 21,300 | 14.0 | 51,750 |
| 2.6 | 2,690 | 4.6 | 10,860 | 7.5 | 23,475 | 15.0 | 56,100 |
| 2.8 | 3,150 | 4.8 | 11,735 | 8.0 | 25,650 | 16.0 | 60 450 |
| 3.0 | 3,900 | 5.0 | 12,600 | 8.5 | 27,825 | 17.0 | 64,800 |
| 3.2 | 4,770 | 5.2 | 13,470 | 9.0 | 30,000 | 18.0 | 69,150 |

*Estimated monthly discharge of Savannah River near Calhoun Falls, S. C.*

[Drainage area, 2,712 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 21,300 | 3,900 | 6,370 | 2.35 | 2.71 |
| February | 62,190 | 6,945 | 14,247 | 5.25 | 5.47 |
| March | 60,450 | 6,945 | 13,302 | 4.90 | 5.65 |
| April | 8,250 | 1,990 | 4,776 | 1.76 | 1.96 |
| May | 3,900 | 1,545 | 2,070 | .76 | .88 |
| June | 12,600 | 1,175 | 2,488 | .92 | 1.03 |
| July | 8,250 | 1,650 | 3,541 | 1.31 | 1.51 |
| August | 6,945 | 1,760 | 2,790 | 1.03 | 1.19 |
| September | 16,950 | 2,120 | 5,651 | 2.08 | 2.32 |
| October | 8,250 | 1,760 | 3,818 | 1.41 | 1.63 |
| November | 7,815 | 1,350 | 2,556 | .94 | 1.05 |
| December | 20,865 | 3,900 | 7,899 | 2.91 | 3.35 |
| The year | 62,190 | 1,175 | 5,792 | 2.12 | 28.75 |

## BROAD RIVER (OF GEORGIA) NEAR CARLTON, GA.

Broad River rises in the northeastern part of Georgia and flows in a southeasterly direction, passing between Elbert and Wilkes counties, and emptying into Savannah River 8 miles below Calhoun Falls station. The drainage area is a rolling country largely covered with timber. Measurements were begun on Broad River at Carlton on May 27, 1897, this station being established by Max Hall. It is located on the bridge of the Seaboard Air Line Railway, 3 miles east of Carlton, Ga., and 2 miles above the mouth of South Fork. The iron bridge is 250 feet long and is approached at each side by wooden trestles. The initial point of sounding is the end of the iron bridge at the right bank, upstream. The length of the wire gage is 56.35 feet. The bench mark is the top of the upstream iron girder under the cross-ties at 30 feet from the initial point, and is 51 feet above datum. The zero of gage is 384.5 feet above sea level. The channel is straight and the flow uninterrupted except by one pier in the middle of the river. The banks are rather low and subject to overflow at high water. The bed is fairly constant. The observer, S. P. Power, jr., a farmer at Carlton, Ga., is paid by the United States Weather Bureau.

The following discharge measurements were made during 1902:

July 18: Gage height, 2.40 feet; discharge, 638 second-feet.
September 30: Gage height, 2.83 feet; discharge, 960 second-feet.

*Daily gage height, in feet, of Broad River (of Georgia) near Carlton, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 4.70 | 7.50 | 23.20 | 4.30 | 3.30 | 2.90 | 2.20 | 2.30 | 2.30 | 3.90 | 2.30 | 4.30 |
| 2 | 4.00 | 23.20 | 9.50 | 4.00 | 3.40 | 2.80 | 2.20 | 2.20 | 2.20 | 3.60 | 2.20 | 3.60 |
| 3 | 3.70 | 17.10 | 5.80 | 3.80 | 3.30 | 2.70 | 2.30 | 3.10 | 2.20 | 2.70 | 2.20 | 6.60 |
| 4 | 3.50 | 6.30 | 4.80 | 3.80 | 3.30 | 2.70 | 2.80 | 3.00 | 2.20 | 2.60 | 2.10 | 6.40 |
| 5 | 3.40 | 5.70 | 4.40 | 3.70 | 3.20 | 2.60 | 2.60 | 2.70 | 2.20 | 3.60 | 2.20 | 4.50 |
| 6 | 3.30 | 4.10 | 4.20 | 3.70 | 3.70 | 2.60 | 2.30 | 2.50 | 2.20 | 3.00 | 2.50 | 4.00 |
| 7 | 3.20 | 3.80 | 3.90 | 3.70 | 3.30 | 2.60 | 2.20 | 2.30 | 2.10 | 2.60 | 2.50 | 3.30 |
| 8 | 3.10 | 3.50 | 3.80 | 3.60 | 3.20 | 2.80 | 2.40 | 2.20 | 2.10 | 2.40 | 2.30 | 3.00 |
| 9 | 3.10 | 3.40 | 4.00 | 3.50 | 3.20 | 2.60 | 2.80 | 2.10 | 3.30 | 2.40 | 2.30 | 2.90 |
| 10 | 3.00 | 3.40 | 3.90 | 3.40 | 3.10 | 2.50 | 2.40 | 2.10 | 4.70 | 2.30 | 2.30 | 2.70 |
| 11 | 3.00 | 3.30 | 3.80 | 3.40 | 3.10 | 2.50 | 2.40 | 2.10 | 3.60 | 2.50 | 2.30 | 2.70 |
| 12 | 2.90 | 3.30 | 3.70 | 3.30 | 3.10 | 2.50 | 2.70 | 2.60 | 2.60 | 3.50 | 2.30 | 2.60 |
| 13 | 2.90 | 3.30 | 4.60 | 3.30 | 3.00 | 2.50 | 2.60 | 2.30 | 2.80 | 2.90 | 2.20 | 2.80 |
| 14 | 2.90 | 3.20 | 4.30 | 3.30 | 3.40 | 2.50 | 2.40 | 5.00 | 2.80 | 2.70 | 2.20 | 2.80 |
| 15 | 2.90 | 3.30 | 4.40 | 3.30 | 3.10 | 2.70 | 4.80 | 4.80 | 2.60 | 2.80 | 2.20 | 2.80 |
| 16 | 2.90 | 3.50 | 5.10 | 3.80 | 3.00 | 3.30 | 3.40 | 3.00 | 2.50 | 2.50 | 2.20 | 2.90 |
| 17 | 2.80 | 3.60 | 8.50 | 4.00 | 3.00 | 2.80 | 2.60 | 3.50 | 2.30 | 2.50 | 2.20 | 4.30 |
| 18 | 2.80 | 3.50 | 6.00 | 4.60 | 3.00 | 2.60 | 2.40 | 3.00 | 2.30 | 2.40 | 2.90 | 3.60 |
| 19 | 2.90 | 3.40 | 4.20 | 3.60 | 3.00 | 2.60 | 2.30 | 2.40 | 2.80 | 2.30 | 2.90 | 3.10 |
| 20 | 3.00 | 3.50 | 3.90 | 3.60 | 3.00 | 3.00 | 2.30 | 2.90 | 2.40 | 2.30 | 2.50 | 2.90 |
| 21 | 3.00 | 3.60 | 3.70 | 3.50 | 3.10 | 2.70 | 2.30 | 2.90 | 2.50 | 2.30 | 2.40 | 2.80 |
| 22 | 3.10 | 4.00 | 3.70 | 3.40 | 3.00 | 2.60 | 2.30 | 2.30 | 2.30 | 2.30 | 2.40 | 3.80 |
| 23 | 2.90 | 3.60 | 3.60 | 3.30 | 3.00 | 2.50 | 2.20 | 2.50 | 2.20 | 2.30 | 2.40 | 3.40 |
| 24 | 2.80 | 3.50 | 3.60 | 3.30 | 2.90 | 2.40 | 2.20 | 2.40 | 2.20 | 2.30 | 2.30 | 3.10 |
| 25 | 2.90 | 4.40 | 3.50 | 3.30 | 2.90 | 2.40 | 2.30 | 2.30 | 5.90 | 2.20 | 2.30 | 3.00 |
| 26 | 2.80 | 4.60 | 3.50 | 3.20 | 2.80 | 2.40 | 2.30 | 2.30 | 8.20 | 2.20 | 4.60 | 2.80 |
| 27 | 2.80 | 3.90 | 3.50 | 3.20 | 2.80 | 2.40 | 2.20 | 2.20 | 4.60 | 2.30 | 4.00 | 2.80 |
| 28 | 3.00 | 24.50 | 3.90 | 3.10 | 2.70 | 2.40 | 3.10 | 2.40 | 3.40 | 2.50 | 3.90 | 2.60 |
| 29 | 4.40 | ..... | 15.00 | 3.10 | 2.70 | 2.30 | 3.30 | 3.60 | 3.60 | 2.30 | 3.00 | 2.60 |
| 30 | 3.90 | ..... | 12.00 | 3.20 | 2.60 | 2.30 | 2.30 | 3.10 | 3.30 | 2.30 | 2.60 | 3.30 |
| 31 | 4.10 | ..... | 6.50 | ..... | 2.60 | ..... | 2.30 | 2.50 | ..... | 2.30 | ..... | 3.30 |

*Rating table for Broad River (of Georgia) near Carlton, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.2 | 490 | 4.6 | 2,550 | 7.0 | 5,550 | 11.5 | 11,575 |
| 2.4 | 640 | 4.8 | 2,750 | 7.2 | 5,770 | 12.0 | 12,250 |
| 2.6 | 790 | 5.0 | 2,950 | 7.4 | 6,040 | 12.5 | 12,925 |
| 2.8 | 950 | 5.2 | 3,160 | 7.6 | 6,310 | 13.0 | 13,600 |
| 3.0 | 1,110 | 5.4 | 3,390 | 7.8 | 6,580 | 13.5 | 14,275 |
| 3.2 | 1,280 | 5.6 | 3,640 | 8.0 | 6,850 | 14.0 | 14,950 |
| 3.4 | 1,450 | 5.8 | 3,900 | 8.5 | 7,525 | 14.5 | 15,625 |
| 3.6 | 1,620 | 6.0 | 4,160 | 9.0 | 8,200 | 15.0 | 16,300 |
| 3.8 | 1,800 | 6.2 | 4,420 | 9.5 | 8,875 | 15.5 | 16,975 |
| 4.0 | 1,980 | 6.4 | 4,690 | 10.0 | 9,550 | 16.0 | 17,650 |
| 4.2 | 2,165 | 6.6 | 4,960 | 10.5 | 10,225 | 17.0 | 19,000 |
| 4.4 | 2,355 | 6.8 | 5,230 | 11.0 | 10,900 | | |

*Estimated monthly discharge of Broad River (of Georgia) near Carlton, Ga.*

[Drainage area, 762 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| January | 2,650 | 950 | 1,304 | 1.71 | 1.97 |
| February | 29,125 | 1,280 | 4,514 | 5.92 | 6.16 |
| March | 27,370 | 1,535 | 4,225 | 5.54 | 6.39 |
| April | 2,550 | 1,195 | 1,579 | 2.07 | 2.31 |
| May | 1,710 | 790 | 1,163 | 1.53 | 1.76 |
| June | 1,365 | 565 | 800 | 1.05 | 1.17 |
| July | 2,750 | 490 | 764 | 1.00 | 1.15 |
| August | 2,950 | 420 | 919 | 1.21 | 1.39 |
| September | 7,120 | 420 | 1,227 | 1.61 | 1.80 |
| October | 1,890 | 490 | 837 | 1.10 | 1.27 |
| November | 2,550 | 420 | 777 | 1.02 | 1.14 |
| December | 4,960 | 790 | 1,479 | 1.94 | 2.24 |
| The year | 29,125 | 420 | 1,632 | 2.14 | 28.75 |

MISCELLANEOUS MEASUREMENTS IN SAVANNAH RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in the Savannah drainage basin during 1902 by B. M. Hall and his assistants:

*Miscellaneous discharge measurements in Savannah drainage basin.*

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| July 18 | Rocky River | Swearingen Mill, near Calhoun Falls, S. C. | 128 |
| July 19 | Beaverdam Creek | Near Calhoun Falls, S. C | 54 |
| July 24 | Toccoa Creek | Toccoa Falls, Ga | 6 |
| July 28 | Brier Creek | Near Waynesboro, Ga | 469 |
| Aug. 7 | Beaverdam Creek | Elberton, Ga | 40 |
| Nov. 10 | do | do | 53 |
| Dec. 12 | Brier Creek | Near Waynesboro, Ga | 604 |

## MISCELLANEOUS MEASUREMENTS IN OGEECHEE RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in the Ogeechee basin in 1902 by B. M. Hall and his assistants:

*Miscellaneous discharge measurements in Ogeechee drainage basin.*

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| July 24 | Williamsons Swamp Creek. | Wadley, Ga | 134 |
| July 25 | Ogeechee River | Near Louisville, Ga., above mouth of Rocky Comfort Creek. | 199 |
| July 25 | Big Creek | Near Louisville, Ga | 78 |
| July 25 | Ogeechee River | Near Louisville, Ga., below mouth of Rocky Comfort Creek. | 603 |
| July 26 | do | Millen, Ga | 1,097 |
| July 26 | Buckhead Creek | Millen, Ga., just above mouth | 109 |
| Dec. 10 | Williamsons Swamp Creek. | Wadley, Ga | 283 |
| Dec. 10 | Ogeechee River | 6 miles from Wadley, Ga | 2,134 |
| Dec. 11 | Buckhead Creek | Millen, Ga | 701 |

## ALTAMAHA RIVER DRAINAGE BASIN.

The Altamaha River is formed by the junction of Oconee and Ocmulgee rivers, which unite at the southern boundary of Montgomery County, Ga., about 100 miles from the coast. It flows in a southeasterly direction and empties into the Atlantic Ocean near Darien, Ga. Oconee River drains the eastern central part of Georgia. Its principal tributary is Apalachee River, which enters it in the southeastern part of Morgan County, Ga. Ocmulgee River, which is formed by the junction of Yellow and South rivers, in the northwestern part of Jasper County, Ga., drains the western central portion of the State.

During 1902 the United States Geological Survey maintained the following stations in this basin under the direction of B. M. Hall:

On the Oconee; at Barnett Shoals, at Dublin, and near Athens.

On the Apalachee; near Buckhead.

On the Ocmulgee; at Macon and near Flovilla.

On the Alcovy; near Covington.

### OCONEE RIVER AT DUBLIN, GA.

Oconee River rises in the northern part of Georgia, near Gainesville, on the southern slope of the Chattahoochee Ridge, which separates the headwaters of this stream from the tributaries of the Chattahoochee River. It flows in a southeasterly direction and joins the Ocmulgee at the southern border of Montgomery County to form the Altamaha. The drainage area is for the most part hilly, and is made up of cultivated ground broken by extensive tracts of forest.

A station was established by the United States Weather Bureau in 1894 at Dublin, Ga., about 60 miles above the junction of the Oconee with the Ocmulgee, 45 miles below Milledgeville and 85 miles below the old Cary station. The station was discontinued on April 30, 1897, but was reestablished by the Georgia geological survey February 11, 1898. Since October 15, 1898, the station has been maintained by the United States Weather Bureau. The station is located in the eastern part of Dublin, Ga. The gage is a vertical rod fastened to the lower side of the middle pier of the Wrightsville and Tennille Railroad bridge. The channel is straight and without obstructions, except the bridge piers. The current is swift. The banks are high and not subject to overflow. Discharge measurements are made from the upper side of the iron highway bridge, which is about 100 yards above the railroad bridge at which the gage is located. The initial point for soundings is the end of the bridge on the right bank of the river. The observer, J. W. Scarborough, is paid by the United States Weather Bureau.

The following discharge measurements were made during 1902:

November 12: Gage height, 0.27 feet; discharge, 1,651 second-feet.
November 12: Gage height, 0.25 feet; discharge, 1,615 second-feet.
November 13: Gage height, 0.27 feet; discharge, 1,619 second-feet.

*Daily gage height, in feet, of Oconee River at Dublin, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 10.00 | 4.00 | 11.00 | 15.30 | 3.40 | 1.00 | 0.20 | 0.00 | 0.70 | 2.80 | 0.80 | 4.00 |
| 2 | 12.00 | 6.30 | 13.40 | 17.60 | 3.30 | 1.00 | −.10 | 1.70 | .50 | 1.70 | .50 | 5.30 |
| 3 | 14.10 | 8.00 | 23.00 | 17.50 | 4.50 | 1.20 | −.20 | .80 | .30 | 2.00 | .20 | 6.10 |
| 4 | 14.90 | 9.50 | 25.50 | 17.10 | 5.50 | 1.80 | −.20 | .30 | − .10 | 2.50 | −.10 | 7.50 |
| 5 | 15.30 | 14.00 | 25.80 | 16.00 | 4.70 | 1.60 | −.20 | 2.90 | − .40 | 1.60 | −.20 | 8.00 |
| 6 | 14.60 | 19.00 | 24.50 | 14.10 | 3.80 | .90 | 1.40 | 4.30 | − .60 | 2.90 | −.20 | 8.70 |
| 7 | 12.40 | 20.00 | 22.00 | 11.30 | 3.50 | .70 | .90 | 4.40 | − .90 | 2.70 | .30 | 9.00 |
| 8 | 7.00 | 19.50 | 19.00 | 9.00 | 3.00 | .60 | .70 | 3.50 | −1.10 | 2.40 | .60 | 9.80 |
| 9 | 4.40 | 18.00 | 16.00 | 9.00 | 3.10 | 2.00 | .20 | 2.00 | −1.20 | 1.80 | .80 | 9.00 |
| 10 | 3.90 | 15.60 | 13.00 | 9.00 | 2.70 | 3.90 | −.20 | .90 | −1.20 | 1.00 | .60 | 5.80 |
| 11 | 3.60 | 12.30 | 9.00 | 9.00 | 2.70 | 4.00 | −.70 | .50 | −1.30 | .70 | .50 | 3.50 |
| 12 | 3.20 | 7.30 | 7.50 | 8.50 | 2.70 | 3.00 | 1.00 | 1.00 | 1.20 | .80 | .40 | 3.20 |
| 13 | 3.00 | 5.00 | 6.50 | 7.00 | 2.50 | 1.30 | 2.50 | 2.40 | 2.00 | .90 | .30 | 3.00 |
| 14 | 2.80 | 4.30 | 6.00 | 6.00 | 2.30 | 1.00 | 4.50 | 1.30 | 1.50 | 1.00 | .20 | 4.80 |
| 15 | 2.60 | 4.10 | 7.10 | 5.60 | 2.00 | 1.00 | 3.50 | .70 | .70 | 1.20 | .10 | 4.90 |
| 16 | 2.50 | 4.10 | 9.80 | 5.50 | 2.20 | 1.20 | 4.40 | 1.00 | .40 | 2.00 | .00 | 3.80 |
| 17 | 2.40 | 4.80 | 12.70 | 5.50 | 3.00 | 4.50 | 5.10 | 2.30 | .80 | 1.00 | −.10 | 3.00 |
| 18 | 2.40 | 5.00 | 14.20 | 6.00 | 3.00 | 4.50 | 5.50 | 3.00 | .60 | .80 | −.10 | 2.60 |
| 19 | 2.40 | 5.00 | 19.00 | 7.90 | 2.70 | 2.50 | 3.30 | 1.70 | .20 | .50 | −.10 | 3.50 |
| 20 | 2.40 | 4.80 | 21.00 | 9.00 | 3.00 | 3.70 | 1.20 | .80 | − .20 | .10 | 1.00 | 3.00 |
| 21 | 2.50 | 4.60 | 19.70 | 10.00 | 2.90 | 2.80 | .80 | .40 | .30 | −.20 | 2.00 | 2.00 |
| 22 | 3.10 | 4.50 | 18.00 | 10.00 | 2.80 | 2.00 | .40 | .10 | .80 | −.40 | 1.40 | 1.40 |
| 23 | 3.70 | 6.50 | 15.90 | 8.10 | 2.70 | 2.00 | 2.40 | .50 | .70 | −.50 | 1.00 | 4.00 |
| 24 | 3.70 | 6.60 | 13.70 | 6.00 | 2.50 | 1.50 | 1.00 | .20 | .50 | −.50 | .70 | 5.50 |
| 25 | 3.40 | 7.00 | 11.60 | 5.00 | 2.30 | 1.10 | .50 | −.20 | .20 | −.60 | .50 | 5.00 |
| 26 | 3.00 | 8.00 | 10.10 | 4.60 | 2.00 | .70 | 1.70 | −.40 | − .10 | −.60 | 1.00 | 2.50 |
| 27 | 2.90 | 8.60 | 9.50 | 4.30 | 1.70 | .50 | 1.00 | −.40 | 1.00 | −.30 | 4.40 | 2.00 |
| 28 | 2.80 | 9.60 | 9.10 | 3.90 | 1.50 | .40 | 1.20 | −.30 | 3.50 | 1.50 | 5.50 | 1.70 |
| 29 | 2.60 | ..... | 8.90 | 3.60 | 1.40 | .30 | 2.00 | .10 | 4.00 | 2.00 | 4.50 | 1.50 |
| 30 | 2.60 | ..... | 10.90 | 3.60 | 1.30 | .20 | 1.80 | .20 | 4.20 | 1.80 | 3.50 | 1.30 |
| 31 | 3.00 | ..... | 12.10 | ..... | 1.10 | ..... | 1.30 | .50 | ..... | 1.50 | ..... | 1.00 |

*Rating table for Oconee River at Dublin, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| —1.2 | 935 | 2.2 | 2,940 | 5.6 | 6,244 | 10.5 | 11,830 |
| —1.0 | 1,010 | 2.4 | 3,090 | 5.8 | 6,472 | 11.0 | 12,400 |
| — .8 | 1,090 | 2.6 | 3,250 | 6.0 | 6,700 | 11.5 | 12,970 |
| — .6 | 1,180 | 2.8 | 3,410 | 6.2 | 6,928 | 12.0 | 13,540 |
| — .4 | 1,270 | 3.0 | 3,570 | 6.4 | 7,156 | 13.0 | 14,680 |
| — .2 | 1,370 | 3.2 | 3,740 | 6.6 | 7,384 | 14.0 | 15,820 |
| .0 | 1,475 | 3.4 | 3,910 | 6.8 | 7,612 | 15.0 | 16,960 |
| .2 | 1,585 | 3.6 | 4,090 | 7.0 | 7,840 | 16.0 | 18,100 |
| .4 | 1,700 | 3.8 | 4,280 | 7.2 | 8,068 | 17.0 | 19,240 |
| .6 | 1,820 | 4.0 | 4,480 | 7.4 | 8,296 | 18.0 | 20,380 |
| .8 | 1,945 | 4.2 | 4,690 | 7.6 | 8,524 | 19.0 | 21,520 |
| 1.0 | 2,075 | 4.4 | 4,900 | 7.8 | 8,752 | 20.0 | 22,660 |
| 1.2 | 2,210 | 4.6 | 5,120 | 8.0 | 8,980 | 21.0 | 23,800 |
| 1.4 | 2,350 | 4.8 | 5,340 | 8.5 | 9,550 | 22.0 | 24,940 |
| 1.6 | 2,490 | 5.0 | 5,560 | 9.0 | 10,120 | 23.0 | 26,080 |
| 1.8 | 2,640 | 5.2 | 5,788 | 9.5 | 10,690 | 24.0 | 27,220 |
| 2.0 | 2,790 | 5.4 | 6,016 | 10.0 | 11,260 | 25.0 | 28,360 |

*Estimated monthly discharge of Oconee River at Dublin, Ga.*

[Drainage area, 4,182 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 17,302 | 3,090 | 6,315 | 1.51 | 1.74 |
| February | 22,660 | 4,480 | 9,813 | 2.35 | 2.45 |
| March | 29,272 | 6,700 | 16,243 | 3.88 | 4.47 |
| April | 19,924 | 4,090 | 9,942 | 2.38 | 2.66 |
| May | 6,130 | 2,140 | 3,436 | .82 | .95 |
| June | 5,010 | 1,585 | 2,685 | .64 | .71 |
| July | 6,130 | 1,135 | 2,567 | .61 | .70 |
| August | 4,900 | 1,270 | 2,318 | .54 | .62 |
| September | 4,690 | 900 | 1,904 | .46 | .51 |
| October | 3,490 | 1,180 | 2,203 | .53 | .61 |
| November | 6,130 | 1,370 | 2,189 | .52 | .58 |
| December | 11,032 | 2,075 | 5,134 | 1.23 | 1.42 |
| The year | 29,272 | 900 | 5,409 | 1.29 | 17.48 |

## OCONEE RIVER AT BARNETT SHOALS, GA.

This station was established by Prof. C. M. Strahan, of the University of Georgia, on August 6, 1901. It is located at Barnett's bridge, 1 mile above Barnett Shoals and 4 miles east of Watkinsville, Ga.

The gage is a 10-foot rod, graduated to feet and tenths, nailed to a tree on the left bank just above the bridge. The gage is extended to a length of 16 feet by means of a plank marked in feet fastened above the rod. The bench mark is a large nail driven into the tree, and its elevation is 6 feet above the datum of the gage.

Discharge measurements were made from the downstream side of the bridge, which is a covered, lattice, single-span bridge, with a total length of 109 feet between abutments. The observer was R. L. McRee, a storekeeper at Barnett Shoals, who read the gage once daily at ordinary stages and twice daily during low stages, when the regularity of the flow is affected by the small dam of the Georgia factory, 6½ miles upstream.

The station was discontinued on August 23, 1902, for want of an observer.

The following discharge measurements were made during 1902:

January 1: Gage height, 6.35 feet; discharge, 5,061 second-feet.
March 22: Gage height, 3.20 feet; discharge, 1,412 second-feet.
May 31: Gage height, 2.10 feet; discharge, 800 second-feet.
June 28: Gage height, 1.77 feet; discharge, 619 second-feet.

*Daily gage height, in feet, of Oconee River at Barnett Shoals, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | |
| 1 | 5.80 | 8.00 | 14.00 | ..... | ..... | 2.20 | 1.50 | 1.60 |
| 2 | 4.00 | 14.00 | 8.00 | ..... | ..... | 2.10 | 1.50 | 1.60 |
| 3 | 3.00 | 10.00 | 6.00 | ..... | ..... | 2.10 | 1.50 | 2.40 |
| 4 | 2.90 | 8.90 | 5.00 | ..... | ..... | 2.10 | 2.60 | 2.40 |
| 5 | 2.80 | 7.60 | 4.50 | ..... | ..... | 2.00 | 2.70 | 3.90 |
| 6 | 2.70 | 6.00 | 4.00 | ..... | ..... | 2.00 | 1.80 | 2.50 |
| 7 | 2.60 | 4.80 | 3.60 | ..... | ..... | 2.20 | 1.80 | 1.90 |
| 8 | 2.50 | 3.90 | [a]3.00 | ..... | ..... | 3.00 | 1.90 | 1.70 |
| 9 | 2.40 | 3.30 | ..... | ..... | ..... | 2.30 | 1.70 | 1.60 |
| 10 | 2.40 | 3.00 | ..... | ..... | ..... | 2.20 | 1.90 | 1.60 |
| 11 | 2.40 | 2.80 | ..... | ..... | ..... | 2.10 | 2.50 | 1.80 |
| 12 | 2.40 | 2.70 | ..... | ..... | ..... | 2.10 | 2.40 | 2.40 |
| 13 | 2.40 | 2.70 | ..... | ..... | ..... | 1.90 | 3.20 | 1.80 |
| 14 | 2.30 | 2.70 | ..... | ..... | ..... | 1.80 | 2.20 | 1.60 |
| 15 | 2.30 | 3.00 | ..... | ..... | ..... | 1.90 | 4.30 | 1.80 |
| 16 | 2.30 | 3.30 | ..... | ..... | ..... | 2.50 | 4.30 | 1.60 |
| 17 | 2.30 | 3.30 | ..... | ..... | ..... | 2.20 | 2.50 | 1.70 |
| 18 | 2.30 | 3.20 | ..... | ..... | ..... | 2.10 | 2.00 | 1.70 |
| 19 | 2.40 | 3.00 | ..... | ..... | ..... | 2.00 | 1.90 | 1.50 |
| 20 | 2.30 | 2.80 | ..... | ..... | 2.20 | 2.70 | 1.80 | 1.70 |
| 21 | 2.50 | 2.60 | ..... | ..... | 2.20 | 2.00 | 1.70 | 1.80 |

[a] No observer obtainable. Discontinued.

*Daily gage height, in feet, of Oconee River at Barnett Shoals, Ga.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | |
| 22 | 2.40 | 2.60 | ..... | ..... | 2.20 | 1.80 | 1.70 | 1.90 |
| 23 | 2.30 | 2.50 | ..... | ..... | 2.20 | 1.80 | 1.60 | a1.60 |
| 24 | 2.60 | 2.50 | ..... | ..... | 2.30 | 1.70 | 1.60 | ..... |
| 25 | 2.50 | 2.50 | ..... | ..... | 2.30 | 1.70 | 1.60 | ..... |
| 26 | 2.40 | 2.50 | ..... | ..... | 2.30 | 1.70 | 1.80 | ..... |
| 27 | 2.50 | 8.00 | ..... | ..... | 2.20 | 1.70 | 1.70 | ..... |
| 28 | 2.60 | 17.00 | ..... | ..... | 2.10 | 1.60 | 1.70 | ..... |
| 29 | 2.90 | ..... | ..... | ..... | 2.10 | 1.70 | 2.00 | ..... |
| 30 | 3.60 | ..... | ..... | ..... | 2.00 | 1.70 | 1.80 | ..... |
| 31 | 4.00 | ..... | ..... | ..... | 2.00 | ..... | 1.70 | ..... |

a No observer obtainable. Discontinued.

*Rating table for Oconee River at Barnett Shoals, Georgia, for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.6 | 568 | 4.6 | 2,615 | 7.6 | 7,522 | 10.6 | 13,582 |
| 1.8 | 665 | 4.8 | 2,827 | 7.8 | 7,926 | 10.8 | 13,986 |
| 2.0 | 763 | 5.0 | 3,055 | 8.0 | 8,330 | 11.0 | 14,390 |
| 2.2 | 864 | 5.2 | 3,299 | 8.2 | 8,734 | 11.2 | 14,794 |
| 2.4 | 967 | 5.4 | 3,559 | 8.4 | 9,138 | 11.4 | 15,198 |
| 2.6 | 1,074 | 5.6 | 3,835 | 8.6 | 9,542 | 11.6 | 15,602 |
| 2.8 | 1,188 | 5.8 | 4,130 | 8.8 | 9,946 | 11.8 | 16,006 |
| 3.0 | 1,310 | 6.0 | 4,445 | 9.0 | 10,350 | 12.0 | 16,410 |
| 3.2 | 1,440 | 6.2 | 4,780 | 9.2 | 10,754 | 12.5 | 17,420 |
| 3.4 | 1,578 | 6.4 | 5,135 | 9.4 | 11,158 | 13.0 | 18,430 |
| 3.6 | 1,724 | 6.6 | 5,510 | 9.6 | 11,562 | 13.5 | 19,440 |
| 3.8 | 1,878 | 6.8 | 5,906 | 9.8 | 11,966 | 14.0 | 20,450 |
| 4.0 | 2,060 | 7.0 | 6,310 | 10.0 | 12,370 | 15.0 | 22,470 |
| 4.2 | 2,233 | 7.2 | 6,714 | 10.2 | 12,774 | 16.0 | 24,490 |
| 4.4 | 2,418 | 7.4 | 7,118 | 10.4 | 13,178 | 17.0 | 26,510 |

*Estimated monthly discharge of Oconee River at Barnett Shoals, Georgia.*

[Drainage area, 835 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 4,130 | 915 | 1,211 | 1.45 | 1.67 |
| February | 26,510 | 1,020 | 4,456 | 5.34 | 5.56 |
| March 1 to 8 | | | 5,486 | 6.57 | 1.95 |
| May 20 to 31 | | | 851 | 1.02 | 0.46 |
| June | 1,310 | 568 | 748 | 0.90 | 1.00 |
| July | 2,324 | 520 | 842 | 1.01 | 1.16 |
| August 1 to 23 | | | 736 | 0.88 | 0.75 |

MIDDLE OCONEE RIVER NEAR ATHENS, GA.

Middle Oconee River rises in Hall County and flows southeastward through Jackson and Clarke counties to its junction with the east fork, 6 miles below Athens. It drains a rolling area of 300 square miles.

Measurements were begun at Athens on October 11, 1901, the station having been established by Prof. C. M. Strahan, of the University of Georgia. It is located on a wagon bridge, known as Mitchell's Bridge, on the Athens and Lawrenceville road, 3½ miles from Athens and about 7½ miles above the junction of Middle Oconee with its eastern fork. It is 4 miles above the dam of the Princeton factory, an 8-foot shoal intervening, and one-third of a mile below the dam of the Athens Electric Railway Company. The gage is of wire, mounted on the north truss, near the east end of the bridge. It is protected by a plank cover and locked. The bridge is of the covered wooden lattice type. The bench mark is the top of the lower chord at the gage pulley, 26.85 feet above the river bottom, which is the zero point of the gage, the latter being set to read zero when the weight touches the bottom. The graduations are laid off on the lower chord to 20 feet, and can be extended to 26 feet. The initial point for soundings is a spike at the west end of the north bridge truss. The channel is straight and unobstructed except by remains of old piers just inside the present piers, the old piers being covered at gage height of 3 feet. The banks are high and the approaches short. The water rises rapidly in time of flood, the maximum gage height being 22.9 feet and the average gage height 2.5 to 3 feet. The station was discontinued on October 25, 1902, for want of an observer.

The following discharge measurements were made during 1902 by C. M. Strahan:

*Discharge measurements of Middle Oconee River near Athens, Ga.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| January 3 | C. M. Strahan | 3.65 | 855 |
| February 28 | do | 22.50 | 16,971 |
| May 2 | do | (a) | 836 |
| June 30 | do | 1.70 | 275 |
| July 17 | do | 2.10 | 400 |
| July 19 | do | 1.95 | 350 |
| July 22 | do | 1.85 | 318 |

a Gaging made 7 miles above Athens.

*Daily gage height, in feet, of Middle Oconee River near Athens, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | |
| 1 | 4.20 | 6.20 | 19.00 | 3.00 | 2.50 | 2.10 | 1.70 | 1.80 | 1.70 | 2.20 |
| 2 | 3.90 | 14.00 | 7.30 | 3.20 | 2.50 | 2.10 | 1.70 | 1.80 | 1.70 | 2.30 |
| 3 | 3.70 | 17.00 | 5.70 | 3.00 | 2.50 | 2.10 | 2.10 | 2.90 | 1.70 | 2.40 |
| 4 | 3.50 | 5.50 | 5.20 | 2.90 | 2.40 | 2.00 | 2.00 | 2.00 | 1.70 | 1.90 |
| 5 | 3.50 | 4.20 | 4.80 | 2.90 | 2.40 | 2.00 | 1.90 | 2.70 | 1.70 | 2.30 |
| 6 | 3.50 | 3.90 | 4.60 | 2.90 | 2.40 | 2.00 | 1.80 | 2.00 | 1.70 | 2.30 |
| 7 | 3.40 | 3.80 | 4.40 | 2.90 | 2.40 | 2.40 | 1.80 | 2.00 | 1.60 | 2.10 |
| 8 | 3.40 | 3.80 | 3.80 | 3.00 | 2.40 | 2.30 | 1.80 | 1.90 | 1.60 | 1.90 |
| 9 | 3.30 | 3.60 | 3.60 | 3.00 | 2.30 | 2.20 | 1.80 | 1.80 | 2.10 | 1.80 |
| 10 | 3.30 | 3.50 | 3.60 | 2.90 | 2.30 | 2.10 | 1.80 | 1.80 | 2.10 | 1.80 |
| 11 | 3.30 | 3.50 | 3.30 | 2.90 | 2.30 | 2.10 | 1.90 | 1.70 | 1.90 | 1.80 |
| 12 | 3.20 | 3.40 | 3.30 | 2.80 | 2.30 | 2.00 | 2.00 | 2.10 | 1.80 | 2.30 |
| 13 | 3.20 | 3.40 | 4.00 | 2.80 | 2.30 | 2.00 | 2.50 | 2.00 | 2.50 | 2.30 |
| 14 | 3.20 | 3.40 | 3.50 | 2.80 | 2.30 | 2.00 | 3.80 | 1.90 | 2.30 | 2.10 |
| 15 | 3.20 | 3.60 | 3.40 | 2.80 | 2.30 | 2.20 | 2.30 | 1.80 | 1.90 | 2.00 |
| 16 | 3.20 | 3.70 | 5.30 | 2.80 | 2.20 | 2.40 | 2.20 | 1.70 | 1.60 | 1.90 |
| 17 | 3.20 | 3.60 | 8.40 | 3.20 | 2.20 | 2.20 | 2.10 | 1.70 | 1.60 | 1.90 |
| 18 | 3.10 | 3.50 | 4.70 | 3.70 | 2.20 | 2.10 | 2.00 | 1.70 | 1.60 | 1.80 |
| 19 | 3.20 | 3.50 | 3.60 | 3.00 | 2.20 | 2.10 | 1.90 | 1.70 | 1.80 | 1.80 |
| 20 | 3.30 | 3.60 | 3.30 | 2.80 | 2.20 | 2.00 | 1.80 | 1.70 | 2.10 | 1.80 |
| 21 | 3.30 | 3.70 | 3.10 | 2.80 | 2.20 | 2.00 | 1.80 | 1.70 | 1.90 | 1.80 |
| 22 | 3.20 | 3.70 | 3.00 | 2.80 | 2.20 | 2.00 | 1.90 | 1.70 | 1.70 | 1.80 |
| 23 | 3.20 | 3.50 | 2.90 | 2.70 | 2.20 | 2.00 | 1.90 | 1.60 | 1.70 | 1.80 |
| 24 | 3.20 | 3.50 | 2.90 | 2.70 | 2.20 | 1.90 | 1.90 | 1.60 | 1.60 | 1.80 |
| 25 | 3.20 | 4.00 | 2.90 | 2.60 | 2.20 | 1.90 | 2.20 | 1.60 | 3.60 | a 1.80 |
| 26 | 3.20 | 4.30 | 2.90 | 2.60 | 2.20 | 1.80 | 1.80 | 1.60 | 5.60 | ..... |
| 27 | 3.20 | 3.80 | 2.90 | 2.60 | 2.20 | 1.80 | 2.00 | 1.60 | 3.90 | ..... |
| 28 | 3.40 | 25.50 | 3.40 | 2.50 | 2.10 | 1.80 | 2.30 | 1.60 | 3.00 | ..... |
| 29 | 4.40 | ..... | 11.30 | 2.50 | 2.10 | 1.80 | 2.00 | 1.70 | 2.10 | ..... |
| 30 | 3.90 | ..... | 18.60 | 2.60 | 2.10 | 1.70 | 1.80 | 1.70 | 2.00 | ..... |
| 31 | 4.30 | ..... | 4.60 | ..... | 2.10 | ..... | 1.80 | 1.70 | ..... | ..... |

a Discontinued. No observer obtainable.

*Rating table for Middle Oconee River near Athens, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.6 | 243 | 5.6 | 1,915 | 9.6 | 5,340 | 16.0 | 11,100 |
| 1.8 | 307 | 5.8 | 2,050 | 9.8 | 5,520 | 16.5 | 11,550 |
| 2.0 | 371 | 6.0 | 2,190 | 10.0 | 5,700 | 17.0 | 12,000 |
| 2.2 | 435 | 6.2 | 2,336 | 10.2 | 5,880 | 17.5 | 12,450 |
| 2.4 | 499 | 6.4 | 2,490 | 10.4 | 6,060 | 18.0 | 12,900 |
| 2.6 | 563 | 6.6 | 2,652 | 10.6 | 6,240 | 18.5 | 13,350 |
| 2.8 | 627 | 6.8 | 2,822 | 10.8 | 6,420 | 19.0 | 13,800 |
| 3.0 | 691 | 7.0 | 3,000 | 11.0 | 6,600 | 19.5 | 14,250 |
| 3.2 | 755 | 7.2 | 3,180 | 11.2 | 6,780 | 20.0 | 14,700 |
| 3.4 | 819 | 7.4 | 3,360 | 11.4 | 6,960 | 20.5 | 15,150 |
| 3.6 | 884 | 7.6 | 3,540 | 11.6 | 7,140 | 21.0 | 15,600 |
| 3.8 | 966 | 7.8 | 3,720 | 11.8 | 7,320 | 21.5 | 16,050 |
| 4.0 | 1,046 | 8.0 | 3,900 | 12.0 | 7,500 | 22.0 | 16,500 |
| 4.2 | 1,131 | 8.2 | 4,080 | 12.5 | 7,950 | 22.5 | 16,950 |
| 4.4 | 1,217 | 8.4 | 4,260 | 13.0 | 8,400 | 23.0 | 17,400 |
| 4.6 | 1,315 | 8.6 | 4,440 | 13.5 | 8,850 | 23.5 | 17,850 |
| 4.8 | 1,426 | 8.8 | 4,620 | 14.0 | 9,300 | 24.0 | 18,300 |
| 5.0 | 1,541 | 9.0 | 4,800 | 14.5 | 9,750 | 24.5 | 18,750 |
| 5.2 | 1,661 | 9.2 | 4,980 | 15.0 | 10,200 | 25.0 | 19,200 |
| 5.4 | 1,786 | 9.4 | 5,160 | 15.5 | 10,650 | | |

*Estimated monthly discharge of Middle Oconee River near Athens, Ga.*

[Drainage area, 395 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 1,217 | 723 | 837 | 2.12 | 2.44 |
| February | 19,560 | 819 | 2,362 | 5.98 | 6.23 |
| March | 13,800 | 659 | 2,189 | 5.54 | 6.39 |
| April | 884 | 531 | 652 | 1.65 | 1.84 |
| May | 531 | 403 | 458 | 1.16 | 1.34 |
| June | 499 | 275 | 383 | .97 | 1.08 |
| July | 966 | 275 | 375 | .95 | 1.10 |
| August | 659 | 243 | 317 | .80 | .92 |
| September | 1,915 | 243 | 426 | 1.08 | 1.20 |
| October 1–25 | ---------- | ---------- | 367 | .93 | .87 |

NOTE.—Discontinued. No observer obtainable.

APALACHEE RIVER NEAR BUCKHEAD, GA.

A gage was established at this station on February 13, 1901, and observations were commenced on March 1. It is located at the iron wagon bridge over Apalachee River, 3½ miles north of the town of Buckhead, Ga. The bridge is a single iron span 103 feet long, supported by four tubular iron piers. Its floor is about 25 feet above low water. The left bank is high and will overflow to a distance of about 75 feet only beyond ordinary high-water mark. The right bank is liable to overflow to a distance of about 400 feet, commencing at a gage height of 6 feet. The overflow areas on both banks are crossed by wooden trestle approaches. The trestle on the right bank is subject to overflow at a gage height of 18 feet, rendering it impossible to make discharge measurements of high floods. The section is good, but the current is irregular on account of the ruins of old bridge piers in the river about 50 feet above. The general course of the river both above and below the station is slightly curved.

The gage is graduated to feet and tenths, with brass figures and staples, and consists of two parts. The first section, extending from 0 to 10 feet, is fastened to a small ash tree on the left bank, about 100 feet below the bridge. The second section, extending from 6 to 20 feet, is nailed to the upstream post of the last wooden bent next to the iron bridge on the right bank.

Bench mark No. 1 is the top of the iron pier on the right bank, downstream side. Its elevation is 25 feet above the datum of the gage.

Bench mark No. 2 is the top of the second iron crossbeam from the left bank on the downstream side. Its elevation is 25.72 feet above the datum of the gage.

The observer is A. S. Adams, a farmer living one-third of a mile from the bridge. The observer is paid by the Georgia geological survey.

The following discharge measurements were made during 1902:

February 8, gage height, 3.95 feet; discharge, 821 second-feet.
June 7, gage height, 1.52 feet; discharge, 262 second-feet.
July 19, gage height, 1.50 feet; discharge, 253 second-feet.

*Daily gage height, in feet, of Apalachee River near Buckhead, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 11.00 | 6.20 | 25.00 | 8.00 | 2.60 | 1.75 | 1.60 | 1.80 | 1.60 | 2.50 | 1.50 | 2.80 |
| 2 | 7.00 | 17.50 | 20.00 | 5.50 | 2.80 | 1.75 | 1.60 | 1.60 | 1.50 | 2.00 | 1.50 | 3.10 |
| 3 | 5.50 | 20.00 | 15.00 | 4.50 | 2.70 | 1.75 | 2.10 | 4.00 | 1.50 | 1.90 | 1.50 | 3.50 |
| 4 | 4.50 | 15.00 | 10.00 | 4.00 | 2.70 | 1.70 | 2.00 | 4.50 | 1.50 | 1.80 | 1.60 | 5.00 |
| 5 | 4.20 | 11.00 | 7.00 | 3.80 | 2.60 | 1.70 | 1.80 | 4.00 | 1.40 | 1.80 | 1.60 | 4.50 |
| 6 | 4.10 | 8.00 | 6.00 | 3.70 | 2.60 | 1.70 | 1.70 | 3.00 | 1.40 | 1.80 | 1.60 | 3.50 |
| 7 | 4.00 | 6.00 | 5.00 | 4.50 | 2.50 | 1.70 | 1.60 | 2.70 | 1.60 | 1.80 | 1.50 | 3.20 |
| 8 | 3.80 | 4.00 | 4.00 | 4.00 | 2.40 | 4.00 | 1.55 | 2.50 | 1.80 | 1.70 | 1.50 | 3.10 |
| 9 | 3.70 | 3.90 | 3.50 | 3.80 | 2.40 | 5.50 | 1.50 | 2.20 | 1.70 | 1.70 | 1.50 | 3.00 |
| 10 | 3.50 | 3.80 | 3.50 | 3.60 | 2.30 | 4.00 | 1.50 | 2.00 | 1.70 | 1.70 | 1.50 | 3 00 |
| 11 | 3.40 | 3.80 | 3.30 | 3.50 | 2.30 | 3.00 | 1.60 | 1.90 | 1.90 | 1.70 | 1.45 | 2.80 |
| 12 | 3.20 | 3.80 | 3.30 | 3.50 | 2.30 | 2.70 | 2.00 | 1.85 | 2.00 | 1.70 | 1.45 | 2.50 |
| 13 | 3.10 | 3.70 | 3.80 | 3.50 | 2.30 | 2.40 | 1.90 | 1.80 | 2.50 | 1.70 | 1.45 | 2.20 |
| 14 | 3.00 | 3.70 | 4.50 | 3.40 | 2.40 | 2.10 | 6.00 | 1.75 | 4.00 | 1.70 | 1.45 | 2.10 |
| 15 | 2.90 | 3.70 | 5.00 | 3.40 | 2.40 | 2.00 | 3.00 | 1.70 | 3.80 | 1.70 | 1.40 | 3.00 |
| 16 | 2.90 | 3.70 | 6.50 | 3.30 | 2.40 | 4.50 | 2.50 | 1.70 | 3.40 | 1.60 | 1.40 | 3.50 |
| 17 | 2.80 | 3.80 | 10.00 | 3.30 | 2.30 | 3.80 | 2.30 | 1.60 | 3.00 | 1.60 | 1.50 | 3.20 |
| 18 | 2.80 | 3.90 | 7.50 | 4.50 | 2.30 | 2.80 | 2.10 | 1.60 | 2.80 | 1.60 | 1.70 | 3.00 |
| 19 | 2.80 | 3.90 | 6.00 | 4.30 | 2.30 | 2.50 | 2.00 | 1.50 | 2.80 | 1.60 | 1.60 | 2.80 |
| 20 | 2.80 | 3.80 | 5.50 | 4.00 | 2.20 | 2.20 | 1.90 | 1.50 | 3.20 | 1.60 | 1.60 | 2.70 |
| 21 | 2.70 | 3.70 | 5.20 | 3.80 | 2.20 | 2.00 | 1.80 | 1.50 | 3.00 | 1.55 | 1.60 | 2.60 |
| 22 | 2.70 | 3.70 | 5.00 | 3.60 | 2.10 | 1.90 | 1.75 | 1.40 | 2.80 | 1.55 | 1.60 | 3.60 |
| 23 | 2.60 | 3.80 | 4.80 | 3.40 | 2.10 | 1.90 | 1.70 | 1.40 | 2.70 | 1.50 | 1.60 | 3.00 |
| 24 | 2.60 | 3.90 | 4.70 | 3.20 | 2.00 | 1.80 | 1.65 | 1.20 | 2.70 | 1.50 | 2.00 | 2.90 |
| 25 | 2.80 | 4.00 | 4.50 | 3.00 | 1.90 | 1.80 | 1.60 | 1.10 | 3.00 | 1.50 | 2.10 | 2.70 |
| 26 | 3.00 | 5.00 | 4.30 | 2.70 | 1.90 | 1.75 | 1.50 | 1.00 | 3.00 | 1.50 | 2.00 | 2.60 |
| 27 | 3.20 | 16.00 | 3.80 | 2.80 | 1.85 | 1.70 | 1.60 | 1.20 | 2.80 | 1.80 | 2.00 | 2.60 |
| 28 | 3.60 | 20.00 | 4.40 | 2.70 | 1.80 | 1.70 | 2.10 | 1.30 | 2.80 | 1.80 | 1.90 | 2.50 |
| 29 | 3.70 | ..... | 4.50 | 2.70 | 1.80 | 1.65 | 2.60 | 1.50 | 2.70 | 1.70 | 2.10 | 2.50 |
| 30 | 4.00 | ..... | 7.00 | 2.70 | 1.75 | 1.65 | 2.10 | 1.60 | 3.50 | 1.70 | 2.60 | 3.20 |
| 31 | 4.50 | ..... | 12.00 | ..... | 1.75 | ..... | 1.90 | 1.60 | ..... | 1.60 | ..... | 3.00 |

*Rating table for Apalachee River near Buckhead, Ga, for 1902.*

| Gage height. | Discharge. | Gage height | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 205 | 5.0 | 1,185 | 10.5 | 2,697 | 20.5 | 5,448 |
| 1.2 | 219 | 5.2 | 1,240 | 11.0 | 2,835 | 21.0 | 5,585 |
| 1.4 | 241 | 5.4 | 1,295 | 11.5 | 2,972 | 21.5 | 5,722 |
| 1.6 | 271 | 5.6 | 1,350 | 12.0 | 3,110 | 22.0 | 5,860 |
| 1.8 | 310 | 5.8 | 1,405 | 12.5 | 3,247 | 22.5 | 5,998 |
| 2.0 | 360 | 6.0 | 1,460 | 13.0 | 3,385 | 23.0 | 6,135 |
| 2.2 | 415 | 6.2 | 1,515 | 13.5 | 3,522 | 23.5 | 6,272 |
| 2.4 | 470 | 6.4 | 1,570 | 14.0 | 3,660 | 24.0 | 6,410 |
| 2.6 | 525 | 6.6 | 1,625 | 14.5 | 3,798 | 24.5 | 6,548 |
| 2.8 | 580 | 6.8 | 1,680 | 15.0 | 3,935 | 25.0 | 6,685 |
| 3.0 | 635 | 7.0 | 1,735 | 15.5 | 4,072 | 25.5 | 6,822 |
| 3.2 | 690 | 7.2 | 1,790 | 16.0 | 4,210 | 26.0 | 6,960 |
| 3.4 | 745 | 7.4 | 1,845 | 16.5 | 4,348 | 26.5 | 7,098 |
| 3.6 | 800 | 7.6 | 1,900 | 17.0 | 4.485 | 27.0 | 7,235 |
| 3.8 | 855 | 7.8 | 1,955 | 17.5 | 4,622 | 27.5 | 7,342 |
| 4.0 | 910 | 8.0 | 2,010 | 18.0 | 4,760 | 28.0 | 7,510 |
| 4.2 | 965 | 8.5 | 2,147 | 18.5 | 4,898 | 28.5 | 7,648 |
| 4.4 | 1,020 | 9.0 | 2,285 | 19.0 | 5,035 | 29.0 | 7,785 |
| 4.6 | 1,075 | 9.5 | 2,422 | 19.5 | 5,172 | | |
| 4.8 | 1,130 | 10.0 | 2,560 | 20.0 | 5,310 | | |

*Estimated monthly discharge of Apalachee River near Buckhead, Ga.*

[Drainage area, 440 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 2,835 | 525 | 842 | 1.91 | 2.20 |
| February | 5,310 | 827 | 1,708 | 3.88 | 4.04 |
| March | 6,685 | 717 | 1,714 | 3.90 | 4.50 |
| April | 2,010 | 552 | 843 | 1.92 | 2.14 |
| May | 580 | 300 | 448 | 1.02 | 1.18 |
| June | 1,322 | 280 | 469 | 1.07 | 1.19 |
| July | 1,460 | 255 | 375 | .85 | .98 |
| August | 1,047 | 205 | 368 | .84 | .97 |
| September | 910 | 241 | 495 | 1.12 | 1.25 |
| October | 497 | 255 | 294 | .67 | .77 |
| November | 525 | 241 | 298 | .68 | .76 |
| December | 1,185 | 388 | 641 | 1.46 | 1.68 |
| The year | 6,685 | 205 | 708 | 1.61 | 21.66 |

### OCMULGEE RIVER AT MACON, GA.

The Ocmulgee River rises in the north-central part of Georgia and flows in a southeasterly direction, joining the Oconee south of Mount Vernon to form the Altamaha River. The drainage area has the same general features as that of the Oconee. A station was established by the United States Weather Bureau on January 21, 1893, and measurements were begun by the United States Geological Survey in 1895. The wire gage on the Macon, Dublin and Savannah Railroad bridge having been twice stolen in the spring of 1897, the observations were taken on the Weather Bureau gage, which is a vertical rod bolted to the stone pier of the Central Railroad bridge. It is referred to the same datum. The bench mark is the top of the track on the Central Railroad bridge. It is 54.85 feet above the zero of the gage. (See United States Weather Bureau reports for description of other bench marks.) Measurements of discharge are made from the wagon bridge a short distance above. The channel is straight and without obstructions, except two bridge piers. The banks are high and not subject to overflow. The bed of the river is soft and changeable. W. T. Bass, a clerk in a store near the gage, was observer for the United States Geological Survey and the Georgia geological survey until June 1, 1899. Then the station was resumed by the United States Weather Bureau, in charge of T. S. Collins, until March, 1901; since that time the Weather Bureau official at that point has been John R. Weeks.

*Discharge measurements of Ocmulgee River at Macon, Ga.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| June 26 | Max Hall | 3.53 | 1,074 |
| July 25 | W. E. Hall | 3.50 | 689 |
| July 31 | H. G. Stokes | 4.20 | 1,126 |
| September 15 | W. E. Hall | 3.61 | 885 |
| September 18 | do | 3.30 | 705 |
| October 23 | A. T. Mitchelson | 3.10 | 829 |
| November 13 | do | 3.10 | 779 |
| November 26 | do | 9.29 | 6,483 |
| Do | do | 9.59 | 5,900 |
| December 5 | do | 9.00 | 4,612 |

*Daily gage height, in feet, of Ocmulgee River at Macon, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 15.70 | 11.50 | 22.80 | 12.80 | 5.80 | 4.20 | 3.30 | 3.90 | 4.00 | 5.00 | 3.50 | 8.50 |
| 2 | 11.00 | 18.00 | 20.90 | 10.40 | 5.70 | 4.10 | 3.20 | 3.80 | 3.60 | 5.60 | 3.30 | 7.30 |
| 3 | 8.10 | 19.20 | 17.30 | 8.80 | 5.70 | 4.50 | 3.30 | 3.70 | 3.50 | 4.50 | 3.30 | 13.30 |
| 4 | 6.30 | 18.50 | 13.00 | 8.50 | 5.80 | 4.30 | 3.10 | 5.50 | 3.30 | 3.90 | 3.20 | 11.90 |
| 5 | 5.20 | 15.00 | 11.10 | 8.20 | 5.50 | 4.10 | 3.30 | 5.90 | 3.40 | 4.30 | 3.20 | 9.50 |
| 6 | 4.70 | 10.60 | 10.10 | 7.90 | 5.40 | 4.00 | 3.30 | 9.50 | 3.40 | 5.20 | 3.30 | 7.00 |
| 7 | 4.40 | 8.40 | 9.40 | 7.60 | 5.30 | 4.00 | 3.30 | 5.50 | 3.40 | 4.80 | 3.40 | 5.90 |
| 8 | 4.20 | 7.20 | 8.70 | 10.50 | 5.20 | 6.20 | 3.20 | 4.60 | 3.30 | 4.20 | 3.70 | 5.20 |
| 9 | 4.00 | 6.40 | 8.40 | 10.20 | 5.20 | 6.10 | 3.30 | 4.00 | 3.40 | 3.80 | 3.50 | 4.70 |
| 10 | 3.90 | 5.80 | 8.20 | 9.80 | 5.50 | 5.00 | 3.20 | 3.80 | 3.40 | 3.70 | 3.40 | 4.20 |
| 11 | 3.70 | 5.50 | 7.90 | 7.70 | 5.50 | 4.60 | 3.20 | 3.70 | 3.80 | 3.50 | 3.30 | 3.80 |
| 12 | 3.60 | 5.30 | 7.70 | 7.30 | 5.30 | 4.20 | 3.30 | 3.40 | 3.60 | 3.90 | 3.30 | 4.00 |
| 13 | 3.50 | 5.00 | 7.50 | 7.10 | 5.20 | 4.10 | 3.20 | 4.60 | 3.50 | 4.60 | 3.20 | 5.20 |
| 14 | 3.30 | 4.90 | 8.40 | 6.90 | 5.10 | 4.00 | 3.20 | 4.00 | 3.30 | 4.60 | 3.10 | 4.00 |
| 15 | 3.10 | 5.10 | 9.40 | 6.90 | 5.00 | 4.00 | 5.20 | 3.80 | 4.20 | 4.30 | 3.20 | 4.30 |
| 16 | 3.10 | 5.50 | 10.70 | 6.90 | 5.40 | 5.80 | 4.10 | 4.10 | 3.80 | 3.90 | 3.10 | 4.10 |
| 17 | 3.20 | 5.70 | 18.60 | 6.80 | 6.40 | 5.00 | 4.00 | 5.90 | 3.50 | 3.60 | 3.20 | 3.60 |
| 18 | 3.10 | 5.40 | 16.80 | 11.10 | 5.70 | 4.50 | 3.80 | 4.10 | 3.30 | 3.50 | 3.50 | 6.80 |
| 19 | 3.10 | 5.30 | 13.40 | 9.00 | 5.70 | 4.80 | 3.60 | 3.40 | 3.30 | 3.40 | 4.80 | 5.80 |
| 20 | 3.20 | 5.20 | 11.00 | 7.60 | 5.70 | 4.40 | 3.40 | 3.70 | 3.20 | 3.40 | 4.60 | 4.80 |
| 21 | 3.40 | 5.90 | 9.40 | 7.10 | 5.20 | 4.20 | 3.40 | 3.40 | 4.20 | 3.30 | 3.90 | 6.80 |
| 22 | 3.90 | 6.30 | 8.90 | 7.00 | 5.00 | 4.00 | 3.40 | 3.30 | 4.10 | 3.50 | 3.60 | 6.60 |
| 23 | 4.20 | 5.90 | 8.60 | 6.60 | 4.80 | 3.80 | 3.80 | 3.70 | 3.70 | 3.20 | 3.50 | 6.00 |
| 24 | 3.70 | 5.30 | 8.20 | 6.40 | 4.70 | 3.70 | 3.50 | 3.60 | 3.60 | 3.20 | 3.30 | 5.30 |
| 25 | 3.40 | 7.20 | 9.10 | 6.30 | 4.60 | 3.70 | 3.60 | 3.30 | 3.40 | 3.10 | 3.20 | 4.80 |
| 26 | 3.40 | 8.10 | 8.90 | 6.20 | 4.60 | 3.60 | 3.50 | 3.20 | 6.80 | 3.10 | 8.80 | 4.30 |
| 27 | 3.40 | 8.40 | 8.30 | 6.20 | 4.50 | 3.60 | 4.80 | 3.20 | 5.80 | 3.80 | 8.50 | 4.20 |
| 28 | 3.40 | 19.90 | 10.00 | 6.10 | 4.40 | 3.50 | 3.70 | 3.30 | 5.30 | 5.40 | 5.70 | 4.00 |
| 29 | 3.30 | ..... | 16.20 | 5.90 | 4.30 | 3.40 | 4.90 | 4.30 | 5.40 | 4.70 | 4.40 | 3.80 |
| 30 | 3.90 | ..... | 17.30 | 5.80 | 4.20 | 3.40 | 4.70 | 4.60 | 5.20 | 3.90 | 4.10 | 4.00 |
| 31 | 4.40 | ..... | 14.60 | ..... | 4.20 | ..... | 4.20 | 4.70 | ..... | 3.60 | ..... | 4.80 |

*Rating table for Ocmulgee River at Macon, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 3.2 | 865 | 6.6 | 3,460 | 10.0 | 6,820 | 15.5 | 20,200 |
| 3.4 | 995 | 6.8 | 3,640 | 10.2 | 7,060 | 16.0 | 22,300 |
| 3.6 | 1,125 | 7.0 | 3,820 | 10.4 | 7,300 | 16.5 | 24,400 |
| 3.8 | 1,260 | 7.2 | 4,000 | 10.6 | 7,540 | 17.0 | 26,500 |
| 4.0 | 1,400 | 7.4 | 4,185 | 10.8 | 7,780 | 17.5 | 28,600 |
| 4.2 | 1,540 | 7.6 | 4,375 | 11.0 | 8,020 | 18.0 | 30,700 |
| 4.4 | 1,685 | 7.8 | 4,565 | 11.2 | 8,260 | 18.5 | 32,800 |
| 4.6 | 1,835 | 8.0 | 4,755 | 11.4 | 8,510 | 19.0 | 34,900 |
| 4.8 | 1,985 | 8.2 | 4,945 | 11.6 | 8,780 | 19.5 | 37,000 |
| 5.0 | 2,140 | 8.4 | 5,140 | 11.8 | 9,050 | 20.0 | 39,100 |
| 5.2 | 2,300 | 8.6 | 5,340 | 12.0 | 9,400 | 20.5 | 41,200 |
| 5.4 | 2,460 | 8.8 | 5,540 | 12.5 | 10,300 | 21.0 | 43,300 |
| 5.6 | 2,620 | 9.0 | 5,740 | 13.0 | 11,240 | 21.5 | 45,400 |
| 5.8 | 2,780 | 9.2 | 5,945 | 13.5 | 12,470 | 22.0 | 47,500 |
| 6.0 | 2,950 | 9.4 | 6,155 | 14.0 | 13,900 | | |
| 6.2 | 3,120 | 9.6 | 6,370 | 14.5 | 16,000 | | |
| 6.4 | 3,290 | 9.8 | 6,590 | 15.0 | 18,100 | | |

*Estimated monthly discharge of Ocmulgee River at Macon, Ga.*

[Drainage area, 2,425 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 21,040 | 800 | 2,242 | 0.92 | 1.06 |
| February | 38,680 | 2,060 | 8,444 | 3.48 | 3.62 |
| March | 50,860 | 4,280 | 12,700 | 5.24 | 6.04 |
| April | 10,840 | 2,780 | 4,738 | 1.95 | 2.18 |
| May | 3,290 | 1,540 | 2,292 | .95 | 1.10 |
| June | 3,120 | 995 | 1,631 | .67 | .75 |
| July | 2,300 | 800 | 1,169 | .48 | .55 |
| August | 6,260 | 865 | 1,624 | .67 | .77 |
| September | 3,680 | 865 | 1,377 | .57 | .64 |
| October | 2,620 | 800 | 1,430 | .59 | .68 |
| November | 5,540 | 800 | 1,423 | .59 | .66 |
| December | 11,950 | 1,125 | 2,961 | 1.22 | 1.41 |
| The year | 50,860 | 800 | 3,502 | 1.44 | 19.46 |

## OCMULGEE RIVER NEAR FLOVILLA, GA.

A station was established on July 26, 1901, on Ocmulgee River at Lamars Ferry, one-half mile below Lamar's mill and 5 miles east of Flovilla, Ga. The object of this station was to compare the discharge of the river at this point with its discharge below at Macon through the low-water season.

The gage consisted of a $\frac{7}{8}$ by 5 inch by 10-foot poplar board graduated to feet and tenths with brass figures, staples, and tacks. The rod was nailed to a 16-foot pine plank, which was spiked to an ash tree 25 feet below the ferry landing. The tree was graduated with nails 1 foot apart, extending the gage up to 20 feet above datum.

The gage and bench marks were washed away by a flood on February 27, 1902, and the station has not been reestablished.

The following discharge measurement was made in 1902:

February 10: Gage height, 5.60 feet; discharge, 2,376 second-feet.

*Daily gage height, in feet, of Ocmulgee River near Flovilla, Ga.*

| Day. | Jan. | Feb. | Day. | Jan. | Feb. | Day. | Jan. | Feb. | Day. | Jan. | Feb. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | | 1902. | | |
| 1..... | 14.00 | 14.60 | 9..... | 4.40 | 5.70 | 17..... | 3.80 | 5.50 | 25..... | 4.00 | 6.20 |
| 2..... | 9.00 | 19.00 | 10..... | 4.30 | 5.60 | 18..... | 3.70 | 5.30 | 26..... | 4.30 | 7.60 |
| 3..... | 6.50 | 20.20 | 11..... | 4.10 | 5.30 | 19..... | 3.90 | 5.00 | 27..... | 4.40 | 7.60 |
| 4..... | 5.70 | 19.50 | 12..... | 4.10 | 5.70 | 20..... | 4.10 | 5.50 | 28..... | 4.10 | (a) |
| 5..... | 5.20 | 10.00 | 13..... | 4.00 | 5.00 | 21..... | 4.20 | 5.80 | 29..... | 4.70 | ..... |
| 6..... | 5.00 | 8.10 | 14..... | 3.70 | 4.80 | 22..... | 4.70 | 5.60 | 30..... | 5.40 | ..... |
| 7..... | 4.80 | 7.20 | 15..... | 3.70 | 5.20 | 23..... | 4.50 | 5.40 | 31..... | 5.30 | ..... |
| 8..... | 4.50 | 6.50 | 16..... | 4.00 | 5.70 | 24..... | 4.20 | 5.10 | | | |

*a* Gage washed out.

*Rating table for Ocmulgee River near Flovilla, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge | Gage height. | Discharge. | Gage height | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.6 | 870 | 4.4 | 1,756 | 6.5 | 2,837 | 15.0 | 7,215 |
| 2.8 | 947 | 4.6 | 1,859 | 7.0 | 3,095 | 16.0 | 7,730 |
| 3.0 | 1,037 | 4.8 | 1,962 | 8.0 | 3,610 | 17.0 | 8,245 |
| 3.2 | 1,138 | 5.0 | 2,065 | 9.0 | 4,125 | 18.0 | 8,760 |
| 3.4 | 1,241 | 5.2 | 2,168 | 10.0 | 4,640 | 19.0 | 9,275 |
| 3.6 | 1,344 | 5.4 | 2,271 | 11.0 | 5,155 | 20.0 | 9,790 |
| 3.8 | 1,447 | 5.6 | 2,374 | 12.0 | 5,670 | 21.0 | 10,305 |
| 4.0 | 1,550 | 5.8 | 2,477 | 13.0 | 6,185 | 22.0 | 10,820 |
| 4.2 | 1,653 | 6.0 | 2,580 | 14.0 | 6,700 | 23.0 | 11,335 |

*Estimated monthly discharge of Ocmulgee River near Flovilla, Ga.*

[Drainage area, 1,500 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 6,700 | 1,395 | 2,020 | 1.35 | 1.56 |
| February 1–27 | | | 3,538 | 2.36 | 2.37 |

ALCOVY RIVER NEAR COVINGTON, GA.

This station was established on April 30, 1901. It is located about 3 miles east of Covington, at a low wooden bridge which is often under water. The gage is a vertical rod 10 feet long, graduated to feet and tenths, marked by tacks and brass figures. It is spiked to a birch tree on the left bank of the river 2 feet from the upstream side of the bridge.

The banks are low and liable to overflow. The ground on the right bank is low and swampy for several hundred yards and is flooded by a moderate rise.

The observer is Stephen Belcher, a farmer living near. This station is above Garners Shoal, on Alcovy River, where the fall is said to be 97 feet in a distance of 1,200 feet. The observer is paid by the Georgia geological survey.

The bench mark is a notch and nail in a maple tree on the right bank, about 15 feet from the upper side of the bridge. Elevation, 5.91 feet above zero of the gage.

The following discharge measurements were made during 1902:

February 7: Gage height, 4.87 feet; discharge, 661 second-feet.
June 14: Gage height, 1.70 feet; discharge, 156 second-feet.
July 18: Gage height, 1.32 feet; discharge, 127 second-feet.
September 12: Gage height, 1.20 feet; discharge, 128 second-feet.

*Daily gage height, in feet, of Alcovy River near Covington, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 6.50 | 5.20 | 9.50 | 5.60 | 3.00 | 1.90 | 1.00 | 1.80 | 1.40 | 2.70 | 1.60 | 3.50 |
| 2 | 5.40 | 7.30 | 7.20 | 5.00 | 3.50 | 1.40 | 1.00 | 1.40 | 1.30 | 2.50 | 1.70 | 5.00 |
| 3 | 4.80 | 8.80 | 6.20 | 4.80 | 3.20 | 2.20 | 1.00 | 4.20 | 1.20 | 2.00 | 1.60 | 5.30 |
| 4 | 4.30 | 7.00 | 5.80 | 4.50 | 3.00 | 2.00 | 2.20 | 3.70 | 1.00 | 1.70 | 1.90 | 5.10 |
| 5 | 4.00 | 6.70 | 5.30 | 4.30 | 2.90 | 1.90 | 1.70 | 5.00 | 1.00 | 2.00 | 2.20 | 4.90 |
| 6 | 3.70 | 6.30 | 5.00 | 4.20 | 2.80 | 1.70 | 1.70 | 3.80 | 1.00 | 1.90 | 2.10 | 4.70 |
| 7 | 3.50 | 4.90 | 4.80 | 4.50 | 2.70 | 1.70 | 1.50 | 2.50 | 1.20 | 1.80 | 2.00 | 2.50 |
| 8 | 3.40 | 4.40 | 4.60 | 4.90 | 2.60 | 2.50 | 1.30 | 2.40 | 1.10 | 1.70 | 2.00 | 3.20 |
| 9 | 3.30 | 4.30 | 4.50 | 4.70 | 2.70 | 3.80 | 1.20 | 1.90 | 1.00 | 1.60 | 1.60 | 3.00 |
| 10 | 3.20 | 4.00 | 4.40 | 4.50 | 2.60 | 2.70 | 1.10 | 1.50 | 1.00 | 1.60 | 1.60 | 2.90 |
| 11 | 3.10 | 3.80 | 4.30 | 4.00 | 2.60 | 2.20 | 1.00 | 1.40 | 1.00 | 1.60 | 1.50 | 2.70 |
| 12 | 3.00 | 3.70 | 4.20 | 3.80 | 2.60 | 2.00 | 2.50 | 1.30 | 1.80 | 2.20 | 1.50 | 2.40 |
| 13 | 2.90 | 3.60 | 4.00 | 3.80 | 2.50 | 1.90 | 2.00 | 1.00 | 2.90 | 2.50 | 1.50 | 2.20 |
| 14 | 2.80 | 3.60 | 4.40 | 3.70 | 2.50 | 1.80 | 1.90 | 1.00 | 3.30 | 2.60 | 1.40 | 2.20 |
| 15 | 2.70 | 3.60 | 4.80 | 3.70 | 2.50 | 2.20 | 1.80 | 2.00 | 2.90 | 2.10 | 1.40 | 2.10 |
| 16 | 2.80 | 3.80 | 5.80 | 3.60 | 2.60 | 2.70 | 1.70 | 1.90 | 2.40 | 1.90 | 1.60 | 2.70 |
| 17 | 2.80 | 3.80 | 6.80 | 3.60 | 2.50 | 2.50 | 1.60 | 1.20 | 2.00 | 1.70 | 1.60 | 3.00 |
| 18 | 2.70 | 3.80 | 6.70 | 4.30 | 2.80 | 2.30 | 1.40 | 1.10 | 1.70 | 1.50 | 2.70 | 3.50 |
| 19 | 2.80 | 3.70 | 6.00 | 4.20 | 2.70 | 2.20 | 1.40 | 1.30 | 2.20 | 1.70 | 3.20 | 2.90 |
| 20 | 2.80 | 3.70 | 5.70 | 4.00 | 2.60 | 2.10 | 1.10 | 1.20 | 2.80 | 1.80 | 2.90 | 2.40 |
| 21 | 3.00 | 3.80 | 5.10 | 3.90 | 2.40 | 1.90 | 1.10 | 1.10 | 2.90 | 1.60 | 2.20 | 3.00 |
| 22 | 3.40 | 3.80 | 4.80 | 3.80 | 2.60 | 1.90 | 1.10 | 1.00 | 2.40 | 1.60 | 2.00 | 2.90 |
| 23 | 3.50 | 3.80 | 4.50 | 3.70 | 2.40 | 1.80 | 1.10 | 1.00 | 2.10 | 1.60 | 1.70 | 2.80 |
| 24 | 3.00 | 4.20 | 4.50 | 3.70 | 2.40 | 1.80 | 1.10 | 1.00 | 1.60 | 1.60 | 1.70 | 2.70 |
| 25 | 3.00 | 4.30 | 4.50 | 3.50 | 2.30 | 1.80 | 1.00 | 1.00 | 3.00 | 1.60 | 3.30 | 2.60 |
| 26 | 3.00 | 4.40 | 4.30 | 3.40 | 2.20 | 1.80 | 1.00 | 1.00 | 3.00 | 1.70 | 4.10 | 2.40 |
| 27 | 3.00 | 5.00 | 3.90 | 3.00 | 2.00 | 1.80 | 1.00 | 1.00 | 3.40 | 2.10 | 3.30 | 2.10 |
| 28 | 3.00 | 12.80 | 4.30 | 3.00 | 2.00 | 1.80 | 2.30 | 1.20 | 2.80 | 2.00 | 3.00 | 2.90 |
| 29 | 3.20 | ..... | 5.50 | 3.00 | 2.00 | 1.20 | 3.50 | 1.90 | 2.60 | 1.90 | 2.40 | 2.90 |
| 30 | 3.60 | ..... | 7.40 | 3.00 | 2.00 | 1.20 | 3.70 | 2.40 | 2.80 | 1.80 | 2.40 | 3.00 |
| 31 | 4.00 | ..... | 6.90 | ..... | 2.00 | ..... | 2.80 | 1.50 | ..... | 1.70 | ..... | 3.00 |

*Rating table for Alcovy River near Covington, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 108 | 3.0 | 308 | 5.0 | 688 | 7.0 | 1,068 |
| 1.2 | 121 | 3.2 | 346 | 5.2 | 726 | 7.2 | 1,106 |
| 1.4 | 136 | 3.4 | 384 | 5.4 | 764 | 7.4 | 1,144 |
| 1.6 | 152 | 3.6 | 422 | 5.6 | 802 | 7.6 | 1,182 |
| 1.8 | 169 | 3.8 | 460 | 5.8 | 840 | 7.8 | 1,220 |
| 2.0 | 187 | 4.0 | 498 | 6.0 | 878 | 8.0 | 1,258 |
| 2.2 | 207 | 4.2 | 536 | 6.2 | 916 | 8.5 | 1,353 |
| 2.4 | 229 | 4.4 | 574 | 6.4 | 954 | 9.0 | 1,448 |
| 2.6 | 252 | 4.6 | 612 | 6.6 | 992 | 9.5 | 1,543 |
| 2.8 | 278 | 4.8 | 650 | 6.8 | 1,030 | ..... | ..... |

*Estimated monthly discharge of Alcovy River near Covington, Ga.*

[Drainage area, 228 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 973 | 265 | 391 | 1.72 | 1.98 |
| February | 2,170 | 422 | 675 | 2.96 | 3.08 |
| March | 1,543 | 479 | 754 | 3.31 | 3.82 |
| April | 802 | 308 | 496 | 2.18 | 2.43 |
| May | 403 | 187 | 251 | 1.10 | 1.27 |
| June | 460 | 121 | 195 | .86 | .96 |
| July | 441 | 108 | 163 | .71 | .82 |
| August | 688 | 108 | 193 | .85 | .98 |
| September | 384 | 108 | 204 | .89 | .99 |
| October | 265 | 144 | 181 | .79 | .91 |
| November | 517 | 136 | 212 | .93 | 1.04 |
| December | 745 | 197 | 344 | 1.51 | 1.74 |
| The year | 2,170 | 108 | 338 | 1.48 | 20.02 |

MISCELLANEOUS MEASUREMENTS IN ALTAMAHA DRAINAGE BASIN.

The following miscellaneous measurements were made in the Altamaha drainage basin during 1902 by B. M. Hall and his assistants:

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| | | | *Second-feet.* |
| May 2 | Middle Oconee River | Foot of Tallahassee Shoals, 7 miles above Athens gaging station, Georgia. | 836.5 |
| June 27 | Oconee River | Park's mill, Georgia (minimum stage). | 903 |
| July 26 | Ocmulgee River | Southern Railway bridge, Lumber City, Ga. | 2,368 |
| July 26 | Little Ocmulgee River, or Aucheehachee Creek. | ¾ mile east of Lumber City, Ga. | 285 |
| July 29 | Little River | Near Meriwether, Ga. | 719 |
| July 30 | Oconee River | Milledgeville, Ga. (gage height, 4.8 feet). | 3,140 |
| Nov. 17 | Ocmulgee River | Pittman's ferry, near Flovilla, Ga. | 795 |
| Dec. 17 | Little Ocmulgee River, or Aucheehachee Creek. | Near Lumber City, Ga. | 1,247 |
| Dec. 17 | Alligator Creek | 2 miles north of Lumber City, Ga. | 279 |
| Dec. 17 | Oconee Creek | 4 miles from Lumber City, Ga. | 461 |

## EASTERN GULF DRAINAGE.

The rivers flowing into the eastern portion of the Gulf of Mexico are for the most part similar in character to those in the Southern Atlantic drainage, though in their lower courses their flow is usually more sluggish. In this report the rivers in this section from which the United States Geological Survey has obtained data during 1902 have been grouped into the following drainage areas: The Apalachicola, the Mobile, and the Pearl.

### APALACHICOLA RIVER DRAINAGE BASIN.

Apalachicola River is formed by the union of Flint and Chattahoochee rivers, about 5 miles north of the boundary between Georgia and Florida. It flows across the western part of Florida and empties into the Gulf of Mexico. Chattahoochee River rises in the northeastern part of Georgia and flows in a southwesterly direction until it reaches the Alabama-Georgia State line in the northern part of Harris County, Ga.; hence it flows south, forming the boundary between Alabama and Georgia. Flint River rises in the west-central part of Georgia and flows in a general southerly direction. During 1902 the United States Geological Survey maintained the following stations in this basin, under the direction of B. M. Hall: On the Flint River, at Albany, and near Woodbury, Ga.; on the Chattahoochee River, at Westpoint, at Oakdale, and near Gainesville, Ga.

#### FLINT RIVER AT ALBANY, GA.

This station was originally established by the United States Weather Bureau on April 10, 1893, and has been maintained from that date to the present. The gage was washed out and replaced in 1898. It was again injured, in 1902, and was replaced by a new gage on June 17, 1902, which was read for the first time on June 18. The new gage was set 9 inches, or seventy-five hundredths of a foot, lower than the old gage. The gage as it existed prior to June 17, 1902, is described in Water-Supply Paper No. 48, on page 156. R. V. Watson was employed by the Weather Bureau to make and set the new gage, and it appears from Mr. Watson's description of this gage on June 17, 1902, that a certain bench mark cut in the lower iron pier of the county bridge and described in Paper No. 48, above referred to, as being 10 feet above zero of gage, was in reality only 9 feet and 3 inches above the zero of the old gage. As Mr. Watson set the new gage 10 feet below this bench mark, its zero is 9 inches lower than that of the old gage. The gage heights have been corrected from January 1 to June 17, 1902, inclusive, to correspond with the new gage, so that one rating table will apply to the whole year.

Albany station is, and has always been, a Weather Bureau station, and John E. Clark has been the observer for years. Discharge measurements were begun by the United States Geological Survey in 1901.

The following is Mr. Watson's description of the present gage: The name of the bridge to which the gage is attached is the Dougherty County Flint River bridge, located at Albany, Ga. The gage is in three parts or sections. No. 1 is attached to the crib around the middle piers (the crib is filled with rocks, being 30 by 14 feet), and extends about 3 feet above ordinary low water. This section reads to 4 feet above zero. It is securely spiked to the wooden crib. Section No. 2 is securely spiked to a green cypress tree just above the bridge on the west bank of the river and shows 17 feet, beginning at 2 feet above the zero on No. 1. No. 3 is securely spiked to a cedar post 16 feet high, the post being put 3 feet into the firm ground. This section begins at 17 feet above the zero on No. 1 and reads to 32 feet, which is about 2½ feet above any high water known since 1840. The gage is subdivided into feet and tenths.

The main bench mark is a chisel cut on the downstream iron pier on the west bank. This cut is 10 feet above the low water of 1888, at which time the river was lower than had been known for years. The zero of the new gage is 10 feet below this bench mark, this being 9 inches lower than originally.

The following discharge measurements were made during 1902 by M. R. Hall and W. E. Hall:

June 25: Gage height, 1.90 feet; discharge, 3,386 second-feet.
June 25: Gage height, 1.90 feet; discharge, 3,440 second-feet.
September 26: Gage height, 1.2 feet; discharge, 2,492 second-feet.
December 4: Gage height, 6.11 feet; discharge, 8,006 second-feet.

*Daily gage height, in feet, of Flint River at Albany, Ga., for 1902.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 6.80 | 3.80 | 9.60 | 8.90 | 4.80 | 4.30 | 2.60 | 3.00 | 2.30 | 2.20 | 1.80 | 2.20 |
| 2 | 6.10 | 5.00 | 11.80 | 9.30 | 4.80 | 3.60 | 2.30 | 3.00 | 2.00 | 2.00 | 1.70 | 3.60 |
| 3 | 6.70 | 6.80 | 15.00 | 9.80 | 4.90 | 2.80 | 2.00 | 2.80 | 1.80 | 1.80 | 1.60 | 4.20 |
| 4 | 6.90 | 9.00 | 19.60 | 9.80 | 5.10 | 2.60 | 2.00 | 2.40 | 1.60 | 1.70 | 1.70 | 6.10 |
| 5 | 6.80 | 11.90 | 20.90 | 10.50 | 5.00 | 2.50 | 2.20 | 2.40 | 1.60 | 1.70 | 1.50 | 7.30 |
| 6 | 6.60 | 12.60 | 22.70 | 10.80 | 5.10 | 2.50 | 2.10 | 2.50 | 1.40 | 1.80 | 1.10 | 7.90 |
| 7 | 7.50 | 13.30 | 22.90 | 9.90 | 4.80 | 2.60 | 1.80 | 2.80 | 1.60 | 1.70 | .60 | 8.20 |
| 8 | 8.30 | 14.50 | 19.70 | 8.80 | 4.60 | 2.90 | 1.70 | 3.10 | 1.40 | 1.30 | .40 | 8.90 |
| 9 | 9.10 | 14.80 | 17.60 | 8.70 | 3.90 | 4.10 | 1.70 | 3.10 | 1.80 | 1.40 | .20 | 9.40 |
| 10 | 9.90 | 15.90 | 15.10 | 7.90 | 3.70 | 4.10 | 1.60 | 2.90 | 2.50 | 1.20 | .10 | 9.90 |
| 11 | 10.80 | 16.10 | 11.20 | 7.80 | 3.80 | 4.30 | 1.40 | 2.70 | 3.20 | 1.00 | .40 | 10.40 |
| 12 | 12.10 | 14.00 | 10.40 | 7.50 | 3.60 | 4.50 | 1.10 | 2.70 | 3.20 | .90 | .60 | 9.70 |
| 13 | 13.30 | 11.90 | 9.80 | 7.20 | 3.50 | 4.50 | 1.30 | 2.50 | 3.40 | .80 | .90 | 8.20 |
| 14 | 13.80 | 10.40 | 9.50 | 7.20 | 3.10 | 4.90 | 1.50 | 2.90 | 3.40 | .70 | .90 | 7.60 |
| 15 | 14.50 | 7.80 | 8.90 | 7.00 | 2.60 | 4.80 | 2.20 | 3.80 | 3.60 | .70 | 1.10 | 6.40 |
| 16 | 14.30 | 6.90 | 11.50 | 7.50 | 2.50 | 4.50 | 2.10 | 3.60 | 3.90 | .70 | .80 | 6.00 |

*Daily gage height, in feet, of Flint River at Albany, Ga., for 1902*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 17 | 12.10 | 6.60 | 16.30 | 7.60 | 2.60 | 4.90 | 2.00 | 3.40 | 4.30 | .60 | .60 | 5.40 |
| 18 | 10.80 | 6.00 | 17.00 | 7.50 | 3.00 | 4.30 | 1.90 | 3.40 | 4.40 | .70 | .40 | 5.10 |
| 19 | 10.10 | 7.60 | 15.60 | 7.60 | 3.30 | 3.90 | 1.80 | 3.20 | 3.90 | .50 | .40 | 4.70 |
| 20 | 9.80 | 7.80 | 14.10 | 7.80 | 3.60 | 3.70 | 1.80 | 3.10 | 3.70 | .40 | .30 | 4.40 |
| 21 | 8.60 | 8.90 | 12.80 | 7.90 | 3.10 | 3.10 | 1.80 | 2.90 | 3.90 | .90 | .10 | 4.90 |
| 22 | 7.10 | 9.80 | 11.70 | 8.00 | 2.80 | 2.80 | 1.90 | 2.20 | 4.10 | 1.20 | .20 | 5.50 |
| 23 | 6.50 | 10.30 | 11.40 | 8.10 | 2.50 | 2.60 | 2.20 | 2.10 | 4.00 | 1.30 | .40 | 5.70 |
| 24 | 5.10 | 9.70 | 10.80 | 7.90 | 2.60 | 2.60 | 2.60 | 1.90 | 4.00 | 1.80 | .40 | 5.80 |
| 25 | 4.60 | 8.80 | 10.70 | 7.80 | 3.10 | 1.90 | 2.90 | 1.90 | 3.20 | 1.90 | .50 | 6.10 |
| 26 | 4.40 | 8.10 | 10.50 | 7.60 | 3.50 | 2.30 | 2.90 | 1.80 | 1.20 | 2.10 | .60 | 6.30 |
| 27 | 4.30 | 7.80 | 9.90 | 6.80 | 3.60 | 2.20 | 3.20 | 2.00 | 2.60 | 2.00 | .90 | 6.90 |
| 28 | 4.30 | 7.90 | 9.60 | 6.50 | 3.80 | 2.20 | 3.40 | 2.20 | 2.40 | 1.80 | .90 | 7.10 |
| 29 | 4.30 | ..... | 9.60 | 5.60 | 4.30 | 2.00 | 3.40 | 2.40 | 2.20 | 1.70 | 1.30 | 6.60 |
| 30 | 4.20 | ..... | 8.70 | 4.80 | 4.60 | 2.00 | 3.40 | 2.40 | 2.00 | 1.60 | 1.80 | 5.70 |
| 31 | 3.90 | ..... | 7.90 | ..... | 4.60 | ..... | 3.20 | 2.30 | ..... | 1.90 | ..... | 4.80 |

*Rating table for Flint River at Albany, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.2 | 1,495 | 3.8 | 5,545 | 7.4 | 9,595 | 11.0 | 13,645 |
| .4 | 1,720 | 4.0 | 5,770 | 7.6 | 9,820 | 11.5 | 14,208 |
| .6 | 1,945 | 4.2 | 5,995 | 7.8 | 10,045 | 12.0 | 14,770 |
| .8 | 2,170 | 4.4 | 6,220 | 8.0 | 10,270 | 12.5 | 15,333 |
| 1.0 | 2,395 | 4.6 | 6,445 | 8.2 | 10,495 | 13.0 | 15,895 |
| 1.2 | 2,620 | 4.8 | 6,670 | 8.4 | 10,720 | 13.5 | 16,458 |
| 1.4 | 2,845 | 5.0 | 6,895 | 8.6 | 10,945 | 14.0 | 17,020 |
| 1.6 | 3,070 | 5.2 | 7,120 | 8.8 | 11,170 | 14.5 | 17,583 |
| 1.8 | 3,295 | 5.4 | 7,345 | 9.0 | 11,395 | 15.0 | 18,145 |
| 2.0 | 3,520 | 5.6 | 7,590 | 9.2 | 11,620 | 15.5 | 18,708 |
| 2.2 | 3,745 | 5.8 | 7,795 | 9.4 | 11,845 | 16.0 | 19,270 |
| 2.4 | 3,970 | 6.0 | 8,020 | 9.6 | 12,070 | 17.0 | 20,395 |
| 2.6 | 4,195 | 6.2 | 8,245 | 9.8 | 12,295 | 18.0 | 21,520 |
| 2.8 | 4,420 | 6.4 | 8,470 | 10.0 | 12,520 | 19.0 | 22,645 |
| 3.0 | 4,645 | 6.6 | 8,695 | 10.2 | 12,745 | 20.0 | 23,770 |
| 3.2 | 4,870 | 6.8 | 8,920 | 10.4 | 12,858 | 21.0 | 24,895 |
| 3.4 | 5,095 | 7.0 | 9,145 | 10.6 | 13,195 | 22.0 | 26,020 |
| 3.6 | 5,320 | 7.2 | 9,370 | 10.8 | 13,420 | 23.0 | 27,145 |

*Estimated monthly discharge of Flint River at Albany, Ga.*

[Drainage area, 5,000 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 17,583 | 5,658 | 10,472 | 2.09 | 2.41 |
| February | 19,383 | 5,545 | 12,279 | 2.46 | 2.56 |
| March | 27,033 | 10,158 | 16,251 | 3.25 | 3.75 |
| April | 13,420 | 6,670 | 10,274 | 2.05 | 2.29 |
| May | 7,008 | 4,080 | 5,509 | 1.10 | 1.27 |
| June | 6,783 | 3,405 | 5,020 | 1.00 | 1.12 |
| July | 5,095 | 2,505 | 3,737 | .75 | .86 |
| August | 5,545 | 3,295 | 4,296 | .86 | .99 |
| September | 6,220 | 2,620 | 4,442 | .89 | .99 |
| October | 3,745 | 1,720 | 2,793 | .56 | .65 |
| November | 3,295 | 1,380 | 2,176 | .44 | .49 |
| December | 12,970 | 3,745 | 8,565 | 1.71 | 1.97 |
| The year | 27,033 | 1,380 | 7,151 | 1.43 | 19.35 |

FLINT RIVER NEAR WOODBURY, GA.

Measurements of the flow of Flint River were made during 1897 and 1898 at Molina, Ga., but the river bed was so shifting that the station was discontinued on June 2, 1898. Two measurements were made in 1899 at the Macon and Birmingham Railroad bridge, near Woodbury, Ga., 5 miles below the Molina station. On March 29, 1900, a gage was put in near this bridge, and the station was reestablished. The gage is a vertical rod, fastened to a willow tree on the left bank of the river about 300 feet above the bridge. The bench mark is the top of the iron girder under the cross-ties at a point 12 feet to the left of the center pier, and is 27 feet above the zero of the gage, the zero of the gage being 659.6 feet above sea level. This gage was maintained by the Georgia geological survey until November 1, 1900, when it was adopted by the United States Weather Bureau instead of the one at Reynolds, Ga. The observer is J. C. Wright, a farmer living near.

This station is at the head of a series of shoals and rapids, having an aggregate fall of 334 feet in a distance of 45 miles, a map and profile of which is published in Twenty-second Annual Report, part 4.

The following discharge measurements were made during 1902:

June 30: Gage height, 0.00 feet; discharge, 292 second-feet.
July 16: Gage height, 1.20 feet; discharge, 1,226 second-feet.
July 31: Gage height, 0.12 foot; discharge, 329 second-feet.
October 6: Gage height, 1.45 feet; discharge, 1,520 second-feet.

*Daily gage height, in feet, of Flint River near Woodbury, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 8.00 | 3.20 | 12.00 | 4.60 | 1.00 | 0.40 | 0.10 | 0.10 | 0.40 | 1.40 | 1.20 | 1.80 |
| 2 | 5.00 | 8.50 | 11.00 | 2.90 | 1.00 | .50 | .00 | .10 | .30 | 1.20 | .50 | 1.70 |
| 3 | 2.90 | 11.00 | 9.50 | 2.30 | .90 | .80 | .00 | .00 | .20 | .90 | .40 | 2.30 |
| 4 | 2.00 | 9.50 | 5.40 | 2.00 | .80 | .60 | .20 | .20 | .30 | .60 | .30 | 3.20 |
| 5 | 1.60 | 8.00 | 3.00 | 1.90 | .80 | .50 | .10 | .70 | .70 | 1.10 | .40 | 3.00 |
| 6 | 1.40 | 3.60 | 2.50 | 1.80 | .70 | .40 | .10 | 1.50 | .40 | 1.60 | .50 | 2.30 |
| 7 | 1.30 | 2.50 | 2.30 | 1.70 | .70 | .30 | .10 | 1.10 | .20 | .80 | .90 | 1.60 |
| 8 | 1.20 | 2.00 | 2.10 | 2.80 | .70 | 1.80 | .20 | .60 | .10 | .40 | 1.30 | 1.30 |
| 9 | 1.20 | 1.70 | 1.90 | 2.70 | 1.20 | .90 | .10 | .30 | .20 | .30 | .90 | 1.20 |
| 10 | 1.10 | 1.60 | 1.80 | 2.30 | .90 | .60 | .20 | .20 | .30 | .20 | .60 | .90 |
| 11 | 1.20 | 1.50 | 1.70 | 1.90 | .80 | .50 | .30 | .10 | .40 | .40 | .50 | .80 |
| 12 | 1.10 | 1.40 | 1.60 | 1.70 | .70 | .40 | 1.90 | .30 | .20 | .60 | .40 | .90 |
| 13 | 1.00 | 1.30 | 1.60 | 1.50 | .60 | .30 | 1.00 | .60 | .10 | .50 | .40 | 1.00 |
| 14 | .90 | 1.30 | 2.00 | 1.50 | .80 | .30 | .60 | .30 | .10 | .40 | .30 | .90 |
| 15 | 1.00 | 1.60 | 2.30 | 1.60 | .70 | .40 | .70 | .20 | .10 | .30 | .30 | .80 |
| 16 | 1.00 | 1.80 | 2.80 | 1.50 | 1.70 | 1.00 | 1.30 | .40 | .00 | .30 | .20 | 1.00 |
| 17 | 1.00 | 1.80 | 10.00 | 1.60 | 2.30 | .80 | .70 | .20 | .00 | .20 | .40 | 2.00 |
| 18 | 1.00 | 1.60 | 9.00 | 2.80 | 1.70 | .60 | .30 | .10 | .10 | .20 | .90 | 2.90 |
| 19 | 1.00 | 1.50 | 6.70 | 2.40 | 1.40 | .50 | .20 | .00 | .10 | .10 | .80 | 3.00 |
| 20 | 1.10 | 1.60 | 4.00 | 1.90 | 1.20 | .40 | .10 | .00 | .00 | .10 | .80 | 2.00 |
| 21 | 1.20 | 1.90 | 2.50 | 1.60 | .90 | .30 | .00 | .00 | .00 | .20 | .70 | 1.40 |
| 22 | 1.60 | 1.80 | 2.30 | 1.40 | .80 | .30 | .10 | .50 | .00 | .20 | .60 | 1.50 |
| 23 | 1.50 | 1.70 | 2.10 | 1.30 | .70 | .30 | .10 | .20 | .00 | .10 | .50 | 1.60 |
| 24 | 1.30 | 1.60 | 2.00 | 1.20 | .60 | .20 | .00 | .10 | .00 | .10 | .40 | 1.40 |
| 25 | 1.20 | 2.00 | 2.70 | 1.30 | .60 | .20 | .00 | .00 | 1.50 | .00 | .40 | 1.30 |
| 26 | 1.30 | 2.50 | 2.50 | 1.40 | .50 | .10 | .00 | .00 | 1.60 | .20 | 2.90 | 1.20 |
| 27 | 1.20 | 2.60 | 2.40 | 1.30 | 1.60 | .10 | .00 | .00 | 1.50 | 1.00 | 2.80 | 1.10 |
| 28 | 1.20 | 14.00 | 4.50 | 1.20 | .50 | .10 | .00 | .50 | 1.40 | 1.50 | 2.00 | 1.00 |
| 29 | 1.30 | ..... | 8.00 | 1.10 | .40 | .10 | .10 | 1.30 | 1.30 | 2.00 | 1.50 | 1.10 |
| 30 | 1.20 | ..... | 8.50 | 1.10 | .40 | .00 | .20 | 1.20 | 1.80 | 1.70 | 1.00 | 1.20 |
| 31 | 1.50 | ..... | 6.80 | ..... | .30 | ..... | .10 | .40 | ..... | 1.40 | ..... | 1.30 |

*Rating table for Flint River near Woodbury, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.0 | 290 | 2.6 | 2,890 | 5.2 | 6,880 | 7.8 | 12,750 |
| .2 | 360 | 2.8 | 3,150 | 5.4 | 7,260 | 8.0 | 13,250 |
| .4 | 470 | 3.0 | 3,410 | 5.6 | 7,640 | 8.2 | 13,750 |
| .6 | 620 | 3.2 | 3,680 | 5.8 | 8,040 | 8.4 | 14,250 |
| .8 | 800 | 3.4 | 3,960 | 6.0 | 8,450 | 8.6 | 14,750 |
| 1.0 | 1,005 | 3.6 | 4,240 | 6.2 | 8,880 | 8.8 | 15,250 |
| 1.2 | 1,225 | 3.8 | 4,540 | 6.4 | 9,320 | 9.0 | 15,750 |
| 1.4 | 1,455 | 4.0 | 4,840 | 6.6 | 9,780 | 9.2 | 16,250 |
| 1.6 | 1,685 | 4.2 | 5,160 | 6.8 | 10,260 | 9.4 | 16,750 |
| 1.8 | 1,920 | 4.4 | 5,480 | 7.0 | 10,750 | 9.6 | 17,250 |
| 2.0 | 2,160 | 4.6 | 5,820 | 7.2 | 11,250 | 9.8 | 17,750 |
| 2.2 | 2,400 | 4.8 | 6,160 | 7.4 | 11,750 | 10.0 | 18,250 |
| 2.4 | 2,640 | 5.0 | 6,520 | 7.6 | 12,250 | 11.0 | 21,250 |

*Estimated monthly discharge of Flint River near Woodbury, Ga.*

[Drainage area, 988 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 13,250 | 900 | 1,891 | 1.91 | 2.20 |
| February | 30,250 | 1,340 | 5,143 | 5.21 | 5.43 |
| March | 24,250 | 1,685 | 6,721 | 6.80 | 7.84 |
| April | 5,820 | 1,115 | 2,042 | 2.07 | 2.31 |
| May | 2,520 | 410 | 934 | .95 | 1.10 |
| June | 1,920 | 290 | 552 | .56 | .62 |
| July | 2,040 | 290 | 470 | .48 | .55 |
| August | 1,570 | 290 | 512 | .52 | .60 |
| September | 1,920 | 290 | 609 | .62 | .69 |
| October | 2,160 | 290 | 752 | .76 | .88 |
| November | 3,280 | 360 | 900 | .91 | 1.02 |
| December | 3,680 | 800 | 1,676 | 1.70 | 1.96 |
| The year | 30,250 | 290 | 1,850 | 1.87 | 25.20 |

### CHATTAHOOCHEE RIVER AT WEST POINT, GA.

This station was established on July 30, 1896, by Max Hall, and is at the highway bridge at West Point, Ga., about 1,200 feet above the railroad passenger station. A chain gage is suspended from the

bridge and referred to two bench marks. The first bench mark is the top of the downstream end of the second iron floor beam from the west-bank pier of the highway bridge; elevation, 24.19 feet above datum. The second bench mark is a notch in a large oak tree on the east bank of the river, 100 feet above the wagon bridge; elevation, 19.26 feet. The length of the chain gage is 27.60 feet. The channel is straight and has no obstructions except the piers of the bridge. The flow is sluggish at low stages of water. The banks overflow at high water, but all ordinary stages of water pass through the main channel. The bed of the stream is fairly constant. The observer, E. N. Dunn, is paid by the United States Weather Bureau.

This station is situated at the head of a series of shoals and rapids, having an aggregate fall of 368 feet in a distance of 35 miles, as surveyed under the direction of B. M. Hall in August, 1902.

The following discharge measurements were made during 1902:

January 15: Gage height, 3.50 feet; discharge, 4,364 second-feet.
July 25: Gage height, 2 feet; discharge, 1,916 second-feet.

*Daily gage height, in feet, of Chattahoochee River at West Point, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 19.00 | 7.70 | 20.00 | 14.00 | 4.00 | 4.60 | 2.00 | 3.10 | 2.80 | 3.80 | 2.00 | 3.60 |
| 2 | 17.60 | 15.50 | 17.30 | 8.30 | 4.00 | 3.50 | 2.00 | 2.30 | 2.20 | 3.20 | 2.00 | 3.70 |
| 3 | 8.30 | 17.10 | 17.60 | 6.10 | 4.70 | 3.30 | 1.90 | 2.10 | 2.10 | 2.90 | 2.00 | 7.00 |
| 4 | 7.50 | 14.90 | 15.90 | 5.50 | 4.40 | 3.10 | 2.70 | 2.00 | 2.20 | 2.40 | 2.00 | 6.70 |
| 5 | 5.10 | 9.20 | 8.40 | 5.30 | 4.00 | 2.90 | 2.50 | 2.20 | 3.00 | 3.00 | 2.00 | 7.40 |
| 6 | 4.70 | 7.50 | 6.70 | 5.40 | 3.90 | 2.90 | 2.80 | 2.40 | 2.80 | 3.00 | 5.70 | 5.50 |
| 7 | 4.20 | 5.40 | 5.90 | 5.50 | 3.80 | 2.80 | 2.60 | 3.10 | 2.40 | 2.60 | 4.30 | 4.40 |
| 8 | 4.10 | 5.20 | 5.60 | 6.20 | 3.70 | 2.80 | 2.40 | 2.40 | 2.00 | 2.60 | 3.30 | 3.80 |
| 9 | 4.00 | 4.70 | 5.40 | 5.10 | 3.80 | 2.70 | 2.30 | 2.10 | 2.30 | 2.50 | 3.30 | 3.40 |
| 10 | 3.90 | 4.30 | 5.20 | 4.90 | 4.00 | 2.70 | 2.20 | 1.80 | 2.60 | 2.20 | 2.70 | 3.20 |
| 11 | 3.80 | 4.00 | 5.00 | 4.70 | 3.90 | 2.70 | 3.20 | 2.00 | 2.20 | 2.20 | 2.50 | 3.00 |
| 12 | 3.70 | 4.00 | 4.90 | 4.70 | 3.80 | 2.60 | 3.00 | 1.80 | 2.20 | 2.60 | 2.40 | 3.00 |
| 13 | 3.60 | 4.00 | 6.30 | 4.60 | 3.80 | 2.60 | 3.60 | 2.10 | 2.30 | 2.50 | 2.30 | 3.00 |
| 14 | 3.40 | 3.90 | 5.90 | 4.50 | 3.70 | 2.60 | 3.40 | 2.30 | 2.30 | 2.70 | 2.30 | 3.00 |
| 15 | 3.40 | 4.60 | 6.10 | 4.50 | 3.60 | 2.60 | 3.20 | 2.00 | 2.50 | 2.80 | 2.20 | 2.90 |
| 16 | 3.30 | 5.30 | 8.70 | 4.50 | 4.40 | 2.50 | 3.10 | 1.70 | 2.50 | 2.40 | 2.20 | 7.00 |
| 17 | 3.30 | 4.90 | 16.20 | 4.50 | 4.20 | 2.50 | 3.00 | 2.00 | 2.30 | 2.40 | 2.20 | 10.10 |
| 18 | 3.20 | 4.40 | 11.40 | 5.50 | 3.90 | 2.90 | 3.90 | 2.10 | 2.00 | 2.40 | 2.40 | 7.60 |
| 19 | 3.50 | 4.30 | 8.80 | 4.90 | 3.80 | 2.70 | 3.60 | 1.90 | 1.90 | 2.20 | 2.70 | 6.10 |
| 20 | 3.90 | 4.90 | 7.00 | 4.70 | 3.70 | 2.80 | 3.30 | 1.60 | 1.90 | 2.10 | 2.70 | 4.50 |
| 21 | 5.40 | 4.50 | 5.50 | 4.50 | 3.60 | 2.90 | 3.80 | 1.60 | 2.00 | 2.00 | 2.70 | 3.90 |
| 22 | 5.00 | 4.20 | 5.30 | 4.30 | 3.50 | 2.80 | 3.40 | 1.60 | 1.90 | 2.00 | 2.50 | 4.50 |
| 23 | 4.30 | 4.10 | 4.90 | 3.90 | 3.50 | 2.70 | 3.30 | 1.80 | 2.10 | 2.00 | 2.30 | 4.40 |
| 24 | 3.80 | 4.00 | 5.10 | 3.90 | 3.40 | 2.50 | 3.20 | 1.50 | 1.90 | 2.00 | 2.30 | 5.00 |
| 25 | 3.70 | 4.60 | 6.00 | 3.90 | 3.30 | 2.40 | 2.00 | 1.40 | 3.00 | 1.90 | 2.30 | 4.10 |
| 26 | 3.70 | 4.70 | 6.20 | 3.80 | 3.30 | 2.30 | 1.90 | 1.20 | 3.30 | 1.90 | 5.70 | 3.70 |
| 27 | 3.60 | 4.90 | 6.40 | 3.80 | 3.30 | 2.30 | 1.90 | 1.30 | 5.30 | 3.40 | 4.90 | 3.40 |
| 28 | 4.50 | 18.00 | 11.40 | 3.90 | 3.20 | 2.20 | 1.80 | 1.50 | 5.00 | 3.20 | 4.50 | 3.30 |
| 29 | 4.10 | ..... | 14.90 | 3.90 | 3.10 | 2.20 | 2.00 | 3.00 | 4.50 | 2.70 | 3.50 | 3.20 |
| 30 | 4.40 | ..... | 14.90 | 4.00 | 3.00 | 2.10 | 2.20 | 4.10 | 3.80 | 2.20 | 3.00 | 3.70 |
| 31 | 4.90 | ..... | 14.60 | ..... | 2.90 | ..... | 2.40 | 3.00 | ..... | 2.10 | ..... | 4.10 |

*Rating table for Chattahoochee River at West Point, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 935 | 4.2 | 5,880 | 7.4 | 14,664 | 10.6 | 23,940 |
| 1.2 | 1,000 | 4.4 | 6,400 | 7.6 | 15,240 | 10.8 | 24,520 |
| 1.4 | 1,180 | 4.6 | 6,940 | 7.8 | 15,820 | 11.0 | 25,100 |
| 1.6 | 1,380 | 4.8 | 7,490 | 8.0 | 16,400 | 12.0 | 28,800 |
| 1.8 | 1,600 | 5.0 | 8,040 | 8.2 | 16,980 | 12.5 | 31,110 |
| 2.0 | 1,840 | 5.2 | 8,592 | 8.4 | 17,560 | 13.0 | 33,410 |
| 2.2 | 2,100 | 5.4 | 9,144 | 8.6 | 18,140 | 13.5 | 35,710 |
| 2.4 | 2,380 | 5.6 | 9,696 | 8.8 | 18,720 | 14.0 | 38,030 |
| 2.6 | 2,680 | 5.8 | 10,248 | 9.0 | 19,300 | 14.5 | 40,330 |
| 2.8 | 3,000 | 6.0 | 10,800 | 9.2 | 19,880 | 15.0 | 42,630 |
| 3.0 | 3,340 | 6.2 | 11,352 | 9.4 | 20,460 | 15.5 | 44,930 |
| 3.2 | 3,700 | 6.4 | 11,904 | 9.6 | 21,040 | 16.0 | 47,230 |
| 3.4 | 4,080 | 6.6 | 12,456 | 9.8 | 21,620 | 17.0 | 51,830 |
| 3.6 | 4,480 | 6.8 | 13,008 | 10.0 | 22,200 | 18.0 | 56,430 |
| 3.8 | 4,920 | 7.0 | 13,560 | 10.2 | 22,780 | 19.0 | 61,030 |
| 4.0 | 5,370 | 7.2 | 14,112 | 10.4 | 23,360 | 20.0 | 65,630 |

*Estimated monthly discharge of Chattahoochee River at West Point, Ga.*

[Drainage area, 3,300 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 61,030 | 3,700 | 9,585 | 2.90 | 3.34 |
| February | 56,430 | 5,145 | 13,852 | 4.20 | 4.37 |
| March | 65,630 | 7,765 | 21,982 | 6.66 | 7.68 |
| April | 38,030 | 4,920 | 8,231 | 2.49 | 2.78 |
| May | 7,215 | 3,170 | 4,791 | 1.45 | 1.67 |
| June | 6,940 | 1,970 | 2,962 | .90 | 1.00 |
| July | 5,145 | 1,600 | 2,988 | .91 | 1.05 |
| August | 5,625 | 1,000 | 2,061 | .62 | .71 |
| September | 8,868 | 1,720 | 2,963 | .90 | 1.00 |
| October | 4,920 | 1,720 | 2,603 | .79 | .91 |
| November | 9,972 | 1,840 | 3,460 | 1.05 | 1.17 |
| December | 22,490 | 3,170 | 7,187 | 2.18 | 2.51 |
| The year | 65,630 | 1,000 | 6,889 | 2.09 | 28.19 |

CHATTAHOOCHEE RIVER AT OAKDALE, GA.

This station was established at Oakdale by Cyrus C. Babb, on October 17, 1895. It is described in the Eighteenth Annual Report, part 4, page 85. It is located at the Southern Railway bridge, 1 mile above the mouth of Proctor Creek and 8 miles northwest of Atlanta.

On July 30, 1896, the location of the station was changed to Mason & Turner's ferry, 1 mile below Oakdale. The gage at this point, known as the "Oakdale lower gage," is nailed to a tree on the right bank, 100 feet below the ferry, and set 1 foot lower than the gage at the Southern Railway bridge. On June 1, 1899, the lower gage was discontinued and the upper gage resumed and adopted by the United States Weather Bureau, the United States Geological Survey still receiving the records and making current-meter discharge measurements at that point. The gage now used is set on the same datum as the old wire gage of the United States Geological Survey, established at that point by Mr. Babb in 1895, and above referred to, but is a vertical timber rod, bolted to the east side of the center pier of the Southern Railway bridge. It is well painted and is graduated to feet with brass figures and to tenths with copper nails from −1.5 feet to +26.5 feet, making its total length 28 feet. Its zero point is 753.5 feet above sea level. Bench mark No. 1 is a railroad spike in the corner of the pier on the right bank, 12.39 feet above datum of gage. The flow is obstructed by rafts, which have to be cleared from the channel occasionally. The channel is straight and the current swift. The banks are subject to overflow. The bed of the stream is constant and the results obtained fairly good.

The observer is Glenn H. Thomas, an employee in the office of the Whittier mills, about 300 yards east of the gage.

*Discharge measurements of Chattahoochee River at Oakdale, Ga.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| Jan. 14 | K. T. Thomas | 2.50 | 2,477 |
| Jan. 25 | W. E. Hall | 2.50 | 2,104 |
| Feb. 3 | K. T. Thomas | 16.70 | 17,587 |
| Feb. 4 | do | 7.20 | 6,573 |
| June 23 | W. E. Hall | 1.85 | 1,902 |
| July 10 | Max Hall | 1.75 | 1,689 |
| Sept. 16 | do | 1.10 | 1,300 |
| Nov. 1 | J. C. Conn | .75 | 1,086 |
| Nov. 20 | W. E. Hall | 1.12 | 1,234 |

*Daily gage height, in feet, of Chattahoochee River at Oakdale, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 9.20 | 7.20 | 25.00 | 7.10 | 3.40 | 3.20 | 2.60 | 2.10 | 2.40 | 2.10 | 0.80 | 2.40 |
| 2 | 6.00 | 18.00 | 20.80 | 6.40 | 3.80 | 3.10 | 2.60 | 1.90 | 2.10 | 1.50 | .70 | 2.60 |
| 3 | 5.10 | 19.20 | 10.30 | 6.20 | 3.80 | 3.10 | 3.40 | 1.80 | 2.10 | 1.60 | .70 | 7.00 |
| 4 | 4.20 | 8.60 | 7.10 | 5.80 | 3.60 | 3.00 | 2.80 | 1.80 | 2.10 | 1.80 | .50 | 8.60 |
| 5 | 3.70 | 6.00 | 7.80 | 5.20 | 3.60 | 2.80 | 2.60 | 1.80 | 2.40 | 1.50 | .50 | 4.90 |
| 6 | 3.20 | 4.30 | 6.00 | 4.80 | 3.60 | 2.80 | 2.40 | 1.80 | 2.30 | 1.60 | .70 | 4.10 |
| 7 | 3.10 | 3.20 | 5.20 | 4.90 | 3.60 | 2.80 | 2.40 | 1.90 | 2.10 | 2.10 | .90 | 3.30 |
| 8 | 2.80 | 2.80 | 4.60 | 4.90 | 3.50 | 2.80 | 2.10 | 1.90 | 2.00 | 1.80 | .80 | 2.40 |
| 9 | 2.50 | 2.80 | 4.40 | 5.00 | 3.50 | 2.80 | 2.10 | 1.80 | 3.50 | 1.60 | 1.00 | 1.90 |
| 10 | 2.30 | 2.70 | 4.10 | 4.40 | 3.50 | 2.70 | 1.80 | 1.80 | 3.20 | 1.50 | 1.20 | 1.80 |
| 11 | 2.30 | 2.70 | 3.80 | 4.20 | 3.60 | 2.70 | 1.80 | 1.90 | 2.80 | 1.40 | 1.30 | 1.60 |
| 12 | 2.30 | 2.80 | 3.60 | 4.20 | 3.80 | 2.70 | 3.60 | 1.80 | 2.30 | 1.80 | 1.00 | 1.60 |
| 13 | 2.30 | 2.80 | 5.50 | 3.80 | 3.60 | 2.70 | 2.40 | 1.80 | 2.30 | 2.10 | .90 | 1.80 |
| 14 | 2.10 | 2.80 | 4.80 | 3.80 | 3.60 | 2.60 | 2.20 | 1.80 | 4.80 | 1.90 | .70 | 1.60 |
| 15 | 2.10 | 2.80 | 5.70 | 3.80 | 3.60 | 2.80 | 2.60 | 1.70 | 3.50 | 1.40 | .60 | 1.70 |
| 16 | 2.10 | 3.00 | 11.40 | 3.60 | 3.80 | 5.60 | 2.40 | 1.70 | 2.80 | 1.60 | .80 | 5.40 |
| 17 | 2.10 | 3.20 | 8.00 | 3.80 | 3.80 | 4.20 | 2.20 | 1.70 | 2.40 | 1.20 | .90 | 7.00 |
| 18 | 2.10 | 3.10 | 6.20 | 4.10 | 3.80 | 3.40 | 2.10 | 1.70 | 2.40 | 1.40 | 1.30 | 6.00 |
| 19 | 2.30 | 2.80 | 5.60 | 4.10 | 3.80 | 4.00 | 1.80 | 1.70 | 2.60 | 1.50 | 1.00 | 4.00 |
| 20 | 2.20 | 2.80 | 4.80 | 3.80 | 3.50 | 3.60 | 1.80 | 1.80 | 2.60 | 1.60 | 1.10 | 2.70 |
| 21 | 2.60 | 3.00 | 4.60 | 3.80 | 3.50 | 4.10 | 2.20 | 1.80 | 2.60 | 1.20 | 1.00 | 3.00 |
| 22 | 2.60 | 3.00 | 4.40 | 3.80 | 3.50 | 4.40 | 2.00 | 1.80 | 2.40 | 1.00 | .80 | 2.90 |
| 23 | 2.50 | 2.80 | 4.10 | 3.80 | 3.40 | 4.20 | 1.90 | 1.60 | 2.10 | .80 | .80 | 2.40 |
| 24 | 2.40 | 2.80 | 4.10 | 3.60 | 3.20 | 4.20 | 1.80 | 1.60 | 2.10 | .70 | .90 | 2.00 |
| 25 | 2.40 | 3.60 | 3.80 | 3.60 | 3.20 | 3.80 | 1.80 | 1.60 | 5.70 | .50 | 1.00 | 1.80 |
| 26 | 2.40 | 3.60 | 3.80 | 3.60 | 3.20 | 3.80 | 1.80 | 1.60 | 5.80 | .80 | 4.80 | 1.70 |
| 27 | 2.40 | 3.80 | 4.20 | 3.60 | 3.20 | 3.00 | 1.80 | 1.50 | 4.60 | .90 | 4.30 | 1.60 |
| 28 | 2.80 | 23.20 | 6.40 | 3.60 | 3.20 | 2.80 | 2.60 | 1.80 | 7.90 | 1.00 | 3.60 | 1.70 |
| 29 | 3.10 | ..... | 21.00 | 3.40 | 3.10 | 2.80 | 2.70 | 2.70 | 5.20 | .90 | 1.90 | 2.00 |
| 30 | 4.00 | ..... | 21.70 | 3.50 | 3.10 | 2.80 | 2.50 | 2.60 | 3.10 | .70 | 1.60 | 3.40 |
| 31 | 4.60 | ..... | 9.80 | ..... | 3.10 | ..... | 2.10 | 2.40 | ..... | .50 | ..... | 3.00 |

*Rating table for Chattahoochee River at Oakdale, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.6 | 1,005 | 4.4 | 4,115 | 8.5 | 8,790 | 18.0 | 19,620 |
| .8 | 1,120 | 4.6 | 4,344 | 9.0 | 9,360 | 18.5 | 20,190 |
| 1.0 | 1,240 | 4.8 | 4,572 | 9.5 | 9,930 | 19.0 | 20,760 |
| 1.2 | 1,360 | 5.0 | 4,800 | 10.0 | 10,500 | 19.5 | 21,330 |
| 1.4 | 1,490 | 5.2 | 5,028 | 10.5 | 11,070 | 20.0 | 21,900 |
| 1.6 | 1,620 | 5.4 | 5,256 | 11.0 | 11,640 | 20.5 | 22,470 |
| 1.8 | 1,750 | 5.6 | 5,484 | 11.5 | 12,210 | 21.0 | 23,040 |
| 2.0 | 1,890 | 5.8 | 5,712 | 12.0 | 12,780 | 21.5 | 23,610 |
| 2.2 | 2,030 | 6.0 | 5,940 | 12.5 | 13,350 | 22.0 | 24,180 |
| 2.4 | 2,180 | 6.2 | 6,168 | 13.0 | 13,920 | 22.5 | 24,750 |
| 2.6 | 2,335 | 6.4 | 6,396 | 13.5 | 14,490 | 23.0 | 25,320 |
| 2.8 | 2,500 | 6.6 | 6,624 | 14.0 | 15,060 | 23.5 | 25,890 |
| 3.0 | 2,675 | 6.8 | 6,852 | 14.5 | 15,630 | 24.0 | 26,460 |
| 3.2 | 2,855 | 7.0 | 7,080 | 15.0 | 16,200 | 24.5 | 27,030 |
| 3.4 | 3,045 | 7.2 | 7,308 | 15.5 | 16,770 | 25.0 | 27,600 |
| 3.6 | 3,245 | 7.4 | 7,536 | 16.0 | 17,340 | 25.5 | 28,170 |
| 3.8 | 3,450 | 7.6 | 7,764 | 16.5 | 17,910 | 26.0 | 28,740 |
| 4.0 | 3,665 | 7.8 | 7,992 | 17.0 | 18,480 | 26.5 | 29,310 |
| 4.2 | 3,885 | 8.0 | 8,220 | 17.5 | 19,050 | 27.0 | 29,880 |

*Estimated monthly discharge of Chattahoochee River at Oakdale, Ga.*

[Drainage area, 1,560 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 9,588 | 1,960 | 2,881 | 1.85 | 2.13 |
| February | 25,548 | 2,415 | 5,306 | 3.40 | 3.54 |
| March | 27,600 | 3,245 | 8,024 | 5.14 | 5.93 |
| April | 7,194 | 3,045 | 4,065 | 2.61 | 2.91 |
| May | 3,450 | 2,765 | 3,150 | 2.02 | 2.33 |
| June | 5,484 | 2,335 | 3,004 | 1.93 | 2.15 |
| July | 3,245 | 1,750 | 2,113 | 1.35 | 1.56 |
| August | 2,415 | 1,555 | 1,786 | 1.14 | 1.31 |
| September | 8,106 | 1,890 | 2,938 | 1.88 | 2.10 |
| October | 1,960 | 950 | 1,470 | .94 | 1.08 |
| November | 4,572 | 950 | 1,481 | .95 | 1.06 |
| December | 8,904 | 1,620 | 3,032 | 1.94 | 2.24 |
| The year | 27,600 | 950 | 3,271 | 2.10 | 28.34 |

## CHATTAHOOCHEE RIVER NEAR GAINESVILLE, GA.

This station was established on June 26, 1901, 3½ miles northwest of Gainesville, at Thompson's bridge.

The gage is a 15-foot vertical rod, graduated to feet and tenths. It is on the right bank about 50 feet below the bridge. The bridge is a three-span wooden structure supported on stone piers. At low water nearly the whole of the river flows through the center span, which is 100 feet long. It is entirely housed in, but holes are cut in the floor along the upstream side at intervals of 12 feet, through which the meter can be lowered for gaging.

The bench mark is the top of the main bridge stringer at the left side of the first stone pier, in the river, from the left bank, and is 31 feet above datum.

The observer, Homer D. Thompson, moved away on September 27, 1902, without giving notice, and another observer could not be secured until December 28, 1902. On that date Jack Elrod was employed.

*Discharge measurements of Chattahoochee River near Gainesville, Ga.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| February 7 | K. T. Thomas | 3.65 | 1,482 |
| May 3 | W. E. Hall | 3.80 | 1,241 |
| July 11 | B. M. Hall | 2.58 | 704 |
| October 11 | J. C. Conn | 2.80 | 715 |
| November 24 | W. E. Hall | 2.33 | 520 |

*Daily gage height, in feet, of Chattahoochee River near Gainesville, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 8.00 | 4.90 | 14.00 | 5.50 | 3.10 | 3.50 | 2.30 | 3.10 | 4.20 | ..... | ..... | ..... |
| 2 | 6.40 | 15.60 | 6.00 | 5.30 | 3.40 | 3.40 | 2.00 | 3.00 | 4.00 | ..... | ..... | ..... |
| 3 | 6.30 | 10.40 | 5.90 | 5.00 | 4.60 | 3.20 | 7.90 | 4.20 | 4.50 | ..... | ..... | ..... |
| 4 | 6.00 | 9.30 | 5.60 | 4.60 | 4.50 | 3.00 | 6.30 | 3.60 | 4.50 | ..... | ..... | ..... |
| 5 | 5.60 | 6.10 | 5.00 | 4.20 | 4.20 | 3.00 | 4.20 | 2.80 | 4.60 | ..... | ..... | ..... |
| 6 | 4.20 | 5.00 | 4.90 | 4.00 | 4.00 | 2.90 | 4.20 | 2.60 | 4.80 | ..... | ..... | ..... |
| 7 | 3.60 | 4.10 | 4.80 | 3.90 | 4.60 | 2.90 | 4.00 | 3.00 | 4.50 | ..... | ..... | ..... |
| 8 | 3.40 | 4.00 | 6.80 | 3.90 | 4.80 | 2.80 | 4.00 | 2.80 | 4.30 | ..... | ..... | ..... |
| 9 | 3.40 | 3.90 | 5.60 | 3.60 | 4.30 | 2.80 | 3.80 | 3.10 | 4.90 | ..... | ..... | ..... |
| 10 | 3.40 | 3.80 | 5.30 | 3.40 | 5.00 | 3.00 | 3.60 | 4.00 | 4.60 | ..... | ..... | ..... |
| 11 | 3.30 | 3.60 | 5.00 | 3.40 | 4.90 | 3.00 | 3.50 | 4.60 | 4.80 | ..... | ..... | ..... |
| 12 | 3.20 | 3.50 | 4.80 | 3.40 | 4.60 | 2.90 | 3.20 | 4.00 | 4.60 | ..... | ..... | ..... |
| 13 | 3.20 | 3.60 | 4.60 | 3.30 | 4.30 | 2.90 | 3.00 | 3.60 | 4.50 | ..... | ..... | ..... |
| 14 | 3.10 | 3.50 | 4.20 | 3.20 | 4.00 | 2.80 | 4.00 | 3.60 | 4.20 | ..... | ..... | ..... |
| 15 | 3.00 | 3.30 | 4.60 | 3.10 | 4.00 | 2.80 | 3.80 | 3.60 | 4.60 | ..... | ..... | ..... |
| 16 | 3.00 | 3.20 | 6.30 | 3.20 | 4.00 | 2.90 | 2.90 | 3.10 | 4.80 | ..... | ..... | ..... |

*Daily gage height, in feet, of Chattahoochee River near Gainesville, Ga.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 17 | 2.90 | 3.10 | 5.60 | 3.80 | 4.00 | 3.00 | 4.60 | 3.60 | 4.00 | ..... | ..... | ..... |
| 18 | 2.80 | 3.20 | 4.30 | 3.90 | 4.00 | 4.00 | 4.00 | 3.10 | 4.20 | ..... | ..... | ..... |
| 19 | 2.80 | 3.30 | 4.20 | 3.50 | 4.10 | 3.80 | 3.60 | 3.60 | 4.60 | ..... | ..... | ..... |
| 20 | 2.70 | 3.40 | 4.00 | 3.60 | 4.00 | 3.60 | 3.50 | 2.80 | 4.80 | ..... | ..... | ..... |
| 21 | 2.60 | 3.00 | 4.00 | 3.40 | 3.90 | 4.20 | 3.40 | 2.80 | 4.60 | ..... | ..... | ..... |
| 22 | 2.60 | 3.00 | 3.90 | 3.20 | 3.40 | 4.00 | 4.20 | 3.10 | 4.80 | ..... | ..... | ..... |
| 23 | 2.60 | 2.90 | 3.80 | 3.80 | 6.00 | 4.00 | 3.60 | 4.00 | 4.00 | ..... | ..... | ..... |
| 24 | 3.60 | 2.90 | 3.60 | 3.60 | 5.30 | 3.80 | 4.00 | 4.60 | 3.60 | ..... | ..... | ..... |
| 25 | 3.80 | 2.90 | 3.60 | 3.40 | 5.00 | 3.40 | 3.10 | 4.00 | 3.70 | ..... | ..... | ..... |
| 26 | 3.80 | 3.00 | 3.50 | 3.40 | 4.80 | 3.40 | 2.60 | 4.60 | 4.00 | ..... | ..... | ..... |
| 27 | 3.70 | 6.00 | 7.60 | 3.40 | 4.60 | 3.40 | 2.50 | 4.00 | 4.60 | ..... | ..... | ..... |
| 28 | 3.60 | 26.40 | 15.60 | 3.50 | 4.30 | 2.80 | 3.00 | 3.60 | (a) | ..... | ..... | 4.00 |
| 29 | 3.60 | ..... | 18.40 | 3.40 | 4.00 | 2.80 | 4.00 | 4.20 | ..... | ..... | ..... | 3.90 |
| 30 | 3.50 | ..... | 10.60 | 3.20 | 3.60 | 2.40 | 3.40 | 4.20 | ..... | ..... | ..... | 3.80 |
| 31 | 4.60 | ..... | 6.40 | ..... | 3.50 | ..... | 2.80 | 4.60 | ..... | ..... | ..... | 3.70 |

[a] Observer absent from September 28 to December 27.

*Rating table for Chattahoochee River near Gainesville, Ga., for 1901 and 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.0 | 350 | 5.6 | 2,690 | 9.2 | 5,030 | 14.0 | 8,150 |
| 2.2 | 480 | 5.8 | 2,820 | 9.4 | 5,160 | 15.0 | 8,800 |
| 2.4 | 610 | 6.0 | 2,950 | 9.6 | 5,290 | 16.0 | 9,450 |
| 2.6 | 740 | 6.2 | 3,080 | 9.8 | 5,420 | 17.0 | 10,100 |
| 2.8 | 870 | 6.4 | 3,210 | 10.0 | 5,550 | 18.0 | 10,750 |
| 3.0 | 1,000 | 6.6 | 3,340 | 10.2 | 5,680 | 19.0 | 11,400 |
| 3.2 | 1,130 | 6.8 | 3,470 | 10.4 | 5,810 | 20.0 | 12,050 |
| 3.4 | 1,260 | 7.0 | 3,600 | 10.6 | 5,940 | 21.0 | 12,700 |
| 3.6 | 1,390 | 7.2 | 3,730 | 10.8 | 6,070 | 22.0 | 13,350 |
| 3.8 | 1,520 | 7.4 | 3,860 | 11.0 | 6,200 | 23.0 | 14,000 |
| 4.0 | 1,650 | 7.6 | 3,990 | 11.2 | 6,330 | 24.0 | 14,650 |
| 4.2 | 1,780 | 7.8 | 4,120 | 11.4 | 6,460 | 25.0 | 15,300 |
| 4.4 | 1,910 | 8.0 | 4,250 | 11.6 | 6,590 | 26.0 | 15,950 |
| 4.6 | 2,040 | 8.2 | 4,380 | 11.8 | 6,720 | 27.0 | 16,600 |
| 4.8 | 2,170 | 8.4 | 4,510 | 12.0 | 6,850 | 28.0 | 17,250 |
| 5.0 | 2,300 | 8.6 | 4,640 | 12.5 | 7,175 | 29.0 | 17,900 |
| 5.2 | 2,430 | 8.8 | 4,770 | 13.0 | 7,500 | 30.0 | 18,550 |
| 5.4 | 2,560 | 9.0 | 4,900 | 13.5 | 7,825 | 31.0 | 19,200 |

*Estimated monthly discharge of Chattahoochee River near Gainesville, Ga.*

[Drainage area, 544 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| June 26–30 | ..... | ..... | 1,975 | 3.63 | 0.68 |
| July | 4,640 | 870 | 1,520 | 2.79 | 3.22 |
| August | 8,800 | 805 | 2,724 | 5.01 | 5.78 |
| September | 6,200 | 1,130 | 1,912 | 3.51 | 3.92 |
| October | 1,715 | 1,000 | 1,327 | 2.44 | 2.81 |
| November | 1,000 | 480 | 792 | 1.46 | 1.63 |
| December | 17,510 | 545 | 2,342 | 4.31 | 4.97 |
| 1902. | | | | | |
| January | 4,250 | 740 | 1,530 | 2.81 | 3.24 |
| February | 16,210 | 935 | 2,553 | 4.69 | 4.88 |
| March | 11,010 | 1,325 | 3,086 | 5.67 | 6.54 |
| April | 2,625 | 1,065 | 1,479 | 2.72 | 3.03 |
| May | 2,950 | 1,065 | 1,835 | 3.37 | 3.89 |
| June | 1,780 | 610 | 1,139 | 2.09 | 2.33 |
| July | 4,185 | 350 | 1,461 | 2.69 | 3.10 |
| August | 2,040 | 740 | 1,388 | 2.55 | 2.94 |
| September 1–27 | ..... | ..... | 1,922 | 3.53 | 3.55 |
| December 28–31 | ..... | ..... | 1,552 | 2.85 | .42 |

## MISCELLANEOUS MEASUREMENTS IN APALACHICOLA RIVER DRAINAGE BASIN.

The following miscellaneous measurements were taken in the Apalachicola drainage basin during 1902 by B. M. Hall and his assistants:

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| | | | *Second-feet.* |
| June 10 | Chattahoochee River | Medlocks bridge, 4 miles north of Norcross, Ga. (gage height, 2.42 feet). | 1,674 |
| 25 | Kinchafoonee Creek | Albany, Ga. (gage height, 1.15 feet). | 477 |
| 25 | Muckalee Creek | Albany, Ga. (gage height, 0.97 foot). | 746 |
| 26 | Sweetwater Creek | Strickland's bridge, Austell, Ga. | 80 |
| 27 | Peachtree Creek | River Park, near Atlanta, Ga | 60 |
| July 11 | Little River | Below Dunlap's mill, near Gainesville, Ga. | 86 |
| 22 | Chestatee River | Ferry at mouth, near Gainesville, Ga | 266 |
| 24 | Chattahoochee River | Flowery Branch, Ga. (gage height, 2.65 feet). | 967 |

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| | | | *Second-feet.* |
| July 30 | Standingboy Creek..... | Columbus, Ga., half mile above mouth. | 5 |
| 30 | Roaring Creek ..... | Near Columbus, Ga., one-fourth mile above mouth. | 1 |
| Sept. 25 | Sweetwater Creek..... | Strickland's bridge, near Austell, Ga. (gage height, 2.15 feet). | 188 |
| 27 | Muckalee Creek..... | Albany, Ga. (gage height, 0.90 foot). | 690 |
| 27 | Kinchafoonee Creek.... | Albany, Ga. (gage height, 1.20 feet). | 499 |
| Oct. 3 | Sweetwater Creek..... | Strickland's bridge, near Austell, Ga. (gage height, 1.53 feet). | 119 |
| 31 | Chattahoochee River... | Plant System R. R. bridge, Alaga, Ala. | 9,634 |
| Dec. 4 | Kinchafoonee Creek.... | Albany, Ga. (gage height, 2.40 feet). | 1,196 |
| 4 | Muckalee Creek..... | Albany, Ga. (gage height, 2.50 feet). | 2,180 |

## MOBILE RIVER DRAINAGE BASIN.

This is the largest drainage basin in Georgia and Alabama, and is designated the Mobile Basin because its waters all enter the Gulf through Mobile River at Mobile, Ala. It is formed as follows: Beginning at the headwaters, the Cartecay and Ellijay rivers unite at Ellijay, Ga., to form the Coosawattee River. Just above Resaca, Ga., this unites with the Conasauga to form Oostanaula River. At Rome, Ga., the Oostanaula and the Etowah unite to form Coosa River. Six miles above Montgomery, Ala., the Coosa and the Tallapoosa unite to form the Alabama River; and not far from the coast the Tombigbee unites with the Alabama to form the Mobile River, which flows into Mobile Bay, an arm of the Gulf of Mexico.

Cahaba River is the principal tributary of the Alabama and joins it about 10 miles below Selma. Hillabee Creek flows into Tallapoosa River just above Sturdevant and near Alexander. Talladega Creek is a tributary of the Coosa.

Tombigbee River rises in the northeastern part of Mississippi and enters Alabama in Pickens County. Its principal tributary is the Black Warrior, which is formed by the junction of Mulberry Fork and Lipsey Fork. Locust Fork enters the Black Warrior some distance below the junction. During 1902 the following stations were maintained in this basin under the supervision of B. M. Hall: On the Cahaba at Centerville, Ala.; on the Alabama at Selma and at Montgomery, Ala.; on the Tallapoosa at Milstead and at Sturdevant, Ala.; on Hillabee Creek near Alexander, Ala.; on Talladega Creek at Nottingham, Ala.; on the Coosa at Riverside, Ala.; on the Black Warrior at Tuscaloosa and near Cordova, Ala.; on the Black Warrior (Locust Fork) at Palos, Ala.; on the Coosa at Rome, Ga.; on the Etowah at Canton, Ga.; on the Coosawattee at Carters, Ga.; on the Tombigbee at Columbus, Miss.

## CAHABA RIVER AT CENTERVILLE, ALA.

The station was established on August 7, 1901, and is situated at the iron highway bridge one-fourth mile west of Centerville, Ala. The bridge is a single span supported by tubular iron piers.

The gage is a wire fastened to the timber fencing along the downstream side of the bridge. The pulley is 100 feet from the initial point, which is the end of the iron bridge on the left bank, downstream side. The bench mark is the top of the iron crossbeam, under the bridge floor, nearest the gage pulley, and is 42.85 feet above the datum of gage. The observer is Clyde Lowrey.

It was the intention of the Geological Survey to discontinue this station and find a better section, but it will be given another year's trial with the hope of getting better results.

The following discharge measurements were made during 1902:

January 25: Gage height, 5.15 feet; discharge, 1,707 second-feet.
April 7: Gage height, 8.60 feet; discharge, 2,823 second-feet.
July 9: Gage height, 2.40 feet; discharge, 251 second-feet.

*Daily gage height, in feet, of Cahaba River at Centerville, Ala.*

| Day. | Jan. | Feb. | March | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 13.60 | 16.80 | 24.00 | 15.40 | 4.90 | 2.80 | 2.30 | 2.20 | 2.30 | 2.40 | 2.00 | 3.00 |
| 2 | 9.00 | 24.60 | 18.20 | 12.10 | 4.50 | 2.80 | 2.30 | 2.80 | 2.30 | 2.60 | 2.00 | 2.50 |
| 3 | 6.90 | 21.20 | 13.30 | 11.40 | 4.00 | 2.70 | 2.20 | 2.50 | 3.30 | 2.60 | 2.00 | 2.90 |
| 4 | 5.70 | 16.60 | 9.80 | 10.90 | 3.70 | 2.60 | 2.20 | 2.50 | 3.20 | 2.50 | 2.00 | 3.10 |
| 5 | 4.90 | 10.60 | 12.00 | 10.40 | 3.60 | 2.60 | 2.20 | 2.40 | 2.90 | 2.40 | 2.00 | 5.60 |
| 6 | 4.50 | 8.30 | 12.10 | 8.60 | 3.50 | 2.50 | 2.20 | 2.40 | 2.40 | 2.20 | 2.00 | 5.10 |
| 7 | 4.10 | 7.30 | 8.70 | 8.20 | 3.60 | 2.50 | 2.20 | 2 30 | 2.30 | 2.20 | 2.90 | 4.90 |
| 8 | 3.90 | 6.70 | 8.30 | 13.60 | 3.50 | 2.40 | 2.20 | 2.30 | 2.30 | 2.20 | 2.40 | 4.20 |
| 9 | 3.70 | 5.80 | 7.90 | 12.20 | 3.40 | 2.30 | 2.30 | 2.30 | 2.20 | 2.70 | 2.40 | 3.90 |
| 10 | 3.40 | 5.40 | 7.60 | 9.60 | 3.40 | 2.30 | 2.50 | 2.30 | 2.20 | 2.80 | 2.30 | 3.60 |
| 11 | 3.20 | 5.10 | 6.30 | 8.00 | 3.30 | 2.40 | 2.90 | 2.30 | 2.20 | 10.80 | 2.30 | 3.20 |
| 12 | 3.00 | 4.80 | 6.10 | 7.20 | 3.30 | 2.40 | 3.50 | 2.20 | 2.10 | 7.10 | 2.20 | 3.00 |
| 13 | 2.90 | 4.30 | 5.90 | 6.90 | 3.40 | 2.30 | 3.30 | 2.10 | 2.10 | 5.40 | 2.20 | 3.00 |
| 14 | 2.70 | 5.70 | 5.20 | 6.50 | 3.50 | 2.30 | 3.20 | 2.10 | 2.00 | 3.40 | 2.20 | 3.00 |
| 15 | 2.60 | 5.90 | 6.20 | 6.10 | 4.10 | 2.30 | 2.60 | 2.10 | 2.00 | 3.20 | 2.10 | 3.90 |
| 16 | 2.40 | 6.30 | 22.30 | 5.60 | 8.40 | 2.30 | 2.40 | 2.10 | 2.00 | 3.00 | 2.20 | 15.30 |
| 17 | 2.30 | 5.60 | 22.20 | 5.90 | 8.40 | 2.30 | 2.20 | 2.10 | 2.00 | 2.90 | 2.20 | 13.50 |
| 18 | 3.10 | 5.30 | 17.30 | 5.70 | 5.30 | 2.20 | 2.20 | 2.10 | 2.00 | 2.90 | 2.30 | 12.70 |
| 19 | 3.60 | 4.90 | 11.10 | 5.60 | 4.30 | 2.30 | 2.20 | 2.10 | 2.00 | 2.60 | 2.40 | 9.90 |
| 20 | 3.90 | 4.80 | 8.60 | 5.20 | 4.20 | 2.50 | 2.30 | 2.10 | 2.10 | 2.50 | 2.20 | 7.50 |
| 21 | 4.60 | 5.10 | 8.90 | 4.90 | 4.20 | 2.40 | 2.40 | 2.10 | 2.10 | 2.50 | 2.20 | 6.30 |
| 22 | 6.90 | 5.10 | 9.10 | 4.60 | 3.90 | 2.60 | 2.30 | 2.10 | 2.00 | 2.40 | 2.20 | 7.80 |
| 23 | 5.80 | 5.00 | 7.30 | 4.50 | 3.60 | 2.50 | 2.20 | 2.10 | 2.00 | 2.30 | 2.20 | 8.20 |
| 24 | 5.10 | 5.10 | 7.80 | 4.50 | 3.50 | 2.40 | 2.20 | 2.10 | 2.00 | 2.20 | 2.20 | 10.30 |
| 25 | 5.00 | 5.90 | 13.60 | 4.40 | 3.30 | 2.40 | 2.20 | 2.10 | 2.00 | 2.20 | 2.20 | 7.30 |
| 26 | 4.90 | 6.50 | 11.90 | 4.30 | 3.20 | 2.40 | 2.10 | 2.10 | 2.00 | 2.10 | 2.90 | 6.50 |
| 27 | 6.20 | 8.10 | 28.80 | 4.20 | 3.00 | 2.40 | 2.10 | 2.20 | 2.10 | 2.10 | 3.40 | 5.10 |
| 28 | 7.00 | 27.60 | 35.00 | 4.10 | 2.90 | 2.30 | 2.10 | 2.30 | 2.30 | 2.00 | 4.20 | 4.90 |
| 29 | 8.30 | ..... | 29.20 | 4.30 | 2.80 | 2.30 | 2.10 | 2.50 | 2.20 | 2.00 | 3.50 | 4.50 |
| 30 | 8.10 | ..... | 25.20 | 4.90 | 2.80 | 2.30 | 2.20 | 2.60 | 3.00 | 2.00 | 3.20 | 4.10 |
| 31 | 11.60 | ..... | 24.00 | ..... | 2.90 | ..... | 2.20 | 2.50 | ..... | 2.00 | ..... | 4.90 |

*Rating table for Cahaba River at Centerville, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 245 | 4.6 | 1,510 | 11.5 | 3,925 | 20.5 | 7,075 |
| 1.2 | 320 | 4.8 | 1,580 | 12.0 | 4,100 | 21.0 | 7,250 |
| 1.4 | 390 | 5.0 | 1,650 | 12.5 | 4,275 | 22.0 | 7,600 |
| 1.6 | 460 | 5.2 | 1,720 | 13.0 | 4,450 | 23.0 | 7,950 |
| 1.8 | 530 | 5.4 | 1,790 | 13.5 | 4,625 | 24.0 | 8,300 |
| 2.0 | 600 | 5.6 | 1,860 | 14.0 | 4,800 | 25.0 | 8,650 |
| 2.2 | 670 | 5.8 | 1,930 | 14.5 | 4,975 | 26.0 | 9,000 |
| 2.4 | 740 | 6.0 | 2,000 | 15.0 | 5,150 | 27.0 | 9,350 |
| 2.6 | 810 | 6.5 | 2,175 | 15.5 | 5,325 | 28.0 | 9,700 |
| 2.8 | 880 | 7.0 | 2,350 | 16.0 | 5,500 | 29.0 | 10,050 |
| 3.0 | 950 | 7.5 | 2,525 | 16.5 | 5,675 | 30.0 | 10,400 |
| 3.2 | 1,020 | 8.0 | 2,700 | 17.0 | 5,850 | 31.0 | 10,750 |
| 3.4 | 1,090 | 8.5 | 2,875 | 17.5 | 6,025 | 32.0 | 11,100 |
| 3.6 | 1,160 | 9.0 | 3,050 | 18.0 | 6,200 | 33.0 | 11,450 |
| 3.8 | 1,230 | 9.5 | 3,225 | 18.5 | 6,375 | 34.0 | 11,800 |
| 4.0 | 1,300 | 10.0 | 3,400 | 19.0 | 6,550 | 35.0 | 12,150 |
| 4.2 | 1,370 | 10.5 | 3,575 | 19.5 | 6,725 | | |
| 4.4 | 1,440 | 11.0 | 3,750 | 20.0 | 6,900 | | |

*Estimated monthly discharge of Cahaba River at Centerville, Ala.*

[Drainage area, 1,040 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 4,660 | 705 | 1,739 | 1.67 | 1.93 |
| February | 9,560 | 1,405 | 2,955 | 2.84 | 2.96 |
| March | 12,150 | 1,720 | 4,799 | 4.61 | 5.31 |
| April | 5,290 | 1,335 | 2,464 | 2.37 | 2.64 |
| May | 2,840 | 880 | 1,282 | 1.23 | 1.42 |
| June | 880 | 670 | 749 | .72 | .80 |
| July | 1,125 | 635 | 730 | .70 | .81 |
| August | 880 | 635 | 690 | .66 | .76 |
| September | 1,055 | 600 | 689 | .66 | .74 |
| October | 3,680 | 600 | 939 | .90 | 1.04 |
| November | 1,370 | 600 | 746 | .72 | .80 |
| December | 5,255 | 775 | 1,974 | 1.90 | 2.19 |
| The year | 12,150 | 600 | 1,646 | 1.58 | 21.40 |

## ALABAMA RIVER AT SELMA, ALA.

This station was originally established by the United States Engineer Corps; readings are now taken by the United States Weather Bureau. The gage, which is attached to the iron highway bridge, the floor of which is about 60 feet above low water, is in two sections. The lower section, which reads from −3.0 feet to +2.30 feet, is secured to the pile on the lower side of the cofferdam on the draw pier; the upper section, which reads from 2.30 feet to 48 feet, is attached to the same pier. The bench mark, which is an iron bolt driven into the face of a rock bluff 182 feet from the first bridge pier, on the road ascending to the city, is 26 feet above the zero of the gage and 87.30 feet above mean sea level. The top of the coping stone of the pivot pier at the highway bridge to which gage is attached is 56 feet above the zero of the gage and 117.30 feet above mean sea level.

*Daily gage height, in feet, of Alabama River at Selma, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 41.00 | 16.80 | 34.30 | 50.10 | 8.40 | 3.60 | 1.50 | 0.40 | 3.50 | 3.70 | 1.40 | 6.00 |
| 2 | 45.00 | 23.00 | 41.50 | 50.70 | 8.70 | 3.50 | 1.20 | .40 | 3.70 | 5.20 | .80 | 6.30 |
| 3 | 46.60 | 29.80 | 45.20 | 50.00 | 8.40 | 3.50 | 1.00 | .70 | 3.00 | 5.00 | .70 | 8.80 |
| 4 | 46.30 | 35.00 | 47.10 | 48.60 | 7.80 | 4.00 | 1.00 | .80 | 3.80 | 4.00 | .50 | 10.50 |
| 5 | 41.40 | 37.50 | 47.10 | 46.00 | 7.40 | 4.00 | .90 | .90 | 3.00 | 3.60 | .20 | 13.60 |
| 6 | 37.00 | 37.90 | 46.20 | 42.40 | 7.00 | 3.80 | .80 | 1.10 | 3.00 | 3.00 | .40 | 14.00 |
| 7 | 35.00 | 37.90 | 44.40 | 39.00 | 7.00 | 3.50 | .70 | 1.40 | 2.50 | 2.80 | .80 | 14.20 |
| 8 | 33.00 | 37.00 | 43.00 | 35.60 | 7.00 | 3.20 | .60 | 1.30 | 2.20 | 2.50 | 3.90 | 13.70 |
| 9 | 30.00 | 34.00 | 41.80 | 32.00 | 6.90 | 2.90 | .60 | 1.10 | 2.00 | 2.50 | 4.80 | 12.00 |
| 10 | 25.40 | 30.00 | 39.00 | 28.90 | 6.80 | 2.90 | .60 | 1.10 | 1.20 | 1.00 | 4.00 | 9.80 |
| 11 | 17.00 | 24.00 | 35.10 | 25.60 | 6.70 | 2.90 | 1.00 | 1.50 | .90 | 2.00 | 2.80 | 7.80 |
| 12 | 14.90 | 17.60 | 30.00 | 22.00 | 6.50 | 2.80 | 1.10 | 1.50 | .80 | 2.00 | 1.90 | 7.20 |
| 13 | 10.10 | 14.00 | 25.50 | 19.00 | 6.30 | 2.60 | 1.10 | 1.10 | .70 | 4.00 | 1.50 | 5.30 |
| 14 | 9.00 | 11.70 | 21.00 | 16.20 | 6.00 | 2.50 | 1.80 | .90 | .60 | 6.00 | 1.40 | 4.20 |
| 15 | 8.10 | 11.60 | 19.20 | 14.60 | 5.80 | 2.50 | 1.90 | .80 | .20 | 5.80 | .90 | 3.80 |
| 16 | 7.50 | 12.00 | 19.80 | 14.20 | 6.00 | 2.80 | 1.90 | .80 | .00 | 5.00 | .70 | 7.60 |
| 17 | 7.00 | 12.30 | 23.00 | 13.00 | 7.40 | 2.60 | 1.90 | .70 | −.10 | 4.60 | .50 | 13.80 |
| 18 | 6.50 | 13.00 | 28.00 | 12.20 | 8.70 | 2.40 | 1.90 | .60 | −.20 | 4.50 | .50 | 21.50 |
| 19 | 6.50 | 12.00 | 32.00 | 12.80 | 9.50 | 2.30 | 1.90 | .10 | −.30 | 4.00 | .70 | 25.50 |
| 20 | 6.50 | 11.80 | 33.60 | 13.20 | 9.00 | 2.20 | 2.00 | .00 | −.30 | 2.00 | .90 | 25.60 |
| 21 | 8.00 | 11.80 | 33.80 | 13.00 | 8.60 | 2.10 | 2.10 | −.10 | .00 | 1.80 | 1.40 | 22.00 |
| 22 | 8.10 | 11.90 | 29.80 | 13.00 | 7.80 | 2.00 | 2.50 | −.20 | .00 | 1.40 | 1.50 | 17.00 |
| 23 | 9.00 | 12.00 | 26.00 | 11.40 | 6.60 | 2.00 | 2.40 | −.30 | −.10 | 1.00 | 1.50 | 15.00 |
| 24 | 12.00 | 12.20 | 23.00 | 10.60 | 5.90 | 2.00 | 1.80 | −.20 | −.20 | 1.00 | 1.30 | 15.00 |
| 25 | 13.80 | 12.00 | 22.80 | 10.00 | 5.40 | 1.90 | 1.00 | −.40 | −.20 | .90 | 1.70 | 15.00 |
| 26 | 13.00 | 12.00 | 24.00 | 9.80 | 5.40 | 1.90 | .80 | −.30 | −.20 | .60 | 2.60 | 14.00 |
| 27 | 11.50 | 14.00 | 24.90 | 9.40 | 5.00 | 1.80 | .60 | −.40 | .20 | .20 | 4.80 | 12.80 |
| 28 | 11.40 | 23.60 | 30.00 | 9.00 | 4.80 | 1.80 | .50 | −.20 | .20 | .00 | 7.60 | 10.90 |
| 29 | 12.00 | ..... | 38.00 | 8.60 | 4.40 | 1.80 | .40 | .10 | .50 | −.10 | 6.90 | 9.00 |
| 30 | 14.60 | ..... | 45.10 | 8.50 | 4.00 | 1.70 | .50 | .20 | .90 | 1.20 | 5.80 | 7.00 |
| 31 | 16.00 | ..... | 48.90 | ..... | 3.80 | ..... | .50 | .40 | ..... | 1.80 | ..... | 6.40 |

*Rating table for Alabama River at Selma, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| —0.4 | 6,470 | 3.6 | 11,092 | 11.5 | 31,490 | 28.0 | 75,380 |
| —.2 | 6,575 | 3.8 | 11,448 | 12.0 | 32,820 | 29.0 | 78,040 |
| .0 | 6,700 | 4.0 | 11,820 | 12.5 | 34,150 | 30.0 | 80,700 |
| .2 | 6,845 | 4.2 | 12,220 | 13.0 | 35,480 | 31.0 | 83,360 |
| .4 | 7,009 | 4.4 | 12,660 | 13.5 | 36,810 | 32.0 | 86,020 |
| .6 | 7,189 | 4.6 | 13,150 | 14.0 | 38,140 | 33.0 | 88,680 |
| .8 | 7,384 | 4.8 | 13,668 | 14.5 | 39,370 | 34.0 | 91,340 |
| 1.0 | 7,596 | 5.0 | 14,200 | 15.0 | 40,800 | 35.0 | 94,000 |
| 1.2 | 7,818 | 5.5 | 15,530 | 16.0 | 43,460 | 36.0 | 96,660 |
| 1.4 | 8,045 | 6.0 | 16,860 | 17.0 | 46,120 | 37.0 | 99,320 |
| 1.6 | 8,276 | 6.5 | 18,190 | 18.0 | 48,780 | 38.0 | 101,980 |
| 1.8 | 8,511 | 7.0 | 19,520 | 19.0 | 51,440 | 39.0 | 104,640 |
| 2.0 | 8,750 | 7.5 | 20,850 | 20.0 | 54,100 | 40.0 | 107,300 |
| 2.2 | 8,996 | 8.0 | 22,180 | 21.0 | 56,760 | 41.0 | 109,960 |
| 2.4 | 9,256 | 8.5 | 23,510 | 22.0 | 59,420 | 42.0 | 112,620 |
| 2.6 | 9,532 | 9.0 | 24,840 | 23.0 | 62,080 | 43.0 | 115,280 |
| 2.8 | 9,822 | 9.5 | 26,170 | 24.0 | 64,740 | 44.0 | 117,940 |
| 3.0 | 10,120 | 10.0 | 27,500 | 25.0 | 67,400 | 45.0 | 120,600 |
| 3.2 | 10,428 | 10.5 | 28,830 | 26.0 | 70,060 | 46.0 | 123,260 |
| 3.4 | 10,752 | 11.0 | 30,160 | 27.0 | 72,720 | 47.0 | 125,920 |

*Estimated monthly discharge of Alabama River at Selma, Ala.*

[Drainage area, 15,400 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 124,856 | 18,190 | 52,655 | 3.42 | 3.94 |
| February | 101,714 | 31,756 | 54,898 | 3.56 | 3.71 |
| March | 130,974 | 51,972 | 90,404 | 5.87 | 6.77 |
| April | 135,762 | 23,510 | 62,017 | 4.03 | 4.49 |
| May | 26,170 | 11,448 | 18,859 | 1.22 | 1.41 |
| June | 11,820 | 8,393 | 9,682 | .63 | 0.70 |
| July | 9,392 | 7,009 | 7,897 | .51 | .59 |
| August | 8,160 | 6,470 | 7,176 | .47 | .54 |
| September | 11,448 | 6,520 | 7,871 | .51 | .57 |
| October | 16,860 | 6,635 | 10,184 | .66 | .76 |
| November | 21,116 | 6,845 | 9,557 | .62 | .69 |
| December | 68,996 | 11,448 | 33,122 | 2.15 | 2.48 |
| The year | 135,762 | 6,470 | 30,360 | 1.97 | 26.65 |

## ALABAMA RIVER AT MONTGOMERY, ALA.

This river, as described in the United States Weather Bureau reports, is formed by the junction of Coosa and Tallapoosa rivers, 6 miles above Montgomery. A gage rod was established by the United States Engineer Corps a number of years ago at the Montgomery wharf, near the union passenger station at the foot of Commerce street. The readings are now taken by the Weather Bureau and are furnished to this Survey. The gage rod is in six sections, as follows: Section 1, from −2 to +10 feet, on the fender pile at the face of the wharf, 108 feet from the lower end; section 2, from 10 to 15 feet, at the upper end of the pile protection to the Louisville and Nashville Railroad bank at the corner pile, the 15-foot mark being 1.1 feet above the top of the pile; section 3, 15 to 27 feet, on the bent in the center of the drain, on the lower side of the Commerce street sewer; section 4, 27 to 36 feet, on the upper side of the sewer, on the third bent; section 5, 36 to 46 feet, on the same side of the sewer, on the sixth bent; section 6, 46 to 50 feet, on the same side of the sewer, on the seventh bent. The rods are of pine timber, painted, and graduated to feet and tenths. There are also two new sections, 15 to 25 feet and 25 to 37 feet, on trees about 50 yards south of the old gage. The bench mark is the northeast corner of the stone doorsill in the north door of Windsor Hotel, on Commerce street. It is 59.7 feet above the zero of the gage, and is 163.4 feet above sea level. The high-water mark for Montgomery is

59.7 feet, and was reached in April, 1886. The danger line is placed at 35 feet. The width of the river at low water is 690 feet. The only point where measurements can be made is at the iron bridge of the Louisville and Nashville Railroad, about 3 miles above Montgomery. This bridge is 60.6 feet above low water, with three spans over the river, the center one being a draw or turn span.

*Daily gage height, in feet, of Alabama River at Montgomery, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 45.80 | 15.00 | 38.50 | 47.00 | 6.70 | 2.70 | 1.00 | 0.40 | 2.70 | 6.60 | 0.50 | 4.80 |
| 2 | 44.90 | 24.50 | 46.40 | 44.50 | 6.00 | 2.90 | 1.00 | .50 | 2.50 | 5.60 | .30 | 4.70 |
| 3 | 42.50 | 32.40 | 46.70 | 41.40 | 5.70 | 3.00 | .80 | .70 | 2.50 | 3.20 | .20 | 7.20 |
| 4 | 39.50 | 36.50 | 45.50 | 38.00 | 5.30 | 2.90 | .70 | .90 | 2.20 | 2.80 | .10 | 10.90 |
| 5 | 36.00 | 37.60 | 41.70 | 34.50 | 5.30 | 2.90 | .60 | 1.00 | 1.60 | 2.40 | .20 | 11.60 |
| 6 | 31.50 | 36.00 | 39.00 | 30.50 | 5.40 | 2.50 | .60 | .80 | 1.10 | 2.00 | 1.10 | 11.80 |
| 7 | 28.40 | 32.80 | 37.50 | 25.50 | 5.30 | 2.30 | .60 | 1.00 | 1.00 | 1.70 | 3.80 | 11.30 |
| 8 | 25.60 | 29.00 | 34.20 | 20.50 | 5.00 | 2.30 | .60 | .70 | 1.00 | 1.30 | 4.10 | 9.70 |
| 9 | 21.00 | 25.00 | 31.40 | 20.00 | 4.80 | 2.30 | .70 | 1.00 | 1.00 | .90 | 3.00 | 7.60 |
| 10 | 15.00 | 18.60 | 28.70 | 18.80 | 4.90 | 2.30 | .50 | 1.40 | .90 | .50 | 2.10 | 5.80 |
| 11 | 8.60 | 13.00 | 23.80 | 16.00 | 4.70 | 2.20 | .50 | 1.10 | .80 | .80 | 1.50 | 4.60 |
| 12 | 6.50 | 9.40 | 17.80 | 14.50 | 4.40 | 2.10 | .60 | .80 | .60 | 4.00 | 1.50 | 3.80 |
| 13 | 6.10 | 8.00 | 14.50 | 12.00 | 4.20 | 2.10 | .80 | .70 | .40 | 4.50 | 1.30 | 3.30 |
| 14 | 5.60 | 7.60 | 14.00 | 11.50 | 3.90 | 2.00 | 1.20 | .90 | .20 | 4.40 | .90 | 3.00 |
| 15 | 5.30 | 7.80 | 13.80 | 10.00 | 4.00 | 1.80 | 1.30 | .50 | .10 | 4.00 | .60 | 2.70 |
| 16 | 5.00 | 9.00 | 15.50 | 9.80 | 5.30 | 1.80 | 1.50 | .50 | .10 | 3.30 | .50 | 4.20 |
| 17 | 4.80 | 9.80 | 23.00 | 9.00 | 7.00 | 1.80 | 1.50 | .40 | .10 | 2.70 | .50 | 17.30 |
| 18 | 4.60 | 9.50 | 28.30 | 9.80 | 7.40 | 1.60 | 1.70 | .20 | .00 | 2.20 | .60 | 20.60 |
| 19 | 4.60 | 8.50 | 30.10 | 10.30 | 7.40 | 1.60 | 1.70 | .20 | −.10 | 1.60 | 1.10 | 21.20 |
| 20 | 4.90 | 8.20 | 28.20 | 10.00 | 7.20 | 1.60 | 2.00 | .10 | .30 | 1.20 | 1.30 | 17.50 |
| 21 | 5.30 | 8.40 | 24.00 | 9.00 | 5.60 | 1.60 | 2.00 | .00 | .20 | 1.00 | 1.30 | 12.00 |
| 22 | 7.00 | 8.80 | 20.00 | 8.70 | 4.80 | 1.60 | 1.60 | .00 | .00 | 1.00 | 1.20 | 10.40 |
| 23 | 8.00 | 8.60 | 17.50 | 8.00 | 4.50 | 1.60 | 1.10 | .10 | −.10 | 1.00 | 1.10 | 12.00 |
| 24 | 10.20 | 8.20 | 14.50 | 7.50 | 4.00 | 1.60 | .80 | .00 | .20 | .70 | 1.30 | 12.50 |
| 25 | 9.50 | 8.80 | 17.50 | 7.00 | 4.00 | 1.50 | .60 | −.10 | .10 | .40 | 1.20 | 11.60 |
| 26 | 8.70 | 9.80 | 19.50 | 7.00 | 3.70 | 1.50 | .40 | .00 | .00 | .20 | 3.70 | 10.20 |
| 27 | 8.00 | 10.20 | 18.50 | 6.50 | 3.40 | 1.30 | .40 | .30 | +.50 | .10 | 6.30 | 8.40 |
| 28 | 7.90 | 25.60 | 32.00 | 6.20 | 3.30 | 1.30 | .30 | .50 | .60 | .20 | 5.10 | 6.60 |
| 29 | 10.90 | ..... | 41.40 | 6.00 | 3.20 | 1.20 | .30 | .50 | 1.20 | 1.50 | 4.40 | 5.50 |
| 30 | 12.50 | ..... | 45.80 | 6.00 | 3.00 | 1.00 | .20 | 1.50 | 3.90 | 1.70 | 4.60 | 5.00 |
| 31 | 13.00 | ..... | 47.80 | ..... | 2.70 | ..... | .20 | 3.50 | ..... | 1.10 | ..... | 5.50 |

TALLAPOOSA RIVER AT MILSTEAD, ALA.

A gaging station was established on August 7, 1897, at the bridge of the Tallassee and Montgomery Railway, about one-fourth of a mile from Milstead, Ala. The bridge is of iron, two spans of about 155 feet each, with short wooden trestles at each end. The initial point of measurement is the end of the iron bridge, on the left bank, downstream side. The rod of the wire gage is fastened to the outside of the guard rail on the downstream side of the bridge. The bench mark is the top of the second crossbeam from the left bank pier at the downstream end, and is 60 feet above datum. The channel is straight at the bridge and bends above and below. The current is

sluggish at low water and obstructed by the center pier of the bridge. The banks are high, but overflow at extreme high water for several hundred feet on each side. The bed is fairly constant, and all the water is confined to the main channel by railroad embankments.

During the year 1902 there have been three different observers—Seth Johnson until April 6, B. F. Wells until October 27, and W. F. McGee from November 20 to the end of the year. Mr. McGee failed to begin at the time that Mr. Wells left off, as he was expected to do.

The large new dams at Tallassee Falls—6 and 9 miles, respectively, above this station—almost stop the flow of the river at certain times, so that discharge measurements at Milstead do not represent the amount of water furnished by the stream. On August 21 to 27, and and on October 19, 20, 24, 25, and 26, the dams were evidently impounding water. The station at Sturdevant, Ala., about 30 miles above these dams, has been established to replace Milstead.

The following discharge measurement was made in 1902:

January 14: Gage height, 3.65 feet; discharge, 3,644 second-feet.

*Daily gage height, in feet, of Tallapoosa River at Milstead, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 29.50 | 18.00 | 45.00 | 21.50 | 4.40 | 2.30 | 1.30 | 1.30 | 4.00 | 4.30 | (a) | (a) |
| 2 | 22.50 | 29.50 | 32.50 | 14.50 | 4.20 | 3.80 | 1.20 | 1.20 | 3.80 | 4.00 | (a) | (a) |
| 3 | 11.30 | 33.00 | 24.70 | 11.20 | 4.80 | 2.90 | 1.10 | 1.60 | 2.60 | 3.80 | (a) | (a) |
| 4 | 7.10 | 23.00 | 17.70 | 9.90 | 4.10 | 2.50 | 1.00 | 1.90 | 2.20 | 3.30 | (a) | 13.40 |
| 5 | 6.30 | 16.60 | 15.10 | 9.80 | 4.10 | 2.30 | 1.00 | 1.70 | 1.90 | 3.20 | (a) | 10.90 |
| 6 | 5.70 | 10.90 | 12.70 | 9.20 | 4.00 | 2.20 | 1.30 | 1.60 | 1.70 | 3.00 | (a) | 8.00 |
| 7 | 5.10 | 8.30 | 10.70 | 8.70 | 3.80 | 2.10 | 1.30 | 2.00 | 1.60 | 1.80 | (a) | 6.00 |
| 8 | 4.80 | 7.10 | 9.10 | 15.40 | 3.60 | 2.40 | 1.40 | 1.80 | 1.50 | 1.70 | (a) | 4.40 |
| 9 | 4.60 | 6.20 | 8.70 | 13.30 | 3.90 | 2.20 | 1.40 | 1.70 | 1.50 | 1.50 | (a) | 3.50 |
| 10 | 4.40 | 5.80 | 8.00 | 10.70 | 4.00 | 2.10 | 1.50 | 1.80 | 1.40 | 1.30 | (a) | 3.10 |
| 11 | 4.25 | 5.40 | 7.30 | 8.90 | 3.60 | 2.10 | 1.40 | 1.60 | 1.30 | 1.50 | (a) | 2.90 |
| 12 | 4.00 | 5.10 | 6.80 | 8.00 | 3.30 | 2.10 | 2.10 | 1.70 | 1.20 | 1.40 | (a) | 2.70 |
| 13 | 3.90 | 5.00 | 10.30 | 7.50 | 3.20 | 2.00 | 1.70 | 1.60 | 1.50 | 1.30 | (a) | 2.60 |
| 14 | 3.65 | 4.70 | 11.00 | 7.10 | 3.10 | 1.90 | 1.60 | 1.50 | 1.20 | 2.00 | (a) | 2.60 |
| 15 | 3.60 | 5.65 | 12.40 | 7.30 | 3.30 | 1.80 | 1.50 | 1.40 | 1.20 | 2.10 | (a) | 2.50 |
| 16 | 3.50 | 6.90 | 14.20 | 7.20 | 6.80 | 1.70 | 2.10 | 1.70 | 1.10 | 2.30 | (a) | 9.60 |
| 17 | 3.50 | 6.30 | 30.00 | 7.20 | 5.80 | 1.90 | 2.50 | 1.40 | 1.10 | 2.10 | (a) | 25.30 |
| 18 | 3.40 | 5.60 | 26.00 | 9.20 | 4.70 | 1.80 | 2.20 | 1.20 | 1.00 | 1.00 | (a) | 10.20 |
| 19 | 3.80 | 5.00 | 17.70 | 8.10 | 5.50 | 1.70 | 2.00 | 1.10 | 1.00 | .90 | (a) | 12.60 |
| 20 | 4.00 | 5.10 | 17.00 | 7.20 | 4.40 | 1.80 | 2.60 | 1.00 | 1.00 | .80 | 2.70 | 7.70 |
| 21 | 4.50 | 5.90 | 14.00 | 6.50 | 3.30 | 1.70 | 2.20 | .90 | 1.00 | .70 | 2.60 | 5.50 |
| 22 | 6.00 | 5.80 | 12.10 | 5.90 | 3.30 | 1.60 | 1.60 | .90 | 1.00 | 2.00 | 2.20 | 6.80 |
| 23 | 6.20 | 5.30 | 10.50 | 5.50 | 3.30 | 1.70 | 1.50 | .80 | .90 | 1.00 | 2.00 | 7.90 |
| 24 | 5.00 | 4.70 | 11.10 | 5.40 | 3.00 | 1.60 | 1.40 | .80 | 1.20 | .90 | 2.10 | 6.80 |
| 25 | 5.70 | 5.90 | 18.50 | 5.80 | 2.80 | 1.50 | 1.20 | .70 | 1.30 | .80 | 2.10 | 5.00 |
| 26 | 4.40 | 6.20 | 12.50 | 5.40 | 2.70 | 1.40 | 1.10 | .60 | 1.90 | .10 | 12.90 | 4.20 |
| 27 | 4.30 | 6.50 | 11.00 | 5.10 | 2.60 | 1.30 | 1.20 | .60 | 1.80 | 1.60 | 8.50 | 3.60 |
| 28 | 5.30 | 42.00 | 38.00 | 4.80 | 2.60 | 1.20 | 1.10 | 1.10 | 2.50 | (a) | 4.30 | 3.30 |
| 29 | 6.00 | ..... | 43.00 | 4.70 | 2.50 | 1.30 | 1.30 | 2.60 | 3.20 | (a) | 3.30 | 3.00 |
| 30 | 7.00 | ..... | 38.50 | 4.60 | 2.40 | 1.30 | 1.20 | 7.30 | 4.00 | (a) | 2.30 | 3.50 |
| 31 | 7.90 | ..... | 25.10 | ..... | 2.30 | ..... | 1.40 | 4.60 | ..... | (a) | ..... | 4.50 |

a No record.

*Rating table for Tallapoosa River at Milstead, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet* | *Feet.* | *Second-feet.* |
| 0.6 | 350 | 4.6 | 4,825 | 9.5 | 10,337 | 26.0 | 28,900 |
| .8 | 562 | 4.8 | 5,050 | 10.0 | 10,900 | 27.0 | 30,025 |
| 1.0 | 774 | 5.0 | 5,275 | 10.5 | 11,462 | 28.0 | 31,150 |
| 1.2 | 990 | 5.2 | 5,499 | 11.0 | 12,025 | 29.0 | 32,275 |
| 1.4 | 1,224 | 5.4 | 5,724 | 11.5 | 12,587 | 30.0 | 33,400 |
| 1.6 | 1,450 | 5.6 | 5,949 | 12.0 | 13,150 | 31.0 | 34,525 |
| 1.8 | 1,675 | 5.8 | 6,174 | 12.5 | 13,712 | 32.0 | 35,650 |
| 2.0 | 1,900 | 6.0 | 6,400 | 13.0 | 14,275 | 33.0 | 36,775 |
| 2.2 | 2,125 | 6.2 | 6,624 | 14.0 | 15,400 | 34.0 | 37,900 |
| 2.4 | 2,350 | 6.4 | 6,849 | 15.0 | 16,525 | 35.0 | 39,025 |
| 2.6 | 2,575 | 6.6 | 7,074 | 16.0 | 17,650 | 36.0 | 40,150 |
| 2.8 | 2,800 | 6.8 | 7,299 | 17.0 | 18,775 | 37.0 | 41,275 |
| 3.0 | 3,025 | 7.0 | 7,525 | 18.0 | 19,900 | 38.0 | 42,400 |
| 3.2 | 3,250 | 7.2 | 7,749 | 19.0 | 21,025 | 39.0 | 43,525 |
| 3.4 | 3,475 | 7.4 | 7,974 | 20.0 | 22,150 | 40.0 | 44,650 |
| 3.6 | 3,700 | 7.6 | 8,199 | 21.0 | 23,275 | 41.0 | 45,775 |
| 3.8 | 3,925 | 7.8 | 8,424 | 22.0 | 24,400 | 42.0 | 46,900 |
| 4.0 | 4.150 | 8.0 | 8,650 | 23.0 | 25,525 | 43.0 | 48,025 |
| 4.2 | 43.75 | 8.5 | 9,212 | 24.0 | 26,650 | 44.0 | 49,150 |
| 4.4 | 4,600 | 9.0 | 9,775 | 25.0 | 27,775 | 45.0 | 50,275 |

*Estimated monthly discharge of Tallapoosa River at Milstead, Ala.*

[Drainage area 3,840 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 32,837 | 3,475 | 6,951 | 1.81 | 2.09 |
| February | 46,900 | 4,937 | 11,520 | 3.00 | 3.12 |
| March | 50,275 | 7,299 | 20,379 | 5.31 | 6.12 |
| April | 23,837 | 4,825 | 9,234 | 2.40 | 2.68 |
| May | 7,299 | 2,237 | 3,838 | 1.00 | 1.15 |
| June | 3,925 | 990 | 1,835 | .48 | .54 |
| July | 2,575 | 774 | 1,368 | .36 | .42 |
| August | 7,861 | 350 | 1,529 | .40 | .46 |
| September | 4,150 | 668 | 1,621 | .42 | .47 |
| October 1 to 25 | ---------- | ---------- | 1,843 | .48 | .45 |
| November 20 to 30 | ---------- | ---------- | 4,252 | 1.11 | .45 |
| December 4 to 31 | ---------- | ---------- | 6,970 | 1.82 | 1.93 |

TALLAPOOSA RIVER AT STURDEVANT, ALA.

This station was established July 19, 1900, by J. R. Hall. It is located at the Columbus and Western Railroad bridge, a fourth of a mile west of Sturdevant. This railroad belongs to the Central of Georgia Railway. The gage rod is 20 feet long, and is graduated to feet and tenths. It is in two sections, and is fastened vertically, the shorter section to a post at the edge of the water on the east bank about 20 feet below the bridge, and the longer section to the first stone pier from the east bank. The initial point of sounding is the east end of the bridge. The section is broken by three piers and by some large rocks below the bridge. The gage is referred to a bench mark consisting of a nail in the southwest corner of pier No. 2, on the east side of the river, 455.70 feet above tide water and 14.20 feet above the zero of the gage. The observer is B. F. Neighbors, farmer and postmaster at Sturdevant, who lives a fourth of a mile from the station. This station, being above the big new dams at Tallassee, is intended to replace Milstead station. Map and profile of Tallapoosa River are published in Twenty-second Annual Report, part 4.

The following discharge measurements were made during 1902:

July 11: Gage height, 1.85 feet; discharge, 1,440 second-feet.
September 17: Gage height, 0.80 foot; discharge, 658 second-feet.
October 9: Gage height, 1.08 feet; discharge, 858 second-feet.
November 12: Gage height, 1.34 feet; discharge, 1,000 second-feet.

*Daily gage height, in feet, of Tallapoosa River at Sturdevant, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 11.10 | 6.90 | 13.70 | 8.00 | 3.50 | 3.60 | 1.00 | 1.10 | 1.80 | 2.90 | 0.9 | 2.30 |
| 2 | 8.40 | 11.40 | 11.00 | 7.20 | 3.40 | 3.10 | 1.00 | 1.30 | 1.50 | 2.50 | .8 | 3.20 |
| 3 | 6.30 | 9.10 | 9.60 | 5.30 | 3.40 | 2.80 | .90 | 1.20 | 1.30 | 2.30 | .8 | 7.00 |
| 4 | 4.00 | 7.00 | 8.50 | 5.00 | 3.30 | 2.40 | .90 | 1.10 | 1.90 | 1.90 | .8 | 5.70 |
| 5 | 3.60 | 5.60 | 7.20 | 4.80 | 3.30 | 2.20 | .80 | 2.00 | 1.60 | 1.60 | 1.2 | 4.50 |
| 6 | 3.40 | 5.00 | 6.00 | 4.70 | 3.30 | 2.10 | 1.40 | 1.80 | 1.50 | 1.40 | 2.8 | 4.10 |
| 7 | 3.30 | 4.80 | 5.50 | 4.60 | 3.20 | 2.10 | 1.20 | 2.50 | 1.40 | 1.20 | 2.7 | 4.00 |
| 8 | 3.20 | 4.30 | 5.00 | 6.40 | 3.20 | 2.00 | 1.10 | 2.30 | 1.20 | 1.00 | 2.6 | 3.90 |
| 9 | 3.10 | 4.00 | 4.80 | 5.20 | 3.20 | 2.20 | 1.20 | 1.10 | 1.50 | 1.90 | 2.50 | 3.70 |
| 10 | 3.00 | 3.80 | 4.60 | 5.00 | 3.20 | 2.10 | 1.10 | 1.10 | 1.40 | 1.80 | 2.30 | 3.30 |
| 11 | 2.90 | 3.70 | 4.50 | 4.80 | 3.10 | 2.00 | 1.90 | 1.20 | 1.10 | 2.30 | 2.10 | 2.90 |
| 12 | 2.90 | 3.60 | 4.40 | 4.50 | 3.10 | 1.90 | 1.60 | 1.20 | 1.00 | 2.00 | 1.90 | 2.60 |
| 13 | 2.80 | 3.50 | 4.80 | 4.40 | 3.10 | 1.80 | 1.50 | 1.40 | .90 | 1.80 | 1.70 | 2.30 |
| 14 | 2.80 | 3.50 | 4.60 | 4.30 | 3.10 | 1.80 | 2.00 | 1.30 | .80 | 1.60 | 1.50 | 2.10 |
| 15 | 2.70 | 4.10 | 5.90 | 4.20 | 4.20 | 1.70 | 2.30 | 1.00 | .70 | 1.50 | 1.30 | 2.00 |
| 16 | 2.70 | 4.50 | 8.40 | 4.10 | 4.00 | 1.70 | 2.10 | .90 | .60 | 1.40 | 1.20 | 7.80 |
| 17 | 2.60 | 4.00 | 10.20 | 4.50 | 3.50 | 1.60 | 1.80 | .80 | .60 | 1.30 | 1.10 | 8.00 |
| 18 | 2.60 | 3.80 | 7.40 | 5.40 | 3.40 | 1.60 | 2.80 | .70 | .60 | 1.20 | 2.20 | 5.00 |
| 19 | 2.90 | 3.60 | 5.70 | 4.80 | 3.30 | 1.60 | 2.30 | .60 | .60 | 1.20 | 2.00 | 4.20 |
| 20 | 2.90 | 3.50 | 5.30 | 4.30 | 3.10 | 1.50 | 1.70 | .50 | .60 | 1.20 | 1.80 | 4.10 |
| 21 | 3.50 | 3.50 | 5.20 | 4.10 | 3.00 | 1.50 | 1.50 | .50 | .60 | 1.1 | 1.40 | 4.30 |
| 22 | 4.00 | 3.50 | 5.00 | 4.00 | 2.90 | 1.40 | 1.30 | .50 | .60 | 1.1 | 1.20 | 4.50 |
| 23 | 3.80 | 3.40 | 4.80 | 3.90 | 2.80 | 1.40 | 1.20 | .60 | .50 | 1.1 | 1.10 | 3.80 |
| 24 | 3.70 | 3.40 | 4.80 | 3.80 | 2.70 | 1.30 | 1.10 | .60 | .50 | 1.0 | 1.10 | 3.30 |
| 25 | 3.60 | 3.70 | 5.10 | 3.70 | 2.60 | 1.30 | 1.00 | .50 | .80 | 1.0 | 3.80 | 3.00 |

*Daily gage height, in feet, of Tallapoosa River at Sturdevant, Ala.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 26 | 3.50 | 3.80 | 4.90 | 3.70 | 2.50 | 1.30 | .90 | .40 | .80 | 1.0 | 5.20 | 2.80 |
| 27 | 3.40 | 3.90 | 6.80 | 3.70 | 2.40 | 1.20 | .90 | 1.20 | 3.00 | 1.0 | 5.00 | 2.60 |
| 28 | 4.00 | 16.10 | 16.10 | 3.60 | 2.40 | 1.20 | .80 | 2.40 | 4.10 | 1.0 | 4.30 | 2.50 |
| 29 | 4.50 | ..... | 14.60 | 3.60 | 2.30 | 1.20 | .90 | 6.00 | 3.20 | .9 | 2.80 | 2.40 |
| 30 | 5.00 | ..... | 10.90 | 3.50 | 2.30 | 1.10 | 1.00 | 3.40 | 4.10 | .9 | 2.30 | 2.60 |
| 31 | 5.00 | ..... | 9.20 | ..... | 2.20 | ..... | 1.00 | 2.30 | ..... | .9 | ..... | 3.90 |

*Estimated monthly discharge of Tallapoosa River at Sturdevant, Ala.*

[Drainage area, 2,500 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 15,695 | 2,520 | 4,550 | 1.82 | 2.10 |
| February | 23,245 | 3,760 | 6,288 | 2.52 | 2.62 |
| March | 23,245 | 5,310 | 9,708 | 3.88 | 4.47 |
| April | 10,890 | 3,914 | 5,677 | 2.27 | 2.53 |
| May | 5,000 | 1,910 | 3,240 | 1.30 | 1.50 |
| June | 4,070 | 840 | 1,544 | .62 | .69 |
| July | 2,830 | 660 | 1,004 | .40 | .46 |
| August | 7,790 | 470 | 1,298 | .52 | .60 |
| September | 4,845 | 510 | 1,255 | .50 | .56 |
| October | 2,985 | 715 | 1,180 | .47 | .54 |
| November | 6,550 | 660 | 2,011 | .80 | .89 |
| December | 10,890 | 1,640 | 4,412 | 1.76 | 2.03 |
| The year | 23,245 | 470 | 3,514 | 1.40 | 18.99 |

*Rating table for Tallapoosa River at Sturdevant, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.6 | 555 | 3.0 | 3,140 | 5.4 | 6,860 | 10.5 | 14,765 |
| .8 | 660 | 3.2 | 3,450 | 5.6 | 7,170 | 11.0 | 15,540 |
| 1.0 | 775 | 3.4 | 3,760 | 5.8 | 7,480 | 11.5 | 16,315 |
| 1.2 | 910 | 3.6 | 4,070 | 6.0 | 7,790 | 12.0 | 17,090 |
| 1.4 | 1,055 | 3.8 | 4,380 | 6.5 | 8,565 | 12.5 | 17,865 |
| 1.6 | 1,220 | 4.0 | 4,690 | 7.0 | 9,340 | 13.0 | 18,640 |
| 1.8 | 1,410 | 4.2 | 5,000 | 7.5 | 10,115 | 13.5 | 19,415 |
| 2.0 | 1,640 | 4.4 | 5,310 | 8.0 | 10,890 | 14.0 | 20,190 |
| 2.2 | 1,910 | 4.6 | 5,620 | 8.5 | 11,665 | 14.5 | 20,965 |
| 2.4 | 2,210 | 4.8 | 5,930 | 9.0 | 12,440 | 15.0 | 21,740 |
| 2.6 | 2,520 | 5.0 | 6,240 | 10.0 | 13,215 | | |
| 2.8 | 2,830 | 5.2 | 6,550 | 9.5 | 13,990 | | |

*Estimated monthly discharge of Tallapoosa River at Sturdevant, Ala.*

[Drainage area, 2,500 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1900. | | | | | |
| July 19–31 | ---------- | ---------- | 4,002 | 1.60 | 0.77 |
| August | 5,155 | 1,520 | 2,533 | 1.01 | 1.16 |
| September | 17,090 | 1,220 | 3,602 | 1.44 | 1.61 |
| October | 9,805 | 1,220 | 3,398 | 1.36 | 1.57 |
| November | 7,635 | 1,910 | 3,275 | 1.31 | 1.46 |
| December | 10,115 | 2,520 | 4,330 | 1.73 | 1.99 |
| 1901. | | | | | |
| January | 20,345 | 4,690 | 7,035 | 2.81 | 3.24 |
| February | 18,485 | 4,535 | 6,468 | 2.59 | 2.70 |
| March | 12,285 | 3,450 | 5,315 | 2.13 | 2.46 |
| April | 12,440 | 4,535 | 6,772 | 2.61 | 2.91 |
| May | 10,270 | 3,140 | 4,885 | 1.95 | 2.25 |
| June | 7,170 | 2,365 | 4,452 | 1.78 | 1.99 |
| July | 5,155 | 1,640 | 2,795 | 1.12 | 1.29 |
| August | 16,625 | 1,640 | 4,793 | 1.92 | 2.21 |
| September | 9,340 | 1,640 | 2,852 | 1.14 | 1.27 |
| October | 7,790 | 1,220 | 1,946 | .78 | .90 |
| November | 2,055 | 1,220 | 1,502 | .70 | .78 |
| December | 24,150 | 1,310 | 4,670 | 1.87 | 2.16 |
| The year | 24,150 | 1,220 | 4,457 | 1.78 | 24.16 |

HILLABEE CREEK NEAR ALEXANDER, ALA.

This station, which was established August 29, 1900, by J. R. Hall, is located 6½ miles northeast of Alexander, on the road leading from that town to Newsite. The gage is graduated to feet and tenths, is placed vertically, and is in two sections. The short section, which reads from 0 to 5.50 feet, is fastened to a post in the edge of the water on the north bank, 20 feet from the upstream side of the bridge. The long section, which reads from 5.50 to 16 feet, is fastened to the upstream end of the first pier on the north bank. Both sections can be easily read from the north approach to the bridge. The initial point of sounding is on the south side of the first pier on the north bank. The gage is referred to a bench mark at the top of a chord on the downstream side of the bridge at the second pier from the north

bank, and is 27.6 feet above the zero of the gage. The bridge is in three spans, having a total length of 276 feet, with a north approach of 116 feet and a south approach of 124 feet, making a total, over all, of 516 feet. The observer is J. H. Chisolm, a farmer, whose post-office address is Alexander, Ala.

The following discharge measurement was made in 1902:

July 16: Gage height, 1.12 feet; discharge, 169 second-feet.

*Daily gage height, in feet, of Hillabee Creek near Alexander, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 3.70 | 5.30 | 4.10 | 3.40 | 1.90 | 1.60 | 0.80 | 0.80 | 1.40 | 3.20 | 0.90 | 1.80 |
| 2 | 3.50 | 7.70 | 4.00 | 3.20 | 1.90 | 1.60 | .80 | .80 | 3.60 | 3.20 | .80 | 6.00 |
| 3 | 3.00 | 3.70 | 3.90 | 3.00 | 1.80 | 1.70 | .80 | .90 | 1.90 | 3.00 | .70 | 4.20 |
| 4 | 2.00 | 3.00 | 2.90 | 3.00 | 1.80 | 1.70 | .80 | 1.20 | 1.50 | 3.00 | 2.60 | 3.50 |
| 5 | 2.00 | 2.70 | 3.00 | 3.00 | 1.90 | 1.70 | .70 | 1.10 | 1.40 | 3.00 | 3.60 | 2.00 |
| 6 | 2.00 | 2.50 | 3.50 | 2.90 | 1.90 | 1.60 | .70 | 1.10 | 1.30 | 2.80 | 2.60 | 1.90 |
| 7 | 2.00 | 2.40 | 3.60 | 4.10 | 1.90 | 1.60 | .70 | 1.00 | 1.20 | 2.60 | 1.10 | 1.90 |
| 8 | 1.90 | 2.10 | 2.60 | 3.40 | 1.90 | 1.60 | .70 | 1.00 | 1.10 | 2.60 | 1.00 | 1.90 |
| 9 | 1.80 | 2.10 | 2.40 | 3.20 | 1.80 | 1.60 | .80 | .90 | 1.40 | 3.30 | 1.00 | 1.80 |
| 10 | 1.70 | 2.00 | 2.30 | 2.80 | 1.80 | 1.50 | 1.00 | .90 | 1.30 | 4.10 | 1.00 | 1.80 |
| 11 | 1.70 | 2.00 | 2.30 | 2.60 | 1.80 | 1.50 | 1.10 | .90 | 1.20 | 3.80 | 1.00 | 1.70 |
| 12 | 1.70 | 2.00 | 2.00 | 2.60 | 1.70 | 1.40 | 1.30 | .90 | 1.10 | 2.10 | 1.00 | 1.60 |
| 13 | 1.70 | 1.90 | 2.50 | 2.60 | 1.70 | 1.40 | 1.30 | .80 | 1.10 | 2.40 | .90 | 1.60 |
| 14 | 1.60 | 1.90 | 3.00 | 2.50 | 1.70 | 1.40 | 1.30 | .80 | 1.00 | 2.60 | .90 | 1.60 |
| 15 | 1.60 | 2.00 | 3.70 | 2.40 | 1.60 | 1.40 | 1.20 | .80 | 1.00 | 2.30 | .80 | 6.00 |
| 16 | 1.60 | 2.20 | 8.00 | 2.40 | 1.60 | 1.40 | 1.20 | .80 | 1.00 | 2.20 | .80 | 4.00 |
| 17 | 1.60 | 2.10 | 3.90 | 2.40 | 1.80 | 1.40 | 1.10 | 1.00 | 1.00 | 2.00 | 1.00 | 2.60 |
| 18 | 1.60 | 2.10 | 3.40 | 2.40 | 2.00 | 1.30 | .90 | .90 | 1.00 | 1.60 | 1.00 | 2.00 |
| 19 | 2.00 | 2.00 | 3.10 | 2.30 | 1.90 | 1.30 | .90 | .70 | 1.00 | 1.40 | .90 | 1.90 |
| 20 | 1.90 | 2.00 | 3.00 | 2.40 | 1.90 | 1.20 | .90 | .70 | .90 | 2.60 | .90 | 1.90 |
| 21 | 2.80 | 2.10 | 3.90 | 2.30 | 1.80 | 1.20 | .80 | .70 | .80 | 2.40 | .90 | 1.90 |
| 22 | 2.10 | 2.00 | 3.50 | 2.20 | 1.80 | 1.20 | .80 | .70 | .80 | 2.00 | .80 | 1.80 |
| 23 | 2.00 | 2.00 | 4.00 | 2.20 | 1.80 | 1.20 | .80 | .70 | .80 | 1.60 | .70 | 2.00 |
| 24 | 2.00 | 2.00 | 3.40 | 2.10 | 1.70 | 1.10 | .70 | .70 | .80 | 1.40 | .70 | 2.00 |
| 25 | 1.90 | 2.20 | 3.00 | 2.10 | 1.70 | 1.10 | .70 | .70 | 2.10 | 1.10 | 1.30 | 1.90 |
| 26 | 1.90 | 2.00 | 3.00 | 2.00 | 1.70 | 1.00 | .80 | .70 | 2.00 | 1.00 | 1.40 | 1.80 |
| 27 | 1.90 | 7.00 | 7.00 | 2.00 | 1.70 | .90 | .80 | 2.00 | 1.80 | .90 | 1.40 | 1.80 |
| 28 | 2.90 | 12.50 | 14.00 | 2.00 | 1.60 | .90 | .80 | 1.70 | 1.80 | .90 | 1.50 | 3.50 |
| 29 | 3.00 | ..... | 8.00 | 2.00 | 1.60 | .80 | .70 | 3.60 | 2.10 | .90 | 1.60 | 2.20 |
| 30 | 2.70 | ..... | 4.10 | 2.00 | 1.60 | .90 | .70 | 1.90 | 3.40 | .90 | 1.70 | 2.00 |
| 31 | 2.80 | ..... | 3.90 | ..... | 1.60 | ..... | 70 | 1.50 | ..... | 1.00 | ..... | 1.90 |

*Rating table for Hillabee Creek near Alexander, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.8 | 125 | 2.2 | 478 | 3.6 | 1,094 | 5.0 | 1,710 |
| 1.0 | 138 | 2.4 | 566 | 3.8 | 1,182 | 6.0 | 2,150 |
| 1.2 | 156 | 2.6 | 654 | 4.0 | 1,270 | 7.0 | 2,590 |
| 1.4 | 184 | 2.8 | 742 | 4.2 | 1,358 | 8.0 | 3,030 |
| 1.6 | 230 | 3.0 | 830 | 4.4 | 1,446 | 9.0 | 3,470 |
| 1.8 | 303 | 3.2 | 918 | 4.6 | 1,534 | 10.0 | 3,910 |
| 2.0 | 390 | 3.4 | 1,006 | 4.8 | 1,622 | 11.0 | 4,350. |

*Estimated monthly discharge of Hillabee Creek near Alexander, Ala.*

[Drainage area, 214 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 1,138 | 230 | 459 | 2.14 | 2.47 |
| February | 5,010 | 346 | 854 | 3.99 | 4.15 |
| March | 5,670 | 390 | 1,284 | 6.00 | 6.92 |
| April | 1,314 | 390 | 647 | 3.02 | 3.37 |
| May | 390 | 230 | 294 | 1.37 | 1.58 |
| June | 263 | 125 | 186 | .87 | .97 |
| July | 169 | 120 | 137 | .64 | .74 |
| August | 1,094 | 120 | 182 | .85 | .98 |
| September | 1,094 | 125 | 254 | 1.19 | 1.33 |
| October | 1,314 | 131 | 525 | 2.45 | 2.82 |
| November | 1,094 | 120 | 213 | 1.00 | 1.12 |
| December | 2,150 | 230 | 569 | 2.66 | 3.07 |
| The year | 5,670 | 120 | 467 | 2.18 | 29.52 |

## TALLADEGA CREEK AT NOTTINGHAM, ALA.

This station is located on the Southern Railway bridge, a fourth of a mile from the depot at Nottingham, Ala., and 1 mile north of Alpine, Ala. The gage, which is graduated to feet and tenths and is 20 feet long, is fastened vertically to a tree on the right bank, about 50 feet upstream from the bridge. The initial point of sounding is end of iron bridge, upstream, right bank. The bench mark is the top rail on the upstream side of the bridge, and is 24.13 feet above gage datum. The section is a good one, and is free from piers. The observer is R. M. McClatchy, station agent at Nottingham.

The following discharge measurements were made during 1902:

January 16: Gage height, 1.30 feet; discharge, 1.55 second-feet.
July 17: Gage height, 0.90 foot; discharge, 97 second-feet.
October 18: Gage height, 0.80 foot; discharge, 78 second-feet.
November 13: Gage height, 0.70 foot; discharge, 63 second-feet.

*Daily gage height, in feet, of Talladega Creek at Nottingham, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 2.40 | 5.60 | 5.00 | 3.50 | 1.80 | 2.60 | 0.90 | 0.90 | 1.00 | 1.40 | 0.70 | 0.80 |
| 2 | 2.20 | 8.90 | 3.70 | 3.10 | 1.70 | 1.50 | .90 | .80 | .90 | 1.10 | .70 | 2.40 |
| 3 | 2.00 | 4.40 | 3.10 | 2.90 | 1.60 | 1.30 | .90 | .80 | .70 | .90 | .70 | 2.70 |
| 4 | 1.80 | 3.30 | 2.90 | 2.90 | 1.50 | 1.30 | .90 | .80 | .70 | .80 | .70 | 1.60 |
| 5 | 1.70 | 2.70 | 4.60 | 2.70 | 1.50 | 1.20 | 1.00 | .80 | .70 | .70 | .70 | 1.40 |
| 6 | 1.60 | 2.50 | 3.30 | 2.50 | 1.50 | 1.10 | 1.00 | .80 | .70 | .70 | 1.90 | 1.20 |
| 7 | 1.50 | 2.30 | 2.90 | 3.60 | 1.60 | 1.10 | 1.00 | .80 | .70 | .70 | 1.10 | 1.30 |
| 8 | 1.50 | 2.10 | 2.60 | 3.20 | 1.90 | 1.10 | .90 | .80 | .70 | .70 | .90 | 1.20 |
| 9 | 1.50 | 2.10 | 2.50 | 3.00 | 1.70 | 1.10 | 1.00 | .80 | .70 | .70 | .80 | 1.10 |
| 10 | 1.50 | 2.00 | 2.40 | 2.70 | 1.60 | 1.10 | 1.50 | 1.00 | .70 | .70 | .80 | 1.00 |
| 11 | 1.40 | 1.90 | 2.30 | 2.50 | 1.60 | 1.10 | 2.00 | 1.20 | .70 | 4.10 | .70 | .90 |
| 12 | 1.40 | 1.90 | 2.20 | 2.30 | 1.50 | 1.10 | 1.50 | 1.50 | .70 | 1.90 | .70 | .80 |
| 13 | 1.30 | 1.90 | 2.20 | 2.30 | 1.40 | 1.10 | 1.20 | 1.10 | .70 | 1.30 | .70 | .80 |
| 14 | 1.30 | 1.90 | 2.10 | 2.30 | 1.40 | 1.10 | 1.00 | 1.00 | .70 | 1.00 | .70 | .80 |
| 15 | 1.30 | 2.30 | 2.60 | 2.20 | 1.40 | 1.10 | 1.00 | .90 | .70 | .80 | .70 | .80 |
| 16 | 1.30 | 2.10 | 7.60 | 2.10 | 1.40 | 1.10 | 1.00 | .80 | .70 | .80 | .70 | 6.30 |
| 17 | 1.30 | 1.90 | 3.80 | 2.50 | 1.50 | 1.10 | .90 | .80 | .70 | .80 | .70 | 2.50 |
| 18 | 1.30 | 1.80 | 2.70 | 2.30 | 1.60 | 1.00 | .90 | .80 | .70 | .70 | 1.20 | 1.80 |
| 19 | 1.40 | 1.80 | 2.60 | 2.20 | 1.50 | 1.00 | .90 | .80 | .70 | .80 | 1.00 | 1.40 |
| 20 | 1.90 | 1.90 | 2.40 | 2.10 | 1.40 | 1.00 | .90 | .80 | .70 | .80 | .90 | 1.20 |
| 21 | 2.10 | 1.80 | 2.40 | 2.00 | 1.30 | 1.00 | 1.50 | .80 | .60 | .80 | .80 | 2.30 |
| 22 | 1.70 | 2.00 | 2.30 | 1.90 | 1.30 | 1.10 | 1.10 | .70 | .60 | .80 | .80 | 2.60 |
| 23 | 1.60 | 1.90 | 2.20 | 1.90 | 1.30 | 1.10 | 1.00 | .70 | .60 | .80 | .80 | 2.20 |
| 24 | 1.50 | 1.80 | 3.20 | 1.90 | 1.30 | .90 | 1.00 | .70 | .60 | .80 | .80 | 1.50 |
| 25 | 1.80 | 1.90 | 3.20 | 1.80 | 1.20 | .90 | 1.00 | .70 | .70 | .80 | 1.90 | 1.30 |
| 26 | 1.60 | 1.80 | 2.50 | 1.80 | 1.20 | .90 | 1.00 | .70 | .70 | .80 | 1.40 | 1.10 |
| 27 | 1.80 | 3.60 | 2.50 | 1.80 | 1.20 | .90 | 1.00 | .70 | .60 | .80 | 1.10 | 1.10 |
| 28 | 3.30 | 12.20 | 12.50 | 1.80 | 1.10 | .90 | 1.00 | 1.50 | 1.10 | .80 | .90 | 1.10 |
| 29 | 4.10 | ..... | 10.70 | 1.80 | 1.10 | .90 | 1.00 | 5.10 | 1.10 | .70 | .80 | 1.30 |
| 30 | 2.80 | ..... | 5.20 | 1.80 | 1.10 | .90 | 1.00 | 3.10 | 1.70 | .70 | .70 | 2.40 |
| 31 | 3.50 | ..... | 3.90 | ..... | 1.10 | ..... | 1.00 | 1.00 | ..... | .70 | ..... | 1.80 |

*Rating table for Talladega Creek at Nottingham, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.6 | 51 | 2.8 | 482 | 5.0 | 966 | 7.2 | 1,450 |
| .8 | 78 | 3.0 | 526 | 5.2 | 1,010 | 7.4 | 1,494 |
| 1.0 | 109 | 3.2 | 570 | 5.4 | 1,054 | 7.6 | 1,538 |
| 1.2 | 143 | 3.4 | 614 | 5.6 | 1,098 | 7.8 | 1,582 |
| 1.4 | 179 | 3.6 | 658 | 5.8 | 1,142 | 8.0 | 1,626 |
| 1.6 | 219 | 3.8 | 702 | 6.0 | 1,186 | 8.5 | 1,736 |
| 1.8 | 262 | 4.0 | 746 | 6.2 | 1,230 | 9.0 | 1,846 |
| 2.0 | 306 | 4.2 | 790 | 6.4 | 1,274 | 9.5 | 1,956 |
| 2.2 | 350 | 4.4 | 834 | 6.6 | 1,318 | 10.0 | 2,066 |
| 2.4 | 394 | 4.6 | 878 | 6.8 | 1,362 | 10.5 | 2,176 |
| 2.6 | 438 | 4.8 | 922 | 7.0 | 1,406 | 11.0 | 2,286 |

*Estimated monthly discharge of Talladega Creek at Nottingham, Ala.*

[Drainage area, 156 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 768 | 161 | 276 | 1.77 | 2.04 |
| February | ~~2,550~~ 3,050 | 262 | ~~513~~ 530 | ~~3.29~~ 3.40 | ~~3.43~~ 3.54 |
| March | ~~2,616~~ 3,220 | 328 | ~~676~~ 703 | ~~4.33~~ 4.51 | ~~4.99~~ 5.20 |
| April | 658 | 262 | 390 | 2.50 | 2.79 |
| May | 284 | 126 | 187 | 1.20 | 1.38 |
| June | 438 | 93 | 128 | .82 | .91 |
| July | 306 | 93 | 121 | .78 | .90 |
| August | 988 | 64 | 135 | .87 | 1.00 |
| September | 240 | 51 | 74 | .47 | .52 |
| October | 768 | 64 | 111 | .71 | .82 |
| November | 284 | 64 | 97 | .62 | .69 |
| December | 1,252 | 78 | 238 | 1.53 | 1.76 |
| The year | ~~2,616~~ 3,220 | 51 | ~~246~~ 248 | ~~1.58~~ 1.59 | ~~21.23~~ 21.55 |

Revised in 1902 report.

## COOSA RIVER AT RIVERSIDE, ALA.

This station, described in the Eighteenth Annual Report, part 4, page 99, was established September 25, 1896, at the bridge of the Southern Railway across the Coosa River, at Riverside, Ala. The

town of Riverside is on the west bank of the river, and the railroad station is 1,000 feet west of the bridge at which the measurements are made. The length of the gage chain from the bottom of the weight to the index is 34.50 feet. The bench mark is the top capstone on the large circular center pier of the turn span, the elevation of which is 26.80 feet above gage datum. The channel is straight, the current swift, but somewhat obstructed by a ledge of rock under water about 300 feet above the station. The observer is J. W. Foster, Riverside, Ala. The initial point is the top of the left abutment at the edge toward the river, on the downstream side of the bridge.

During 1902 the following discharge measurements were made:

April 8: Gage height, 7.30 feet; discharge, 21,138 second-feet.
June 3: Gage height, 2 feet; discharge, 4,720 second-feet.
October 17: Gage height, 2.30 feet; discharge, 5,128 second-feet.

*Daily gage height, in feet, of Coosa River at Riverside, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 15.70 | 10.40 | 15.00 | 15.50 | 3.35 | 2.15 | 1.60 | 1.40 | 2.40 | 2.50 | 1.20 | 2.80 |
| 2 | 13.30 | 13.35 | 15.40 | 14.80 | 3.25 | 2.10 | 1.50 | 1.60 | 2.00 | 2.25 | 1.20 | 2.40 |
| 3 | 15.10 | 14.60 | 15.20 | 14.60 | 3.20 | 2.05 | 1.50 | 2.00 | 1.50 | 2.00 | 1.20 | 4.50 |
| 4 | 15.30 | 14.40 | 14.90 | 14.40 | 3.30 | 2.00 | 1.45 | 1.60 | 1.40 | 1.90 | 1.15 | 6.00 |
| 5 | 15.10 | 14.00 | 15.60 | 12.70 | 3.40 | 2.00 | 1.45 | 1.40 | 2.00 | 1.80 | 1.20 | 7.20 |
| 6 | 14.50 | 13.40 | 15.00 | 8.90 | 3.20 | 1.90 | 1.40 | 1.45 | 1.80 | 1.75 | 1.60 | 6.80 |
| 7 | 13.10 | 13.20 | 14.90 | 6.40 | 3.10 | 1.90 | 1.40 | 1.90 | 1.40 | 1.70 | 1.80 | 5.40 |
| 8 | 9.30 | 11.25 | 14.10 | 7.20 | 3.00 | 1.85 | 1.40 | 1.85 | 1.50 | 2.00 | 1.90 | 4.80 |
| 9 | 6.20 | 9.10 | 13.00 | 7.60 | 2.90 | 1.80 | 1.35 | 1.80 | 1.50 | 1.75 | 1.85 | 4.20 |
| 10 | 4.80 | 6.00 | 9.90 | 7.70 | 2.75 | 1.80 | 1.35 | 1.80 | 1.40 | 1.60 | 1.70 | 3.90 |
| 11 | 4.60 | 5.20 | 8.10 | 7.00 | 2.70 | 1.80 | 1.40 | 2.00 | 1.40 | 2.40 | 1.60 | 3.50 |
| 12 | 2.90 | 5.00 | 6.90 | 6.20 | 2.65 | 2.20 | 1.40 | 1.80 | 1.45 | 4.00 | 1.50 | 2.90 |
| 13 | 2.85 | 4.90 | 6.65 | 5.70 | 2.75 | 2.20 | 1.45 | 1.70 | 1.40 | 3.80 | 1.30 | 2.40 |
| 14 | 4.50 | 4.50 | 6.40 | 5.30 | 2.80 | 1.95 | 1.45 | 1.60 | 1.40 | 3.25 | 1.25 | 2.45 |
| 15 | 5.25 | 5.00 | 6.20 | 4.85 | 2.85 | 1.85 | 1.50 | 1.60 | 1.30 | 2.65 | 1.20 | 2.50 |
| 16 | 7.20 | 5.80 | 7.20 | 4.70 | 2.65 | 1.80 | 1.60 | 1.35 | 1.25 | 2.50 | 1.20 | 3.60 |
| 17 | 6.70 | 5.20 | 9.00 | 4.60 | 2.60 | 1.80 | 2.25 | 1.25 | 2.00 | 2.40 | 1.15 | 5.30 |
| 18 | 6.20 | 5.00 | 9.90 | 4.90 | 3.30 | 1.85 | 2.85 | 1.20 | 1.65 | 2.10 | 1.20 | 5.60 |
| 19 | 2.90 | 4.90 | 10.20 | 4.95 | 2.90 | 2.20 | 2.80 | 1.20 | 1.50 | 1.90 | 1.25 | 5.40 |
| 20 | 2.85 | 4.85 | 9.40 | 5.35 | 2.60 | 2.00 | 2.20 | 1.20 | 1.20 | 1.75 | 1.40 | 4.90 |
| 21 | 4.50 | 4.60 | 8.20 | 5.00 | 2.50 | 1.95 | 1.95 | 1.25 | 1.10 | 1.60 | 1.60 | 5.00 |
| 22 | 5.25 | 4.90 | 6.90 | 4.90 | 2.45 | 1.90 | 1.90 | 1.25 | 1.15 | 1.65 | 2.00 | 6.90 |
| 23 | 7.20 | 4.90 | 5.90 | 4.50 | 2.40 | 1.90 | 1.80 | 1.40 | 1.25 | 1.45 | 1.80 | 7.80 |
| 24 | 6.70 | 5.00 | 5.40 | 4.30 | 2.40 | 1.85 | 1.75 | 1.60 | 1.25 | 1.35 | 1.40 | 7.40 |
| 25 | 6.20 | 5.35 | 5.45 | 3.90 | 2.35 | 1.85 | 1.45 | 1.70 | 1.20 | 1.30 | 1.60 | 6.35 |
| 26 | 5.20 | 5.75 | 5.30 | 3.70 | 2.30 | 2.00 | 1.40 | 1.70 | 1.35 | 1.30 | 2.20 | 5.10 |
| 27 | 4.50 | 6.35 | 6.20 | 3.70 | 2.25 | 1.90 | 1.50 | 1.65 | 2.00 | 1.30 | 2.90 | 4.50 |
| 28 | 5.10 | 12.50 | 8.90 | 3.60 | 2.25 | 1.85 | 2.30 | 1.65 | 4.00 | 1.25 | 3.45 | 3.50 |
| 29 | 6.50 | ..... | 13.30 | 3.50 | 2.20 | 1.80 | 1.60 | 1.60 | 3.50 | 1.25 | 3.90 | 3.40 |
| 30 | 7.00 | ..... | 17.30 | 3.40 | 2.20 | 1.75 | 1.50 | 2.20 | 3.40 | 1.25 | 3.50 | 3.35 |
| 31 | 7.40 | ..... | 16.50 | ..... | 2.20 | ..... | 1.40 | 2.40 | ..... | 1.20 | ..... | 3.25 |

*Rating table for Coosa River at Riverside, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 2,470 | 4.0 | 10,300 | 7.0 | 21,100 | 13.0 | 45,100 |
| 1.2 | 2,760 | 4.2 | 11,000 | 7.2 | 21,900 | 13.5 | 47,100 |
| 1.4 | 3,100 | 4.4 | 11,700 | 7.4 | 22,700 | 14.0 | 49,100 |
| 1.6 | 3,500 | 4.6 | 12,400 | 7.6 | 23,500 | 14.5 | 51,100 |
| 1.8 | 3,940 | 4.8 | 13,100 | 7.8 | 24,300 | 15.0 | 53,100 |
| 2.0 | 4,400 | 5.0 | 13,800 | 8.0 | 25,100 | 15.5 | 55,100 |
| 2.2 | 4,900 | 5.2 | 14,500 | 8.5 | 27,100 | 16.0 | 57,100 |
| 2.4 | 5,430 | 5.4 | 15,200 | 9.0 | 29,100 | 16.5 | 59,100 |
| 2.6 | 5,970 | 5.6 | 15,900 | 9.5 | 31,100 | 17.0 | 61,100 |
| 2.8 | 6,530 | 5.8 | 16,600 | 10.0 | 33,100 | 17.5 | 63,100 |
| 3.0 | 7,100 | 6.0 | 17,300 | 10.5 | 35,100 | 18.0 | 65,100 |
| 3.2 | 7,700 | 6.2 | 18,060 | 11.0 | 37,100 | 18.5 | 67,100 |
| 3.4 | 8,330 | 6.4 | 18,820 | 11.5 | 39,100 | 19.0 | 69,100 |
| 3.6 | 8,970 | 6.6 | 19,580 | 12.0 | 41,100 | | |
| 3.8 | 9,620 | 6.8 | 20,340 | 12.5 | 43,100 | | |

*Estimated monthly discharge of Coosa River at Riverside, Ala.*

[Drainage area 7,065 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 55,900 | 6,670 | 23,804 | 3.37 | 3.89 |
| February | 51,500 | 12,050 | 24,839 | 3.52 | 3.67 |
| March | 62,300 | 14,850 | 34,762 | 4.92 | 5.67 |
| April | 55,100 | 8,330 | 20,872 | 2.95 | 3.29 |
| May | 8,330 | 4,900 | 6,375 | .90 | 1.04 |
| June | 4,900 | 3,830 | 4,247 | .60 | .67 |
| July | 6,670 | 3,015 | 3,718 | .53 | .61 |
| August | 5,430 | 2,760 | 3,577 | .51 | .59 |
| September | 10,300 | 2,610 | 3,938 | .56 | .62 |
| October | 10,300 | 2,760 | 4,576 | .65 | .75 |
| November | 9,950 | 2,685 | 3,994 | .57 | .64 |
| December | 24,300 | 5,430 | 12,719 | 1.80 | 2.08 |
| The year | 62,300 | 2,610 | 12,285 | 1.74 | 23.52 |

## COOSA RIVER AT ROME, GA.

Coosa River is formed by the junction of Etowah and Oostanaula rivers at Rome, Ga. Both the tributary rivers rise in the northern part of Georgia and flow for the most part through a hilly, broken country, well wooded, about one-fourth of the land being under cultivation. The measurements at Rome are made on the Oostanaula and the Etowah just above their junction. The Etowah is measured at the Second avenue bridge and the Oostanaula at the Fifth avenue bridge in Rome, and the results are added to give the flow of the Coosa. The gage height is taken from the United States Weather Bureau gage at the Fifth avenue bridge, on the Oostanaula. There is practically no fall on Oostanaula River from the Fifth avenue bridge to the junction; hence the gage is used as a Coosa River gage, and gives the fluctuations of Coosa River. This gage is a 4 by 6 inch timber, graduated to feet and tenths, and fastened to the downstream left-hand corner of the first pier from the left bank. The zero of the gage is 575.79 feet above sea level. The United States Weather Bureau has maintained the station here for many years. It is now maintained only as a half-year station, from November 1 to April 30, inclusive; but W. M. Towers, the river observer, kindly reads the gage and furnishes the Geological Survey with monthly reports of the daily gage heights for the entire year without charge. The channel of the Etowah is straight and the current swift and unobstructed; but the Oostanaula is rather sluggish and somewhat obstructed by piers. The banks are high, but liable to overflow at times of high water.

The following discharge measurements were made during 1902:

June 24: Gage height, 1.30 feet; discharge, 2,483 second-feet.
October 8: Gage height, 0.80 feet; discharge, 1,800 second-feet.
November 8: Gage height, 1.10 feet; discharge, 2,332 second-feet.

*Daily gage height, in feet, of Coosa River at Rome, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 28.00 | 11.80 | 28.50 | 21.30 | 2.90 | 1.80 | 1.00 | 1.20 | 1.00 | 1.60 | 0.20 | 1.90 |
| 2 | 24.60 | 22.00 | 27.60 | 14.80 | 2.90 | 1.70 | 1.00 | 1.00 | .80 | 1.60 | .20 | 2.00 |
| 3 | 21.90 | 24.00 | 24.10 | 7.20 | 3.70 | 1.70 | 1.10 | .80 | 1.20 | 1.60 | .20 | 6.20 |
| 4 | 17.60 | 20.00 | 21.60 | 5.80 | 3.40 | 1.70 | 1.00 | .80 | 1.00 | 1.50 | .20 | 6.80 |
| 5 | 6.60 | 15.60 | 19.20 | 5.70 | 3.20 | 1.70 | .90 | 1.50 | 1.20 | 1.00 | .20 | 5.80 |
| 6 | 5.60 | 9.80 | 14.00 | 5.20 | 3.00 | 1.70 | .90 | 1.40 | 1.00 | 2.00 | .40 | 5.00 |
| 7 | 4.60 | 6.30 | 10.10 | 6.70 | 2.90 | 1.70 | 1.00 | 1.20 | .80 | 1.40 | 2.00 | 4.00 |
| 8 | 4.20 | 5.70 | 8.70 | 6.70 | 2.80 | 1.70 | .90 | 1.20 | .60 | .90 | 1.60 | 2.70 |
| 9 | 4.00 | 5.00 | 7.20 | 7.70 | 2.60 | 2.00 | .90 | .60 | .90 | .80 | 1.00 | 2.50 |
| 10 | 3.90 | 4.60 | 7.00 | 6.60 | 2.60 | 1.90 | .90 | .40 | 1.00 | .70 | .80 | 1.90 |
| 11 | 3.60 | 4.40 | 6.60 | 5.60 | 2.50 | 1.90 | .90 | .30 | .90 | 2.30 | .80 | 1.60 |
| 12 | 3.50 | 4.00 | 6.00 | 5.00 | 2.40 | 1.80 | 1.40 | .30 | .70 | 2.20 | .70 | 1.40 |
| 13 | 3.40 | 3.90 | 5.60 | 4.70 | 2.30 | 1.70 | 1.50 | 1.00 | .60 | 2.20 | .60 | 1.20 |
| 14 | 3.20 | 3.80 | 5.50 | 4.50 | 2.30 | 1.70 | 1.80 | .60 | 2.50 | 2.00 | .60 | 1.20 |

*Daily gage height, in feet, of Coosa River at Rome, Ga.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 15 | 3.00 | 3.80 | 5.00 | 4.40 | 2.30 | 1.60 | 1.40 | .60 | 1.90 | 1.80 | .60 | 1.10 |
| 16 | 2.80 | 4.00 | 7.00 | 4.30 | 2.40 | 1.60 | 2.00 | .80 | 1.00 | 1.60 | .60 | 2.40 |
| 17 | 2.70 | 4.50 | 14.00 | 4.50 | 2.50 | 1.60 | 1.40 | .60 | .70 | 1.50 | .60 | 4.30 |
| 18 | 2.70 | 4.70 | 11.60 | 5.70 | 2.30 | 1.50 | 1.20 | .50 | .40 | 1.30 | .90 | 4.50 |
| 19 | 3.00 | 4.50 | 8.60 | 5.00 | 2.30 | 1.50 | 1.00 | .40 | .40 | 1.10 | 1.50 | 3.80 |
| 20 | 3.20 | 4.00 | 6.20 | 4.00 | 2.40 | 1.90 | 1.00 | 1.00 | .40 | .90 | 1.30 | 3.00 |
| 21 | 3.60 | 4.00 | 5.60 | 3.90 | 2.40 | 1.60 | .90 | 1.30 | 1.00 | .80 | 1.10 | 4.90 |
| 22 | 4.20 | 5.00 | 5.10 | 3.80 | 2.30 | 1.80 | .80 | 1.00 | .80 | .70 | 1.10 | 5.80 |
| 23 | 5.00 | 5.60 | 5.00 | 3.70 | 2.30 | 1.50 | .80 | .90 | .60 | .60 | 1.00 | 5.80 |
| 24 | 4.00 | 5.30 | 4.70 | 3.50 | 2.10 | 1.30 | .70 | .70 | .30 | .50 | .90 | 5.20 |
| 25 | 3.90 | 5.00 | 4.70 | 3.30 | 2.00 | 1.30 | .60 | .50 | 2.20 | .40 | 1.60 | 3.80 |
| 26 | 3.60 | 5.50 | 4.60 | 3.20 | 2.00 | 1.20 | .50 | .50 | 4.00 | .30 | 3.10 | 3.00 |
| 27 | 3.60 | 5.50 | 4.20 | 3.20 | 2.00 | 1.20 | .50 | .60 | 3.30 | .20 | 4.80 | 2.60 |
| 28 | 4.20 | 22.70 | 5.00 | 3.00 | 1.80 | 1.10 | .50 | 1.20 | 2.00 | .40 | 3.80 | 2.20 |
| 29 | 6.50 | ..... | 20.60 | 3.00 | 1.80 | 1.00 | .70 | 1.70 | 2.00 | .40 | 2.40 | 2.20 |
| 30 | 5.80 | ..... | 28.90 | 2.90 | 1.80 | 1.00 | 2.00 | 1.00 | 1.80 | .30 | 2.20 | 2.60 |
| 31 | 5.40 | ..... | 26.80 | ..... | 1.80 | ..... | 1.60 | 1.00 | ..... | .30 | ..... | 4.00 |

*Rating table for Coosa River at Rome, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.2 | 1,410 | 4.2 | 7,102 | 8.2 | 15,142 | 15.5 | 29,815 |
| 0.4 | 1,555 | 4.4 | 7,504 | 8.4 | 15,544 | 16.0 | 30,820 |
| 0.6 | 1,720 | 4.6 | 7,906 | 8.6 | 15,946 | 17.0 | 32,830 |
| 0.8 | 1,905 | 4.8 | 8,308 | 8.8 | 16,348 | 18.0 | 34,840 |
| 1.0 | 2,110 | 5.0 | 8,710 | 9.0 | 16,750 | 19.0 | 36,850 |
| 1.2 | 2,350 | 5.2 | 9,112 | 9.2 | 17,152 | 20.0 | 38,860 |
| 1.4 | 2,600 | 5.4 | 9,514 | 9.4 | 17,554 | 21.0 | 40,870 |
| 1.6 | 2,850 | 5.6 | 9,916 | 9.6 | 17,956 | 22.0 | 42,880 |
| 1.8 | 3,120 | 5.8 | 10,318 | 9.8 | 18,358 | 23.0 | 44,890 |
| 2.0 | 3,400 | 6.0 | 10,720 | 10.0 | 18,760 | 24.0 | 46,900 |
| 2.2 | 3,700 | 6.2 | 11,122 | 10.5 | 19,765 | 25.0 | 48,910 |
| 2.4 | 4,000 | 6.4 | 11,524 | 11.0 | 20,770 | 26.0 | 50,920 |
| 2.6 | 4,300 | 6.6 | 11,926 | 11.5 | 21,775 | 27.0 | 52,930 |
| 2.8 | 4,600 | 6.8 | 12,328 | 12.0 | 22,780 | 28.0 | 54,940 |
| 3.0 | 4,900 | 7.0 | 12,730 | 12.5 | 23,785 | 29.0 | 56,950 |
| 3.2 | 5,230 | 7.2 | 13,132 | 13.0 | 24,790 | 30.0 | 58,960 |
| 3.4 | 5,580 | 7.4 | 13,534 | 13.5 | 25,795 | 31.0 | 60,970 |
| 3.6 | 5,930 | 7.6 | 13,936 | 14.0 | 26,800 | 32.0 | 62,980 |
| 3.8 | 6,300 | 7.8 | 14,338 | 14.5 | 27,805 | 33.0 | 64,990 |
| 4.0 | 6,700 | 8.0 | 14,740 | 15.0 | 28,810 | 34.0 | 67,000 |

*Estimated monthly discharge of Coosa River at Rome, Ga.*

[Drainage area, 4,006 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 54,940 | 4,450 | 11,816 | 2.95 | 3.40 |
| February | 46,900 | 6,300 | 14,812 | 3.70 | 3.85 |
| March | 56,749 | 7,102 | 21,944 | 5.48 | 6.32 |
| April | 41,473 | 4,750 | 10,015 | 2.50 | 2.79 |
| May | 6,115 | 3,120 | 4,089 | 1.02 | 1.18 |
| June | 3,400 | 2,110 | 2,836 | .71 | .79 |
| July | 3,400 | 1,635 | 2,214 | .55 | .63 |
| August | 2,985 | 1,480 | 1,998 | .50 | .58 |
| September | 6,700 | 1,480 | 2,505 | .63 | .70 |
| October | 3,850 | 1,410 | 2,346 | .59 | .68 |
| November | 8,308 | 1,410 | 2,572 | .64 | .71 |
| December | 12,328 | 2,225 | 5,885 | 1.47 | 1.69 |
| The year | 56,749 | 1,410 | 6,920 | 1.73 | 23.32 |

## ETOWAH RIVER AT CANTON, GA.

This station is one-half mile above the mouth of Canton Creek, and is located at the iron highway bridge over Etowah River, about 1,000 feet north of and upstream from the Atlanta, Knoxville and Northern Railroad depot at Canton, Ga. The United States Weather Bureau gage rod is used. The observer is J. A. Low. The bench mark is on the left-bank pier. The iron bridge rests on four pieces of railroad track iron, forming a cap. Measuring from the end toward the river on one of these on the upstream side of the bridge, its top is 23.3 feet above the datum of the gage. Up to 3 feet gage height the river is only 116 feet wide, and flows between the piers on its lower banks. Up to about 14 feet it is confined between its upper banks, which are the abutments at the outer ends of the approaches. Above this stage it begins to overflow the bottom lands. The initial point is the top of the right-bank pier, at its edge toward the river.

During the year 1902 a fish-trap dam about 1 foot high was constructed across the river about 400 yards below the gage, which changed the rating to such an extent that two different rating tables had to be constructed for the year. To overcome this trouble a gage will be placed below the fish trap.

*Discharge measurements of Etowah River at Canton, Ga.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| March 29 | Max Hall | 15.10 | 12,058 |
| April 26 | Olin P. Hall | .90 | 1,199 |
| July 12 | Max Hall | .51 | 779 |
| August 16 | Olin P. Hall | .20 | 419 |
| November 22 | do | .44 | 410 |

*Daily gage height, in feet, of Etowah River at Canton, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 3.70 | 5.60 | 10.80 | 2.80 | 0.50 | 0.40 | 0.40 | 0.50 | 0.80 | 2.80 | 0.60 | 2.70 |
| 2 | 3.30 | 11.80 | 4.30 | 2.40 | 1.00 | .60 | .40 | .50 | .80 | 1.80 | .50 | 4.00 |
| 3 | 3.00 | 5.40 | 3.10 | 2.10 | 1.10 | .60 | .30 | .50 | 1.20 | .80 | .50 | 4.20 |
| 4 | 2.90 | 3.10 | 3.00 | 1.80 | 1.00 | .30 | .40 | .50 | 1.20 | .80 | .50 | 2.10 |
| 5 | 2.80 | 2.70 | 2.80 | 1.60 | .90 | .30 | .40 | .40 | 1.40 | .80 | .50 | 2.80 |
| 6 | 2.50 | 2.30 | 2.80 | 1.50 | .80 | .30 | .40 | .40 | 1.40 | .60 | .80 | 1.80 |
| 7 | 2.20 | 2.20 | 2.50 | 1.40 | .70 | .30 | .40 | .40 | 1.00 | .60 | .70 | 1.20 |
| 8 | 2.00 | 2.10 | 2.10 | 1.40 | .70 | 1.30 | .40 | .40 | 1.00 | .60 | .70 | 1.10 |
| 9 | 1.90 | 2.00 | 1.90 | 1.30 | .60 | 2.00 | .40 | .40 | 1.00 | .80 | .60 | 1.10 |
| 10 | 1.70 | 1.80 | 1.80 | 1.30 | .50 | 1.80 | .40 | 1.00 | 1.00 | .80 | .70 | 1.00 |
| 11 | 1.60 | 1.60 | 1.70 | 1.30 | .60 | 1.00 | .30 | 1.00 | 1.00 | .70 | .70 | .90 |
| 12 | 1.60 | 1.50 | 1.70 | 1.20 | .50 | 1.00 | .40 | 1.20 | .80 | .70 | .80 | .90 |
| 13 | 1.50 | 1.30 | 1.60 | 1.10 | .60 | 1.00 | .30 | 1.00 | .80 | .70 | .80 | .80 |
| 14 | 1.50 | 1.20 | 1.50 | 1.00 | .60 | 1.00 | .30 | .80 | .80 | .70 | .80 | .80 |
| 15 | 1.40 | 1.20 | 1.40 | 1.00 | .50 | 1.00 | .40 | .80 | .80 | .50 | .80 | .80 |
| 16 | 1.40 | 1.10 | 1.80 | 1.00 | .50 | 1.00 | .40 | .20 | 1.80 | .50 | .90 | 1.70 |
| 17 | 1.40 | 1.00 | 3.10 | 1.00 | .50 | 2.40 | .40 | .80 | 1.00 | .50 | .90 | 1.60 |
| 18 | 1.40 | 1.20 | 2.40 | 2.40 | .50 | 2.00 | .60 | .80 | 1.00 | .70 | .90 | 1.60 |
| 19 | 1.50 | 1.20 | 1.70 | 1.70 | .40 | 1.00 | .60 | .60 | 1.00 | .90 | 1.00 | 1.50 |
| 20 | 1.70 | 1.00 | 1.60 | 1.30 | .50 | 1.00 | .70 | .60 | .80 | .90 | .90 | 1.50 |
| 21 | 1.70 | .90 | 1.60 | 1.00 | .50 | 1.00 | .60 | .60 | .80 | .80 | .80 | 1.50 |
| 22 | 1.70 | .70 | 1.50 | .80 | .40 | .80 | .60 | .60 | .80 | .80 | .40 | 1.50 |
| 23 | 1.60 | .70 | 1.50 | .70 | .40 | .80 | .50 | .60 | .60 | .80 | .70 | 1.50 |
| 24 | 1.90 | .60 | 1.50 | .70 | .40 | .60 | .80 | .60 | 3.00 | .80 | .60 | 1.40 |
| 25 | 2.00 | .50 | 1.50 | .60 | .40 | .50 | .80 | .60 | 1.00 | .80 | 2.10 | 1.40 |
| 26 | 1.90 | .50 | 1.40 | .90 | .40 | .50 | .80 | .40 | 1.00 | .80 | 4.30 | 3.50 |
| 27 | 2.00 | .50 | 1.40 | .60 | .50 | .50 | .70 | .40 | 1.00 | .80 | 3.10 | 3.60 |
| 28 | 3.00 | 18.80 | 2.50 | .60 | .30 | .40 | .80 | .40 | .80 | .80 | 2.50 | 3.60 |
| 29 | 3.80 | ..... | 16.00 | .60 | .30 | .40 | .80 | .40 | .80 | .80 | 2.10 | 3.00 |
| 30 | 3.60 | ..... | 5.40 | .60 | .30 | .40 | .80 | .80 | .80 | .80 | 2.20 | 3.00 |
| 31 | 3.40 | ..... | 3.20 | ..... | .30 | ..... | .60 | .80 | ..... | .80 | ..... | 3.00 |

*Rating table for Etowah River at Canton, Ga., for 1902.*

[From January 1 to July 31.]

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.4 | 820 | 2.6 | 2,648 | 7.5 | 6,715 | 13.0 | 11,280 |
| .6 | 988 | 2.8 | 2,814 | 8.0 | 7,130 | 13.5 | 11,695 |
| .8 | 1,154 | 3.0 | 2,980 | 8.5 | 7,545 | 14.0 | 12,110 |
| 1.0 | 1,320 | 3.5 | 3,395 | 9.0 | 7,960 | 14.5 | 12,525 |
| 1.2 | 1,486 | 4.0 | 3,810 | 9.5 | 8,375 | 15.0 | 12,940 |
| 1.4 | 1,652 | 4.5 | 4,225 | 10.0 | 8,790 | 15.5 | 13,355 |
| 1.6 | 1,818 | 5.0 | 4,640 | 10.5 | 9,205 | 16.0 | 13,770 |
| 1.8 | 1,984 | 5.5 | 5,055 | 11.0 | 9,620 | 16.5 | 14,185 |
| 2.0 | 2,150 | 6.0 | 5,470 | 11.5 | 10,035 | 17.0 | 14,600 |
| 2.2 | 2,316 | 6.5 | 5,885 | 12.0 | 10,450 | 17.5 | 15,015 |
| 2.4 | 2,482 | 7.0 | 6,300 | 12.5 | 10,865 | 18.0 | 15,430 |

[From August 1 to December 31.]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.2 | 350 | 1.2 | 1,040 | 2.2 | 1,940 | 3.2 | 2,840 |
| .4 | 420 | 1.4 | 1,220 | 2.4 | 2,120 | 3.4 | 3,020 |
| .6 | 530 | 1.6 | 1,400 | 2.6 | 2,300 | 3.6 | 3,200 |
| .8 | 680 | 1.8 | 1,580 | 2.8 | 2,480 | 3.8 | 3,380 |
| 1.0 | 860 | 2.0 | 1,760 | 3.0 | 2,660 | 4.0 | 3,560 |

*Estimated monthly discharge of Etowah River at Canton, Ga.*

[Drainage area, 604 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 3,644 | 1,652 | 2,300 | 3.81 | 4.39 |
| February | 16,094 | 905 | 2,698 | 4.47 | 4.65 |
| March | 13,770 | 1,652 | 2,929 | 4.85 | 5.59 |
| April | 2,814 | 988 | 1,533 | 2.54 | 2.83 |
| May | 1,403 | 740 | 950 | 1.57 | 1.81 |
| June | 2,482 | 740 | 1,215 | 2.01 | 2.24 |
| July | 1,154 | 740 | 920 | 1.52 | 1.75 |
| August | 1,040 | 350 | 562 | .93 | 1.07 |
| September | 2,660 | 530 | 897 | 1.49 | 1.66 |
| October | 2,480 | 470 | 725 | 1.20 | 1.38 |
| November | 3,830 | 420 | 978 | 1.62 | 1.81 |
| December | 3,740 | 680 | 1,737 | 2.88 | 3.32 |
| The year | 16,094 | 350 | 1,454 | 2.41 | 32.50 |

## COOSAWATTEE RIVER AT CARTERS, GA.

This river is formed by the junction of Ellijay and Cartecay rivers at Ellijay, Ga., and flows in a southwesterly direction, joining the Conasauga to form the Oostanaula. Its drainage area is for the most part mountainous and covered with forest growth. The station was established August 15, 1896, at the iron highway bridge at Carters, Murray County, Ga., about 20 miles northeast of Calhoun, the most convenient railroad station. Carters is at the head of navigation, small boats running to Rome, Ga., and the Coosa River below. It is at the foot of the great shoals made by this stream in cutting through the Cohutta Mountains, the last of which is Carters Shoals, a short distance above the bridge, with a fall of 50 feet.

The length of the wire gage is 37.24 feet. The top of the cylindrical iron pier at the right-bank downstream corner of the bridge is 30.35 feet above gage datum. The current is swift, but is broken by a gravel bar above the section. The bed is gravelly and not apt to change. The banks are high, but occasionally overflow at high water. The observer is H. S. Weems, a merchant at Carters, Ga.

The following discharge measurements were made during 1902:

April 28: Gage height, 2.72 feet; discharge, 1,088 second-feet.
August 8: Gage height, 0.95 feet; discharge, 313 second-feet.
November 4: Gage height, 0.85 feet; discharge, 273 second-feet.
December 30: Gage height, 2.30 feet; discharge, 902 second-feet.

*Daily gage height, in feet, of Coosawattee River at Carters, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 9.00 | 11.00 | 15.00 | 4.00 | 3.00 | 1.70 | 1.70 | 0.90 | 0.90 | 1.00 | 0.70 | 2.50 |
| 2 | 7.00 | 9.00 | 15.00 | 3.90 | 3.00 | 1.70 | 1.70 | .80 | .80 | 1.00 | .70 | 3.00 |
| 3 | 6.00 | 7.50 | 10.00 | 3.80 | 2.90 | 1.80 | 1.60 | .90 | 1.00 | .90 | .80 | 5.00 |
| 4 | 5.00 | 5.00 | 9.00 | 4.00 | 2.70 | 1.80 | 1.60 | .80 | .90 | .90 | .80 | 4.00 |
| 5 | 4.00 | 4.00 | 8.00 | 3.80 | 2.50 | 1.80 | 1.60 | .80 | 1.00 | 1.00 | .80 | 3.00 |
| 6 | 3.00 | 3.90 | 6.50 | 3.40 | 2.70 | 1.70 | 1.60 | .90 | .90 | .90 | 1.00 | 2.00 |
| 7 | 2.90 | 3.80 | 5.00 | 3.60 | 2.60 | 1.90 | 1.70 | .90 | .80 | .80 | 2.00 | 1.30 |
| 8 | 2.90 | 3.80 | 4.00 | 3.80 | 2.50 | 2.50 | 1.50 | .80 | 1.00 | .80 | 1.70 | 1.70 |
| 9 | 2.80 | 3.70 | 3.50 | 3.70 | 2.40 | 2.30 | 1.50 | .80 | .90 | .80 | .90 | 1.50 |
| 10 | 2.80 | 3.70 | 3.50 | 3.40 | 2.40 | 1.80 | 1.50 | 1.00 | .80 | .90 | .90 | 1.40 |
| 11 | 2.70 | 3.60 | 3.90 | 3.30 | 2.40 | 1.70 | 1.60 | 2.10 | .80 | 1.40 | .80 | 1.20 |
| 12 | 2.70 | 3.60 | 3.80 | 3.30 | 2.30 | 1.70 | 1.50 | 1.80 | 2.00 | 1.00 | .70 | 1.10 |
| 13 | 2.80 | 3.50 | 3.70 | 3.30 | 2.30 | 1.60 | 1.50 | 1.50 | 1.50 | .90 | .70 | 1.10 |
| 14 | 2.80 | 3.40 | 3.50 | 3.20 | 2.20 | 1.60 | 1.40 | 1.00 | 1.10 | 2.50 | .80 | 1.00 |
| 15 | 2.70 | 3.40 | 3.40 | 3.20 | 2.20 | 1.70 | 1.40 | .90 | .90 | 1.40 | .80 | 1.00 |
| 16 | 2.60 | 3.50 | 6.40 | 3.10 | 2.30 | 1.80 | 1.30 | .90 | .80 | 1.20 | .70 | 3.00 |
| 17 | 2.60 | 3.50 | 5.20 | 3.10 | 2.30 | 1.70 | 1.30 | .90 | .80 | .90 | 1.60 | 2.00 |
| 18 | 2.50 | 3.50 | 3.80 | 3.20 | 2.50 | 1.50 | 1.30 | 1.00 | .80 | .90 | 1.50 | 1.80 |
| 19 | 2.60 | 3.60 | 4.70 | 3.00 | 2.30 | 1.50 | 1.20 | .90 | .90 | .80 | 1.10 | 1.70 |
| 20 | 2.50 | 3.70 | 4.40 | 2.90 | 2.20 | 1.40 | 1.20 | .80 | 1.90 | .80 | .90 | 1.60 |
| 21 | 2.40 | 3.80 | 3.40 | 2.90 | 2.40 | 1.40 | 1.20 | .90 | 1.10 | .80 | .90 | 6.50 |
| 22 | 2.50 | 4.00 | 3.30 | 2.80 | 2.20 | 1.50 | 1.20 | 1.00 | .90 | .90 | 1.00 | 4.00 |
| 23 | 2.50 | 4.00 | 3.30 | 2.90 | 2.10 | 1.50 | 1.10 | .90 | .90 | .90 | 1.20 | 2.50 |
| 24 | 2.40 | 3.80 | 3.30 | 2.90 | 2.00 | 1.60 | 1.10 | .80 | 1.00 | .80 | 1.50 | 2.00 |
| 25 | 2.40 | 3.60 | 3.30 | 2.90 | 1.90 | 1.60 | 1.10 | .80 | 1.20 | .80 | 6.50 | 1.70 |
| 26 | 2.40 | 3.50 | 3.40 | 2.80 | 2.00 | 1.50 | 1.00 | .80 | 2.00 | .80 | 4.50 | 1.50 |
| 27 | 2.50 | 4.00 | 3.50 | 2.80 | 2.00 | 1.40 | 1.00 | .90 | 1.30 | .70 | 4.00 | 1.30 |
| 28 | 2.50 | 23.00 | 4.20 | 2.80 | 1.90 | 1.40 | .90 | 1.00 | 1.10 | .70 | 3.50 | 1.20 |
| 29 | 2.60 | ..... | 18.00 | 2.90 | 1.90 | 1.50 | .90 | 1.40 | .90 | .80 | 3.00 | 2.20 |
| 30 | 2.90 | ..... | 5.00 | 3.00 | 1.80 | 1.60 | .90 | 1.10 | .90 | .80 | 2.50 | 2.00 |
| 31 | 3.50 | ..... | 4.70 | ..... | 1.80 | ..... | .90 | .90 | ..... | .80 | ..... | 1.80 |

*Rating table for Coosawattee River at Carters, Ga.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.8 | 280 | 3.8 | 1,750 | 6.8 | 3,846 | 12.0 | 7,590 |
| 1.0 | 345 | 4.0 | 1,875 | 7.0 | 3,990 | 13.0 | 8,310 |
| 1.2 | 420 | 4.2 | 2,010 | 7.2 | 4,134 | 14.0 | 9,030 |
| 1.4 | 495 | 4.4 | 2,145 | 7.4 | 4,278 | 15.0 | 9,750 |
| 1.6 | 575 | 4.6 | 2,280 | 7.6 | 4,422 | 16.0 | 10,470 |
| 1.8 | 670 | 4.8 | 2,415 | 7.8 | 4,566 | 17.0 | 11,190 |
| 2.0 | 765 | 5.0 | 2,550 | 8.0 | 4,710 | 18.0 | 11,910 |
| 2.2 | 865 | 5.2 | 2,694 | 8.2 | 4,854 | 19.0 | 12,630 |
| 2.4 | 970 | 5.4 | 2,838 | 8.4 | 4,998 | 20.0 | 13,350 |
| 2.6 | 1,075 | 5.6 | 2,982 | 8.6 | 5,142 | 21.0 | 14,070 |
| 2.8 | 1,180 | 5.8 | 3,126 | 8.8 | 5,286 | 22.0 | 14,790 |
| 3.0 | 1,290 | 6.0 | 3,270 | 9.0 | 5,430 | 23.0 | 15,510 |
| 3.2 | 1,400 | 6.2 | 3,414 | 9.5 | 5,790 | | |
| 3.4 | 1,510 | 6.4 | 3,558 | 10.0 | 6,150 | | |
| 3.6 | 1,625 | 6.6 | 3,702 | 11.0 | 6,870 | | |

*Estimated monthly discharge of Coosawattee River at Carters, Ga.*

[Drainage area, 531 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 5,430 | 970 | 1,487 | 2.80 | 3.23 |
| February | 15,510 | 1,510 | 2,622 | 4.94 | 5.14 |
| March | 11,910 | 1,455 | 3,127 | 5.89 | 6.79 |
| April | 1,875 | 1,180 | 1,437 | 2.71 | 3.02 |
| May | 1,290 | 670 | 927 | 1.75 | 2.02 |
| June | 1,022 | 495 | 614 | 1.16 | 1.29 |
| July | 622 | 310 | 469 | 0.88 | 1.01 |
| August | 815 | 280 | 350 | 0.66 | 0.76 |
| September | 765 | 280 | 375 | 0.71 | 0.79 |
| October | 1,022 | 250 | 337 | 0.63 | 0.73 |
| November | 3,630 | 250 | 676 | 1.27 | 1.42 |
| December | 3,630 | 345 | 914 | 1.72 | 1.98 |
| The year | 15,510 | 250 | 1,111 | 2.09 | 28.18 |

## BLACK WARRIOR RIVER AT TUSCALOOSA, ALA.

The Black Warrior River above Tuscaloosa is largely in a Carboniferous formation, containing pervious strata, porous shales, and limestone caves, through which a good deal of water is probably lost at low season. A continuous record of gage heights at Tuscaloosa since 1889 has been kept by the United States Engineer Corps. During 1895 and 1896 a number of discharge measurements were also made from which a rating table was obtained, and since that time measurements of flow have been made regularly by the United States Geological Survey, and computations made of the discharge. The gage is located about three-fourths of a mile from the business center of Tuscaloosa, Ala. It is reached by passing down Bridge street to the river, thence down the east bank 1,800 feet. It consists of an inclined timber 2 by 6 inches, supported on posts and graduated by means of notches placed 1 foot apart vertically. There are two bench marks: one on a willow tree, 10 feet west of the gage, and 97.84 feet above the Mobile datum; the other on a small hackberry, 30 feet south of the upper end of the gage and 139.36 feet above the Mobile datum. The zero of the gage is 87.30 feet above the Mobile datum. The discharge measurements are made from the highway bridge above the gage. The channel is straight and unobstructed. The current is sluggish at times of low water. The banks are high and rocky and not subject to overflow. Daily gage heights are furnished to the Survey by R. C. McCalla, United Stafes assistant engineer.

*Daily gage height, in feet, of Black Warrior River at Tuscaloosa, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 44.00 | 37.80 | 49.87 | 52.88 | 10.85 | 1.52 | 0.35 | 0.04 | 2.52 | 5.61 | 4.90 | 8.50 |
| 2 | 38.80 | 47.50 | 48.10 | 45.50 | 9.90 | 1.48 | .30 | .05 | 2.20 | 5.50 | 4.89 | 9.50 |
| 3 | 34.10 | 48.40 | 44.00 | 39.70 | 8.32 | 1.40 | .15 | .08 | 2.85 | 5.00 | 4.89 | 13.55 |
| 4 | 28.50 | 45.00 | 37.50 | 35.00 | 6.51 | 1.52 | .00 | .15 | 4.87 | 5.50 | 4.90 | 17.10 |
| 5 | 24.80 | 40.00 | 33.50 | 32.00 | 5.50 | 1.40 | .00 | 1.80 | 4.65 | 5.52 | 4.91 | 17.92 |
| 6 | 21.15 | 36.00 | 35.78 | 29.00 | 5.00 | 1.30 | .03 | 2.30 | 3.50 | 5.31 | 4.94 | 15.65 |
| 7 | 15.50 | 31.00 | 35.00 | 26.91 | 4.75 | 1.25 | .05 | 1.90 | 2.52 | 5.15 | 5.00 | 14.90 |
| 8 | 14.00 | 28.15 | 31.61 | 32.70 | 5.11 | 1.15 | .05 | 1.35 | 2.00 | 5.00 | 4.94 | 13.40 |
| 9 | 12.50 | 24.38 | 28.50 | 35.75 | 5.15 | 1.10 | .15 | .81 | 1.60 | 4.95 | 4.94 | 11.75 |
| 10 | 11.00 | 21.50 | 25.51 | 32.81 | 4.75 | 1.05 | .20 | .69 | 1.32 | 4.90 | 4.89 | 10.25 |
| 11 | 9.30 | 18.00 | 23.10 | 29.05 | 4.35 | 1.00 | .25 | .49 | 1.12 | 9.65 | 4.89 | 9.10 |
| 12 | 8.50 | 15.40 | 20.40 | 26.00 | 4.05 | .91 | .25 | .48 | .85 | 15.40 | 4.90 | 8.50 |
| 13 | 8.00 | 13.00 | 17.70 | 23.32 | 3.75 | .80 | .15 | 39 | .71 | 14.90 | 4.90 | 8.05 |
| 14 | 7.30 | 11.00 | 15.52 | 20.61 | 3.52 | .72 | .15 | .25 | .50 | 11.75 | 4.91 | 7.85 |
| 15 | 6.70 | 11.50 | 15.00 | 18.00 | 3.15 | .70 | .10 | .18 | .40 | 8.98 | 4.90 | 7.45 |
| 16 | 6.11 | 19.85 | 17.50 | 15.82 | 3.50 | .65 | .10 | .15 | .25 | 7.45 | 4.89 | 15.00 |
| 17 | 5.65 | 21.81 | 31.80 | 14.41 | 6.01 | .53 | .05 | .14 | .15 | 6.40 | 4.90 | 29.65 |

*Daily gage height, in feet, of Black Warrior River at Tuscaloosa, Ala.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 18 | 5.00 | 19.70 | 29.60 | 12.93 | 6.52 | .50 | .05 | .10 | .12 | 6.00 | 5.25 | 28.85 |
| 19 | 6.05 | 17.55 | 25.00 | 11.85 | 6.10 | .80 | .04 | .08 | .75 | 5.83 | 5.50 | 23.90 |
| 20 | 7.81 | 16.00 | 21.30 | 10.57 | 5.31 | 1.00 | .03 | .05 | 2.21 | 5.75 | 5.54 | 19.15 |
| 21 | 11.00 | 14.51 | 18.50 | 9.61 | 4.55 | 1.60 | .03 | .04 | 3.51 | 5.60 | 5.50 | 16.30 |
| 22 | 16.15 | 14.00 | 17.65 | 8.80 | 3.90 | 1.70 | .04 | .10 | 3.92 | 5.60 | 5.50 | 18.00 |
| 23 | 20.81 | 13.60 | 15.21 | 8.05 | 3.50 | 1.72 | .04 | .12 | 4.30 | 5.52 | 5.45 | 20.30 |
| 24 | 20.81 | 13.05 | 13.80 | 7.72 | 3.05 | 1.80 | .10 | .15 | 4.50 | 5.45 | 5.42 | 18.10 |
| 25 | 18.50 | 12.50 | 18.30 | 7.30 | 2.82 | 1.85 | .11 | .10 | 4.75 | 5.35 | 5.69 | 15.41 |
| 26 | 16.85 | 13.00 | 19.00 | 7.05 | 2.75 | 1.50 | .10 | .08 | 4.83 | 5.29 | 6.75 | 13.50 |
| 27 | 15.50 | 14.00 | 35.50 | 6.72 | 2.35 | 1.10 | .11 | .15 | 4.90 | 5.00 | 13.90 | 12.00 |
| 28 | 20.00 | 41.61 | 60.35 | 6.41 | 2.03 | .65 | .07 | .61 | 5.20 | 4.90 | 13.40 | 10.95 |
| 29 | 28.00 | ..... | 60.60 | 5.90 | 1.95 | .40 | .05 | 1.45 | 5.08 | 4.91 | 10.42 | 10.00 |
| 30 | 27.87 | ..... | 58.30 | 5.75 | 1.81 | .40 | .05 | 1.68 | 5.65 | 4.90 | 9.65 | 11.10 |
| 31 | 28.50 | ..... | 57.40 | ..... | 1.65 | ..... | .04 | 1.98 | ..... | 4.92 | ..... | 12.51 |

*Rating table for Black Warrior River at Tuscaloosa, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 24.0 | 14,700 | 28.0 | 20,900 | 32.0 | 28,500 | 44.0 | 61,700 |
| 24.2 | 14,960 | 28.2 | 21,260 | 32.5 | 29,550 | 45.0 | 65,250 |
| 24.4 | 15,220 | 28.4 | 21,620 | 33.0 | 30,600 | 46.0 | 69,000 |
| 24.6 | 15,480 | 28.6 | 21,980 | 33.5 | 31,700 | 47.0 | 72,750 |
| 24.8 | 15,740 | 28.8 | 22,340 | 34.0 | 32,800 | 48.0 | 76,500 |
| 25.0 | 16,000 | 29.0 | 22,700 | 34.5 | 33,900 | 49.0 | 80,250 |
| 25.2 | 16,300 | 29.2 | 23,080 | 35.0 | 35,000 | 50.0 | 84,000 |
| 25.4 | 16,600 | 29.4 | 24,460 | 35.5 | 36,250 | 51.0 | 87,750 |
| 25.6 | 16,900 | 29.6 | 24,840 | 36.0 | 37,500 | 52.0 | 91,500 |
| 25.8 | 17,200 | 29.8 | 25,220 | 36.5 | 38,850 | 53.0 | 95,250 |
| 26.0 | 17,500 | 30.0 | 24,600 | 37.0 | 40,200 | 54.0 | 99,000 |
| 26.2 | 17,840 | 30.2 | 24,980 | 37.5 | 41,600 | 55.0 | 102,750 |
| 26.4 | 18,180 | 30.4 | 25,360 | 38.0 | 43,000 | 56.0 | 106,500 |
| 26.6 | 18,520 | 30.6 | 25,740 | 38.5 | 44,500 | 57.0 | 110,250 |
| 26.8 | 18,860 | 30.8 | 26,120 | 39.0 | 46,000 | 58.0 | 114,000 |
| 27.0 | 19,200 | 31.0 | 26,500 | 39.5 | 47,500 | 59.0 | 117,750 |
| 27.2 | 19,540 | 31.2 | 26,900 | 40.0 | 49,000 | 60.0 | 121,500 |
| 27.4 | 19,880 | 31.4 | 27,300 | 41.0 | 52,000 | | |
| 27.6 | 20,220 | 31.6 | 27,700 | 42.0 | 55,100 | | |
| 27.8 | 20,560 | 31.8 | 28,100 | 43.0 | 58,300 | | |

*Estimated monthly discharge of Black Warrior River at Tuscaloosa, Ala.*

[Drainage area, 4,900 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 61,700 | 2,555 | 12,712 | 2.59 | 2.99 |
| February | 78,000 | 5,885 | 21,987 | 4.49 | 4.68 |
| March | 123,750 | 7,435 | 36,776 | 7.51 | 8.66 |
| April | 94,875 | 2,971 | 18,707 | 3.82 | 4.26 |
| May | 5,800 | 850 | 2,349 | .48 | .55 |
| June | 932 | 400 | 648 | .13 | .15 |
| July | 385 | 280 | 311 | .06 | .07 |
| August | 1,135 | 295 | 477 | .10 | .12 |
| September | 2,915 | 310 | 1,444 | .29 | .32 |
| October | 8,305 | 2,500 | 3,393 | .69 | .80 |
| November | 7,495 | 2,500 | 3,136 | .64 | .71 |
| December | 24,935 | 3,895 | 8,353 | 1.70 | 1.96 |
| The year | 123,750 | 280 | 9,191 | 1.88 | 25.27 |

BLACK WARRIOR RIVER NEAR CORDOVA, ALA.

This station is located at the Kansas City, Memphis and Birmingham Railroad bridge, which crosses the river below the junction of the Mulberry and Spipsey Forks, or about three-fourths of a mile from Cordova, Ala. The gage was established by the United States Weather Bureau, but observations were discontinued by that Bureau some time ago. From 12 to 55 feet the gage is a vertical timber bolted to the inside of the bridge pier on the left bank of the river. Below 12 feet the gage was sloping, but it was out of position and could not be used when the station was established by the Geological Survey on May 21, 1900, so a short new section was put in at that time. This section is a 2-inch by 10-inch plank, graduated to feet and tenths, marked with nails from −1.5 feet to +12.5 feet, and spiked to a willow tree on the right bank of the river about 200 feet below the bridge. The bench mark is the top of the stone pier on the left bank, and is 54.95 feet above the zero of the gage. Measurements are made from the railroad bridge, which is a single-span, iron, through bridge 300 feet long. The section is a good one. The observer, C. F. Diffenderfer, is employed by the United States Engineer Corps, and daily gage heights are furnished through the kindness of R. C. McCalla, United States assistant engineer.

The following discharge measurements were made during 1902:

January 17: Gage height, 0.80 feet; discharge, 1,384 second-feet.
April 4: Gage height, 5.80 feet; discharge, 7,162 second-feet.
September 22: Gage height, —1.10 feet; discharge, 74 second-feet.[a]
October 14: Gage height, 0.60 feet; discharge, 834 second-feet.

*Daily gage height, in feet, of Black Warrior River near Cordova, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 8.80 | 14.60 | 22.60 | 18.10 | 0.80 | −0.60 | −0.90 | −1.00 | −0.80 | −0.40 | −0.80 | 0.70 |
| 2 | 6.50 | 18.10 | 15.00 | 9.20 | .60 | − .70 | − .90 | −1.00 | − .80 | − .20 | − .80 | 2.80 |
| 3 | 5.00 | 15.40 | 8.60 | 6.50 | .50 | − .70 | − .90 | .00 | − .70 | − .10 | − .80 | 7.20 |
| 4 | 4.20 | 10.50 | 6.50 | 5.70 | .30 | − .70 | − .90 | − .10 | − .60 | − .40 | − .80 | 7.00 |
| 5 | 3.70 | 8.00 | 8.80 | 5.40 | .20 | − .70 | − .90 | − .10 | − .70 | − .60 | − .80 | 3.60 |
| 6 | 3.00 | 6.20 | 11.50 | 4.30 | .10 | − .70 | − .90 | − .30 | − .80 | − .60 | − .70 | 3.80 |
| 7 | 2.60 | 5.20 | 8.40 | 5.75 | .00 | − .70 | −1.00 | − .50 | − .90 | − .70 | − .60 | 3.20 |
| 8 | 2.40 | 4.40 | 6.70 | 8.90 | .00 | − .80 | −1.00 | − .80 | −1.00 | − .70 | − .40 | 2.40 |
| 9 | 2.20 | 3.80 | 6.10 | 8.10 | − .10 | − .80 | −1.00 | −1.00 | −1.00 | − .70 | − .40 | 1.80 |
| 10 | 2.00 | 3.30 | 5.70 | 6.40 | − .10 | − .80 | −1.00 | −1.00 | −1.10 | − .70 | − .50 | 1.30 |
| 11 | 1.80 | 2.80 | 4.90 | 5.00 | .00 | − .80 | −1.00 | −1.10 | −1.10 | + .60 | − .60 | 1.00 |
| 12 | 1.60 | 2.50 | 4.30 | 4.20 | − .10 | − .80 | −1.10 | −1.10 | −1.10 | 2.90 | − .70 | .80 |
| 13 | 1.40 | 2.30 | 4.10 | 3.80 | − .20 | − .80 | −1.10 | −1.10 | −1.10 | 1.40 | − .70 | .70 |
| 14 | 1.20 | 2.20 | 3.80 | 3.50 | − .20 | − .80 | −1.10 | −1.10 | −1.10 | .60 | − .70 | .60 |
| 15 | 1.10 | 5.30 | 3.50 | 3.20 | − .20 | − .90 | −1.10 | −1.10 | −1.10 | .60 | − .70 | .50 |
| 16 | 1.00 | 7.50 | 3.80 | 2.80 | .10 | − .90 | −1.10 | −1.10 | −1.10 | .20 | − .70 | 6.50 |
| 17 | 1.00 | 5.50 | 7.10 | 2.30 | .20 | − .90 | −1.10 | −1.10 | −1.10 | − .20 | − .70 | 11.30 |
| 18 | .90 | 4.70 | 5.30 | 2.00 | .50 | − .90 | −1.10 | −1.10 | −1.10 | − .30 | − .50 | 6.30 |
| 19 | 1.70 | 4.20 | 4.10 | 1.70 | .30 | − .90 | −1.10 | −1.10 | −1.10 | − .40 | − .50 | 4.40 |
| 20 | 3.00 | 3.70 | 3.80 | 1.60 | .20 | − .90 | −1.00 | −1.10 | −1.10 | − .50 | − .50 | 3.20 |
| 21 | 3.50 | 3.40 | 3.60 | 1.40 | .00 | − .40 | −1.00 | −1.10 | −1.10 | − .60 | − .50 | 3.70 |
| 22 | 6.70 | 3.30 | 3.60 | 1.20 | − .20 | − .20 | − .90 | −1.00 | −1.10 | − .60 | − .50 | 5.80 |
| 23 | 6.00 | 3.00 | 3.10 | 1.10 | − .30 | − .60 | − .90 | −1.00 | −1.10 | − .60 | − .50 | 4.40 |
| 24 | 4.80 | 2.70 | 2.70 | 1.00 | − .40 | − .70 | − .90 | −1.00 | −1.10 | − .70 | − .50 | 3.50 |
| 25 | 4.30 | 3.20 | 3.50 | .90 | − .50 | − .70 | − .90 | −1.00 | −1.10 | − .80 | − .20 | 2.70 |
| 26 | 3.90 | 4.00 | 3.30 | .80 | − .50 | − .70 | −1.00 | −1.10 | −1.00 | − .80 | 8.00 | 2.40 |
| 27 | 5.00 | 4.00 | 8.10 | .70 | − .50 | − .80 | −1.00 | −1.10 | −1.00 | − .80 | 3.40 | 1.80 |
| 28 | 12.00 | 22.70 | 25.00 | .60 | − .50 | − .80 | −1.00 | − .90 | −1.10 | − .80 | 1.50 | 1.60 |
| 29 | 10.30 | ..... | 35.50 | .50 | − .60 | − .80 | −1.00 | − .70 | −1.10 | − .80 | .80 | 2.40 |
| 30 | 8.30 | ..... | 39.00 | 1.00 | − .60 | − .80 | −1.00 | − .60 | − .80 | − .80 | .60 | 2.50 |
| 31 | 11.00 | ..... | 31.80 | ..... | − .70 | ..... | −1.00 | − .70 | ..... | − .80 | ..... | 2.70 |

[a] Estimated from float measurement.

*Rating table for Black Warrior River near Cordova, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| —1.0 | 95 | 2.8 | 3,404 | 7.5 | 10,360 | 17.0 | 24,420 |
| — .8 | 160 | 3.0 | 3,700 | 8.0 | 11,100 | 17.5 | 25,160 |
| — .6 | 260 | 3.2 | 3,996 | 8.5 | 11,840 | 18.0 | 25,900 |
| — .4 | 384 | 3.4 | 4,292 | 9.0 | 12,580 | 19.0 | 27,380 |
| — .2 | 518 | 3.6 | 4,588 | 9.5 | 13,320 | 20.0 | 28,860 |
| .0 | 660 | 3.8 | 4,884 | 10.0 | 14,060 | 21.0 | 30,340 |
| .2 | 810 | 4.0 | 5,180 | 10.5 | 14,800 | 22.0 | 31,820 |
| .4 | 968 | 4.2 | 5,476 | 11.0 | 15,540 | 23.0 | 33,300 |
| .6 | 1,134 | 4.4 | 5,772 | 11.5 | 16,280 | 24.0 | 34,780 |
| .8 | 1,307 | 4.6 | 6,068 | 12.0 | 17,020 | 25.0 | 36,260 |
| 1.0 | 1,486 | 4.8 | 6,364 | 12.5 | 17,760 | 26.0 | 37,740 |
| 1.2 | 1,669 | 5.0 | 6,660 | 13.0 | 18,500 | 27.0 | 39,220 |
| 1.4 | 1,856 | 5.2 | 6,956 | 13.5 | 19,240 | 28.0 | 40,700 |
| 1.6 | 2,047 | 5.4 | 7,252 | 14.0 | 19,980 | 29.0 | 42,180 |
| 1.8 | 2,242 | 5.6 | 7,548 | 14.5 | 20,720 | 30.0 | 43,660 |
| 2.0 | 2,444 | 5.8 | 7,844 | 15.0 | 21,460 | 31.0 | 45,140 |
| 2.2 | 2,652 | 6.0 | 8,140 | 15.5 | 22,200 | 32.0 | 46,620 |
| 2.4 | 2,868 | 6.5 | 8,880 | 16.0 | 22,940 | 33.0 | 48,100 |
| 2.6 | 3,118 | 7.0 | 9,620 | 16.5 | 23,680 | 34.0 | 49,580 |

*Estimated monthly discharge of Black Warrior River near Cordova, Ala.*

[Drainage area, 1,900 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 17,020 | 1,396 | 5,692 | 3.00 | 3.46 |
| February | 32,856 | 2,652 | 8,599 | 4.53 | 4.72 |
| March | 56,980 | 3,258 | 13,764 | 7.24 | 8.35 |
| April | 26,048 | 1,050 | 5,366 | 2.82 | 3.15 |
| May | 1,307 | 205 | 630 | .33 | .38 |
| June | 518 | 125 | 193 | .10 | .11 |
| July | 125 | 74 | 99 | .05 | .06 |
| August | 660 | 74 | 170 | .09 | .10 |
| September | 260 | 74 | 105 | .06 | .07 |
| October | 3,552 | 160 | 536 | .28 | .32 |
| November | 11,100 | 160 | 880 | .46 | .51 |
| December | 15,984 | 1,050 | 4,395 | 2.31 | 2.66 |
| The year | 56,980 | 74 | 3,369 | 1.77 | 23.89 |

### BLACK WARRIOR RIVER (LOCUST FORK OF) AT PALOS, ALA.

Locust Fork of Black Warrior River rises in Blount County, Ala., and flowing in a southwesterly course enters Black Warrior River a short distance above Wilmington, Ala. Its drainage basin is hilly, and about half its area is in cultivation. Palos station was established November 26, 1901, by R. C. McCalla, United States assistant engineer, who furnishes the daily gage heights to the Geological Survey. It is maintained by the United States Engineer Corps. The gage is a 4 by 8 inch timber, on the right bank of Locust Fork of Black Warrior River, just below the Kansas City, Memphis and Birmingham Railroad bridge. One section follows the slope of the bank from low water to a tree on top of the bank, and from there up a vertical section is fastened to the tree. The slope is 17 feet in elevation, measured vertically, and the vertical section of the rod is 15 feet. The rod is graduated to feet and tenths, with copper figures at the 5-foot points, and round-head tacks at intermediate foot marks. The total height is 32 feet. The plane of reference (about 251.71 feet above Mobile datum) is supposed to be extreme low water. High water, April, 1900, was about 37 feet above the plane of reference.

Measurements are made from the Drennan bridge, which is about a quarter of a mile below the Kansas City, Memphis and Birmingham Railroad bridge. The Drennan bridge is the property of the Drennan Coal Mining Company. It is a mining railroad bridge, having width for a double-track tramway of 3-feet gage. One track is laid and in operation. The bridge has two iron spans of 100 feet each, and trestle approaches at both ends.

The initial point for measurements is the left-bank end of the iron bridge on the downstream side.

The bench mark is the top of the iron crossbeam at station 80 from the initial point, and was 44.3 feet above the water when the gage read 2.50 feet.

This bridge is lower and the section is better than that at the upper bridge, from which some of the measurements have been made; but there is a raft against the center pier that should be removed. At minimum stages the water at both bridges is too sluggish for accurate measurement.

*Discharge measurements of Black Warrior River (Locust Fork of) at Palos, Ala.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| January 18 | K. T. Thomas | 0.85 | 849 |
| April 5 | do | 2.50 | 3,224 |
| Do | do | 2.50 | 3,292 |
| September 20 | J. C. Conn | .00 | [a]117 |
| October 15 | do | .60 | 473 |

[a] Estimated from float measurement.

*Daily gage height, in feet, of Black Warrior River (Locust Fork of) at Palos, Ala.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 5.50 | 8.30 | 13.30 | 4.90 | 0.90 | 0.20 | 0.10 | 0.40 | 0.10 | 0.10 | 0.00 | 1.10 |
| 2 | 3.40 | 12.80 | 6.70 | 3.50 | .80 | .20 | .10 | .30 | .00 | .10 | .00 | 1.10 |
| 3 | 2.70 | 10.20 | 4.40 | 2.70 | .70 | .20 | .10 | 30 | .00 | .10 | .00 | 1.90 |
| 4 | 2.20 | 5.70 | 3.00 | 2.60 | .70 | .20 | .10 | .90 | .00 | .10 | .00 | 1.90 |
| 5 | 2.00 | 3.90 | 5.00 | 2.50 | .60 | .20 | .10 | .30 | .00 | .10 | .00 | 1.70 |
| 6 | 1.70 | 3.00 | 5.30 | 2.30 | .60 | .20 | .00 | .20 | .00 | .10 | .00 | 1.60 |
| 7 | 1.60 | 2.40 | 3.70 | 2.10 | .50 | .20 | .00 | .10 | .00 | .10 | .00 | 1.50 |
| 8 | 1.50 | 2.00 | 3.00 | 5.80 | .50 | .20 | .00 | .10 | .00 | .00 | .00 | 1.20 |
| 9 | 1.30 | 1.80 | 2.50 | 5.00 | .50 | .20 | .10 | .10 | .00 | .00 | .00 | 1.00 |
| 10 | 1.30 | 1.70 | 2.10 | 3.40 | .50 | .20 | .10 | .00 | .00 | .00 | .00 | .90 |
| 11 | 1.20 | 1.60 | 1.90 | 2.60 | .40 | .10 | .10 | .00 | .00 | 1.70 | .00 | .80 |
| 12 | 1.10 | 1.50 | 1.70 | 2.20 | .40 | .10 | .10 | .00 | .00 | 2.00 | .00 | .70 |
| 13 | 1.10 | 1.40 | 1.60 | 2.00 | .40 | .10 | .10 | .00 | .00 | 1.30 | .00 | .70 |
| 14 | 1.00 | 1.30 | 1.60 | 1.80 | .40 | .10 | .10 | .00 | .00 | .80 | .00 | .60 |
| 15 | .90 | 2.20 | 1.50 | 1.70 | .40 | .10 | .10 | .00 | .00 | .60 | .00 | .60 |
| 16 | .90 | 2.80 | 3.40 | 1.60 | .30 | .10 | .00 | .00 | .00 | .40 | .00 | 3.10 |
| 17 | .90 | 2.20 | 4.50 | 1.50 | .60 | .10 | .00 | .00 | .00 | .40 | .00 | 3.30 |
| 18 | .90 | 2.00 | 3.00 | 1.50 | .50 | .10 | .00 | .00 | .00 | .30 | .20 | 2.40 |
| 19 | 1.00 | 1.80 | 2.30 | 1.40 | .50 | .10 | .00 | .00 | .00 | .20 | .20 | 1.90 |
| 20 | 1.10 | 1.70 | 2.00 | 1.30 | .40 | .10 | .00 | .00 | .00 | .20 | .20 | 1.50 |
| 21 | 1.60 | 1.60 | 1.80 | 1.10 | .40 | .10 | .10 | .00 | .00 | .10 | .20 | 1.60 |
| 22 | 2.50 | 1.60 | 1.70 | 1.00 | .40 | .10 | .10 | .00 | .00 | .10 | .20 | 2.50 |
| 23 | 2.40 | 1.50 | 1.60 | 1.00 | .40 | .10 | .00 | .00 | .00 | .10 | .20 | 2.20 |
| 24 | 2.30 | 1.50 | 1.50 | .90 | .30 | .10 | .00 | .00 | .00 | .00 | .10 | 1.80 |
| 25 | 2.40 | 1.80 | 1.90 | .90 | .30 | .10 | .00 | .00 | .00 | .00 | .20 | 1.50 |
| 26 | 1.90 | 1.60 | 1.70 | .90 | .30 | .10 | .00 | .00 | .00 | .00 | 1.10 | 1.30 |
| 27 | 1.80 | 2.20 | 6.30 | .80 | .30 | .10 | .00 | .00 | .00 | .00 | 1.40 | 1.10 |
| 28 | 2.10 | 14.90 | 24.00 | .80 | .20 | .10 | .10 | .00 | .10 | .00 | 1.10 | 1.00 |
| 29 | 3.10 | ..... | 27.00 | .70 | .20 | .20 | .10 | .10 | .00 | .00 | .80 | 1.00 |
| 30 | 3.30 | ..... | 25.00 | 1.20 | .20 | .20 | .20 | .10 | .10 | .00 | .60 | 1.20 |
| 31 | 3.60 | ..... | 17.90 | ..... | .20 | ..... | .50 | .10 | ..... | .00 | ..... | 1.40 |

*Rating table for Black Warrior River (Locust Fork of) at Palos, Ala., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.0 | 100 | 0.9 | 900 | 1.8 | 2,250 | 2.7 | 3,600 |
| .1 | 140 | 1.0 | 1,050 | 1.9 | 2,400 | 2.8 | 3,750 |
| .2 | 190 | 1.1 | 1,200 | 2.0 | 2,550 | 2.9 | 3,900 |
| .3 | 245 | 1.2 | 1,350 | 2.1 | 2,700 | 3.0 | 4,050 |
| .4 | 310 | 1.3 | 1,500 | 2.2 | 2,850 | 3.1 | 4,200 |
| .5 | 390 | 1.4 | 1,650 | 2.3 | 3,000 | 3.2 | 4,350 |
| .6 | 490 | 1.5 | 1,800 | 2.4 | 3,150 | 3.3 | 4,500 |
| .7 | 610 | 1.6 | 1,950 | 2.5 | 3,300 | 3.4 | 4,650 |
| .8 | 750 | 1.7 | 2,100 | 2.6 | 3,450 | 3.5 | 4,800 |

*Estimated monthly discharge of Black Warrior River (Locust Fork of) at Palos, Ala.*

[Drainage area, 1,020 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 7,800 | 900 | 2,468 | 2.42 | 2.79 |
| February | 21,900 | 1,500 | 4,746 | 4.65 | 4.84 |
| March | 40,050 | 1,800 | 8,400 | 8.24 | 9.50 |
| April | 8,250 | 610 | 2,635 | 2.58 | 2.88 |
| May | 900 | 190 | 374 | .37 | .43 |
| June | 190 | 140 | 160 | .16 | .18 |
| July | 390 | 100 | 133 | .13 | .15 |
| August | 900 | 100 | 157 | .15 | .17 |
| September | 140 | 100 | 104 | .10 | .11 |
| October | 2,550 | 100 | 359 | .35 | .40 |
| November | 1,650 | 100 | 282 | .28 | .31 |
| December | 4,500 | 490 | 1,784 | 1.75 | 2.02 |
| The year | 21,900 | 100 | 1,800 | 1.76 | 23.78 |

## TOMBIGBEE RIVER AT COLUMBUS, MISS.

This station is located about 1,000 feet below the county highway bridge, 1½ miles from the Southern Railway depot at Columbus. The rod is fastened vertically to the rock bluff on the left bank. It is a 3 by 10 inch pine timber, 45 feet long, marked with brass figures and copper nails, the graduations extending from −5 feet to +40 feet. The initial point of sounding is the end of the iron bridge, on the right bank, downstream side. Bench mark No. 1 is 250 feet from the initial point of sounding. The bridge floor at this point is 40.85 feet above the zero of the rod, and the top of the iron girder under the floor timbers is 39.85 feet above the zero. Bench mark No. 2 is the top of the rail at the depot of the Southern Railway, and is 55.2 feet above gage datum and 190.9 above mean sea level. Measurements are made from the county highway bridge. The width of the river at low water is 160 feet. The maximum recorded height of the river was on April 8, 1892, when the gage registered 42 feet. The lowest recorded height was on October 26, 1893, when the gage reading was −3.9 feet. The danger line is at 33 feet. The observer, J. J. Richards, is paid by the United States Weather Bureau.

*Discharge measurements of Tombigbee River at Columbus, Miss.*

| Date. | Hydrographer | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| April 3 | K. T. Thomas | 27.60 | 45,214 |
| July 11 | J. C. Conn | —3.40 | 697 |
| July 15 | do | —2.70 | 1,058 |
| September 23 | do | —3.25 | 545 |
| September 26 | do | —3.30 | 493 |

*Dailg gage height, in feet, of Tombigbee River at Columbus, Miss.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 9.20 | 14.50 | 9.50 | 30.30 | 0.00 | −2.60 | −3.20 | −2.60 | −2.40 | −2.20 | −3.30 | 3.80 |
| 2 | 8.90 | 16.80 | 9.30 | 29.40 | − .50 | −2.50 | −3.20 | −1.30 | −2.70 | −1.80 | −3.30 | 3.90 |
| 3 | 7.70 | 17.90 | 9.30 | 28.20 | −1.50 | −2.50 | −3.20 | − .50 | −2.40 | − .90 | −3.30 | 4.90 |
| 4 | 5.80 | 18.50 | 9.20 | 26.30 | − .90 | −2.60 | −3.20 | − .20 | −2.20 | − .60 | −3.30 | 5.10 |
| 5 | 4.00 | 19.00 | 9.80 | 23.70 | − .20 | −2.60 | −3.20 | − .10 | −2.50 | −1.00 | −3.30 | 5.70 |
| 6 | 2.50 | 17.60 | 9.20 | 20.50 | − .10 | −2.70 | −3.30 | − .40 | −2.20 | −1.30 | −3.20 | 5.70 |
| 7 | 1.50 | 16.00 | 8.20 | 18.20 | − .40 | −2.70 | −3.30 | −1.00 | −2.20 | −1.60 | −3.10 | 4.90 |
| 8 | .90 | 13.60 | 7.80 | 18.90 | − .60 | −2.80 | −3.30 | −1.60 | −2.10 | −2.00 | −3.10 | 4.60 |
| 9 | .50 | 10.70 | 7.00 | 18.30 | − .40 | −2.80 | −3.40 | −2.00 | −2.20 | −2.30 | −3.00 | 3.90 |
| 10 | .10 | 7.60 | 6.00 | 17.80 | − .20 | −2.90 | −3.40 | −2.30 | −2.40 | −2.50 | −2.90 | 3.00 |
| 11 | − .20 | 5.60 | 6.00 | 17.40 | − .50 | −2.80 | −3.20 | −2.70 | −2.70 | −2.90 | −3.00 | 2.20 |
| 12 | − .20 | 3.00 | 4.20 | 16.00 | − .80 | −2.90 | −3.40 | −2.90 | −3.00 | −2.60 | −3.00 | 1.50 |
| 13 | − .50 | 2.10 | 4.30 | 13.00 | −1.00 | −2.80 | −3.00 | −3.00 | −3.20 | −2.70 | −3.10 | .80 |
| 14 | − .60 | 1.40 | 4.30 | 9.00 | −1.30 | −2.90 | −2.50 | −3.10 | −3.30 | −2.50 | −3.10 | .60 |
| 15 | − .90 | 4.00 | 4.80 | 5.60 | −1.50 | −3.00 | −2.70 | −3.20 | −3.40 | −2.20 | −3.10 | .60 |
| 16 | −1.00 | 5.40 | 6.00 | 4.20 | −1.60 | −3.10 | −3.00 | −3.30 | −3.50 | −2.20 | −3.00 | 1.20 |
| 17 | −1.00 | 5.60 | 7.40 | 3.50 | −1.10 | −3.20 | −3.10 | −3.30 | −3.50 | −2.00 | −3.00 | 1.90 |
| 18 | −1.00 | 5.90 | 7.60 | 3.00 | −1.30 | −3.20 | −3.20 | −3.30 | −3.50 | −2.50 | −3.00 | 11.10 |
| 19 | − .60 | 5.60 | 7.50 | 2.70 | −1.10 | −3.20 | −3.30 | −3.40 | −3.50 | −2.50 | −3.00 | 11.80 |
| 20 | + .50 | 4.60 | 6.79 | 2.20 | −1.10 | −3.20 | −3.30 | −3.40 | −3.50 | −2.60 | −3.00 | 13.00 |
| 21 | 3.10 | 4.40 | 5.70 | 2.00 | −1.00 | −3.10 | −2.70 | −3.40 | −3.40 | −2.90 | −2.90 | 13.20 |
| 22 | 5.20 | 5.30 | 4.70 | 1.80 | −1.20 | −3.00 | −3.00 | −3.50 | −3.30 | −3.00 | −2.90 | 14.80 |
| 23 | 5.60 | 5.60 | 3.50 | 1.60 | −1.50 | −2.90 | −3.00 | −3.50 | −3.30 | −3.00 | −2.90 | 13.80 |
| 24 | 5.80 | 5.30 | 4.00 | 1.10 | −1.70 | −2.80 | −2.90 | −3.50 | −3.30 | −3.00 | −2.90 | 12.10 |
| 25 | 5.50 | 6.40 | 6.40 | .90 | −1.90 | −3.00 | −2.90 | −3.60 | −3.40 | −3.10 | −1.40 | 10.00 |
| 26 | 4.60 | 5.80 | 6.10 | .70 | −2.10 | −3.00 | −2.80 | −3.60 | −3.40 | −3.10 | .30 | 10.40 |
| 27 | 4.00 | 5.70 | 13.40 | .60 | −2.20 | −3.00 | −2.90 | −3.60 | −3.30 | −3.10 | 1.20 | 10.60 |
| 28 | 6.10 | 8.10 | 21.00 | .40 | −2.30 | −3.00 | −2.90 | −3.10 | −3.20 | −3.20 | 2.50 | 10.80 |
| 29 | 7.40 | ..... | 28.00 | .30 | −2.40 | −3.10 | −2.60 | −3.00 | −3.10 | −3.30 | 2.90 | 11.30 |
| 30 | 10.00 | ..... | 30.50 | .30 | 2.50 | −3.20 | −5.00 | −2.50 | −2.90 | −3.30 | 3.50 | 10.40 |
| 31 | 12.40 | ..... | 30.60 | ..... | −2.50 | ..... | −3.00 | −2.40 | ..... | −3.30 | ..... | 9.50 |

*Rating table for Tombigbee River at Columbus, Miss.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| —3.4 | 500 | 0.2 | 3,230 | 6.5 | 10,400 | 15.5 | 24,750 |
| —3.2 | 630 | .4 | 3,410 | 7.0 | 11,100 | 16.0 | 25,600 |
| —3.0 | 760 | .6 | 3,590 | 7.5 | 11,815 | 17.0 | 27,300 |
| —2.8 | 890 | .8 | 3,780 | 8.0 | 12,540 | 18.0 | 29,000 |
| —2.6 | 1,030 | 1.0 | 3,970 | 8.5 | 13,290 | 19.0 | 30,700 |
| —2.4 | 1,170 | 1.2 | 4,160 | 9.0 | 14,040 | 20.0 | 32,400 |
| —2.2 | 1,310 | 1.4 | 4,350 | 9.5 | 14,815 | 21.0 | 34,100 |
| —2.0 | 1,450 | 1.6 | 4,550 | 10.0 | 15,590 | 22.0 | 35,800 |
| —1.8 | 1,590 | 1.8 | 4,750 | 10.5 | 16,370 | 23.0 | 37,500 |
| —1.6 | 1,740 | 2.0 | 4,950 | 11.0 | 17,170 | 24.0 | 39,200 |
| —1.4 | 1,890 | 2.5 | 5,475 | 11.5 | 17,975 | 25.0 | 40,900 |
| —1.2 | 2,040 | 3.0 | 6,020 | 12.0 | 18,800 | 26.0 | 42,600 |
| —1.0 | 2,190 | 3.5 | 6,585 | 12.5 | 19,650 | 27.0 | 44,300 |
| — .8 | 2,350 | 4.0 | 7,170 | 13.0 | 20,500 | 28.0 | 46,000 |
| — .6 | 2,520 | 4.5 | 7,775 | 13.5 | 21,350 | 29.0 | 47,700 |
| — .4 | 2,690 | 5.0 | 8,400 | 14.0 | 22,200 | 30.0 | 49,400 |
| — .2 | 2,870 | 5.5 | 9,050 | 14.5 | 23,050 | | |
| .0 | 3,050 | 6.0 | 9,720 | 15.0 | 23,900 | | |

*Estimated monthly discharge of Tombigbee River at Columbus, Miss.*

[Drainage area, 4,440 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 19,480 | 2,190 | 7,009 | 1.58 | 1.82 |
| February | 30,700 | 4,350 | 14,148 | 3.19 | 3.32 |
| March | 50,420 | 6,585 | 15,583 | 3.51 | 4.05 |
| April | 49,910 | 3,320 | 18,180 | 4.09 | 4.56 |
| May | 3,050 | 1,100 | 2,060 | .46 | .53 |
| June | 1,100 | 630 | 825 | .19 | .21 |
| July | 1,100 | 500 | 717 | .16 | .18 |
| August | 2,960 | 370 | 1,095 | .25 | .29 |
| September | 1,380 | 435 | 790 | .18 | .20 |
| October | 2,520 | 565 | 1,165 | .26 | .30 |
| November | 6,585 | 565 | 1,482 | .33 | .37 |
| December | 23,560 | 3,590 | 11,730 | 2.64 | 3.04 |
| The year | 50,420 | 370 | 6,232 | 1.40 | 18.87 |

MISCELLANEOUS MEASUREMENTS IN MOBILE RIVER DRAINAGE BASIN.

The following miscellaneous measurements were taken in the Mobile drainage basin during 1902 by B. M. Hall and his assistants:

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| Apr. 4 | Luxapelila Creek | City waterworks, Columbus, Miss. (gage height, 12.4 feet). | 3,864 |
| June 2 | Tallapoosa River | Tallapoosa, Ga. (gage height, 1.30 feet). | 114 |
| June 11 | Etowah River | Euharlee, Ga., 8 miles south of Kingston, Ga. | 1,393 |
| June 11 | Etowah River | Four miles south of Kingston, Ga | 1,631 |
| June 24 | Euharlee Creek | Rockmart, Ga. (gage height, 1 foot) | 25 |
| July 11 | Luxapelila Creek | City waterworks, Columbus, Miss. (gage height, 1.60 feet). | 141 |
| July 22 | Etowah River | Loopers Bridge, south of Dawson, Ga. | 136 |
| Sept. 23 | Luxapelila Creek | City waterworks, Columbus, Miss. (gage height, 1.70 feet). | 322 |
| Sept. 25 | Euharlee Creek | Rockmart, Ga | 41 |
| Oct. 8 | Euharlee Creek | Rockmart, Ga. (gage height, 0.60 foot). | 13 |
| Nov. 4 | Talking Rock Creek | Near Carters, Ga. (gage height, 0.85 foot). | 55 |

## PEARL RIVER DRAINAGE BASIN.

Pearl River rises in the eastern part of Mississippi. It flows south into Lake Borgne, an arm of the Gulf of Mexico, forming part of the boundary between Louisiana and Mississippi. The United States Geological Survey maintains one station on this river, under the direction of B. M. Hall. It is located at Jackson, Miss.

### PEARL RIVER AT JACKSON, MISS.

This station was established June 24, 1901, by the United States Geological Survey, and is situated at the highway bridge 2 miles from the union station of Jackson and one-eighth of a mile above the Alabama and Vicksburg Railway bridge.

The gage is a wire gage fastened to the guard timber on the downstream side of the bridge. The rod is 10 feet long, graduated to feet and tenths, and is marked with staples and brass figures. Above 10 feet the guard timber is marked. The bench mark is the downstream end of the top of the iron crossbeam 120 feet from the right-bank end of the bridge. This end of the bridge is the initial point for soundings. The elevation of the bench mark is 39 feet above datum. The bridge floor at the same point is 40.15 feet above datum. The observer is James Hurst.

During 1902 the following discharge measurements were made:

July 14: Gage height, 1.10 feet; discharge, 193 second-feet.
September 25: Gage height, 0.90 foot; discharge, 290 second-feet.

*Daily gage height, in feet, of Pearl River at Jackson, Miss.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 15.00 | 13.90 | 13.00 | 37.20 | 6.00 | 2.20 | 1.30 | 1.30 | 7.90 | 1.90 | 1.00 | 3.10 |
| 2 | 15.20 | 16.60 | 13.00 | 36.20 | 5.90 | 2.20 | 1.30 | 1.20 | 4.80 | 2.00 | 1.00 | 4.60 |
| 3 | 15.10 | 17.10 | 13.00 | 34.60 | 5.60 | 2.10 | 1.30 | 1.70 | 3.60 | 2.40 | 1.00 | 4.10 |
| 4 | 15.00 | 18.30 | 13.20 | 33.10 | 5.10 | 2.00 | 1.20 | 1.70 | 3.40 | 2.80 | 1.00 | 5.30 |
| 5 | 14.80 | 18.60 | 13.40 | 32.00 | 4.90 | 2.00 | 1.20 | 1.60 | 3.20 | 3.00 | 1.10 | 5.80 |
| 6 | 14.50 | 18.40 | 13.70 | 31.00 | 4.80 | 1.90 | 1.20 | 1.60 | 2.50 | 3.60 | 1.00 | 6.30 |
| 7 | 14.20 | 18.30 | 14.00 | 30.10 | 4.60 | 1.90 | 1.20 | 1.40 | 3.90 | 3.20 | 1.00 | 6.80 |
| 8 | 13.90 | 18.20 | 13.80 | 29.10 | 4.30 | 1.80 | 1.30 | 1.40 | 3.80 | 3.10 | 1.00 | 6.40 |
| 9 | 13.40 | 17.00 | 13.60 | 28.10 | 4.00 | 1.80 | 1.30 | 1.40 | 3.60 | 2.90 | 1.20 | 6.00 |
| 10 | 12.60 | 17.70 | 13.20 | 27.10 | 3.90 | 1.80 | 1.30 | 1.40 | 3.50 | 2.30 | 1.20 | 5.80 |
| 11 | 11.80 | 17.60 | 12.00 | 26.30 | 3.50 | 1.80 | 3.50 | 1.40 | 3.60 | 2.30 | 1.30 | 5.70 |
| 12 | 10.80 | 17.40 | 12.20 | 25.60 | 3.20 | 1.70 | 3.00 | 1.40 | 3.50 | 2.60 | 1.30 | 5.60 |
| 13 | 10.00 | 16.90 | 11.70 | 24.80 | 3.20 | 1.70 | 1.20 | 1.40 | 3.50 | 2.60 | 1.30 | 5.20 |
| 14 | 9.10 | 15.80 | 11.90 | 24.40 | 3.10 | 1.70 | 1.20 | 1.30 | 3.90 | 2.80 | 1.40 | 5.70 |
| 15 | 8.10 | 14.30 | 10.30 | 24.00 | 3.00 | 1.60 | 1.20 | 1.30 | 3.70 | 3.00 | 1.40 | 5.10 |
| 16 | 8.00 | 12.60 | 9.90 | 23.50 | 2.10 | 1.60 | 1.30 | 1.30 | 3.60 | 3.20 | 1.40 | 10.60 |
| 17 | 7.90 | 10.90 | 10.60 | 23.00 | 2.80 | 1.50 | 1.30 | 1.20 | 3.40 | 3.30 | 1.40 | 10.70 |
| 18 | 6.70 | 9.70 | 10.60 | 22.30 | 2.60 | 1.50 | 1.20 | 1.20 | 3.00 | 3.60 | 1.30 | 10.50 |
| 19 | 5.40 | 9.00 | 10.50 | 21.20 | 3.00 | 1.50 | 1.10 | 1.10 | 2.90 | 3.50 | 1.30 | 11.10 |
| 20 | 5.10 | 8.60 | 10.00 | 19.50 | 2.90 | 1.40 | 1.10 | 1.10 | 2.60 | 3.30 | 1.20 | 11.30 |
| 21 | 5.40 | 8.30 | 9.90 | 17.20 | 2.80 | 1.30 | 1.10 | 1.10 | 2.40 | 3.20 | 1.20 | 11.60 |
| 22 | 5.60 | 8.20 | 9.90 | 14.00 | 2.60 | 1.30 | 1.10 | 1.10 | 1.00 | 2.00 | 1.20 | 12.20 |
| 23 | 5.80 | 8.30 | 9.90 | 11.10 | 2.80 | 1.30 | 1.10 | .90 | 1.20 | 1.90 | 1.10 | 12.20 |
| 24 | 6.40 | 9.00 | 10.80 | 9.30 | 3.00 | 1.40 | 1.10 | 1.00 | 1.20 | 1.80 | 1.80 | 11.90 |
| 25 | 6.90 | 10.70 | 12.90 | 8.10 | 3.00 | 1.40 | 1.20 | .90 | 1.10 | 1.50 | 1.70 | 11.70 |
| 26 | 6.20 | 11.40 | 13.80 | 7.20 | 2.80 | 1.30 | 1.40 | .80 | 1.30 | 1.50 | 1.80 | 11.10 |
| 27 | 7.00 | 11.60 | 22.70 | 7.10 | 2.70 | 1.30 | 1.40 | 1.00 | 1.30 | 1.40 | 1.70 | 10.80 |
| 28 | 7.10 | 12.30 | 28.55 | 6.50 | 2.60 | 1.30 | 1.40 | 2.30 | 1.40 | 1.30 | 1.60 | 10.00 |
| 29 | 7.20 | ..... | 30.40 | 6.40 | 2.50 | 1.30 | 1.40 | 4.50 | 1.60 | 1.20 | 1.60 | 10.90 |
| 30 | 8.50 | ..... | 32.10 | 6.20 | 2.40 | 1.30 | 1.40 | 7.20 | 1.80 | 1.10 | 2.60 | 8.00 |
| 31 | 10.10 | ..... | 36.50 | ..... | 2.20 | 1.30 | 1.40 | 7.40 | ..... | 1.10 | ..... | 9.90 |

## EASTERN MISSISSIPPI RIVER DRAINAGE.

For convenience of classification the drainage areas of the tributaries from the east that contribute to the Mississippi River drainage have been grouped together. These tributaries vary widely in character, as regards both the types of the rivers and the topography of the areas which they drain. Those draining the comparatively low rolling country adjacent to the valley of the Mississippi are as a rule sluggish streams, with few falls of importance, while the upper Ohio River and its numerous tributaries drain a country of high elevations, their upper courses being through narrow V-shaped valleys, with frequent falls and with high rocky banks. Owing to the steep slopes the

run-off is rapid, causing sudden fluctuations in the streams and giving rise to the high floods and extreme low waters for which the Ohio Basin is noted, and the influence of which is felt to a marked degree even in the flow of the Mississippi below Cairo.

In this report these drainage areas have been arranged geographically from north to south, and the Ohio River drainage has been divided into its smaller systems. The following are the systems from which the United States Geological Survey has obtained data during 1902: Those which enter the Mississippi above the mouth of the Ohio are the Chippewa, Black, and Wisconsin rivers in Wisconsin, and Rock River and Illinois River. Those that enter the Ohio from the north are the Wabash and the Muskingum. Those entering the Ohio from the south are the Monongahela, the Kanawha, the Cumberland, and the Tennessee. Entering below the mouth of the Ohio is the Yazoo.

## CHIPPEWA RIVER DRAINAGE BASIN.

Chippewa River rises in the southeastern part of Ashland County, Wis. It flows southwest, emptying into the Mississippi near Wabasha, Minn. Its principal tributary is the Flambeau, which enters from the east in Gates County. During the latter part of the year 1902, the United States Geological Survey began systematic measurements in this and other drainage basins of Wisconsin. This study is carried on in cooperation with the Wisconsin Geological and Natural History Survey, under the direction of L. S. Smith, hydrographer of the latter survey. The field work is performed by L. R. Stockman.

A gaging station has been established in this basin at Eau Claire, Wis.

### CHIPPEWA RIVER NEAR EAU CLAIRE, WIS.

This station was established November 13, 1902, by L. R. Stockman. It is located on the highway bridge, 3 miles from Eau Claire, Wis. The gage is a plain staff graduated to feet and tenths, fastened to the center pier of the bridge. It is read twice daily by R. F. Duncan. The channel is straight for 300 feet above the station and for 800 feet below. The left bank is low and liable to overflow. The right bank is high and rocky; the bed of the stream is sandy gravel. The initial point for soundings is a nail in the foot board at the right end of the bridge. The bench mark is a nail in the top of a 6-inch white-oak stump, 200 feet from the road, and 200 feet from the river; elevation above zero of gage, 20.09 feet.

The following discharge measurements were made during 1902:

November 13: Gage height, 8.7 feet; discharge, 11,134 second-feet.
December 6: Gage height, 4.45 feet; discharge, 2,871 second-feet.
December 28: Gage height, 4.6 feet; discharge, 3,063 second-feet.

*Daily gage height, in feet, of Chippewa River near Eau Claire, Wis.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | (a) | 12 | | 4.20 | 23 | 7.15 | 4.50 |
| 2 | | (a) | 13 | 3.00 | 4.45 | 24 | 7.00 | 4.70 |
| 3 | | (a) | 14 | 10.20 | 4.25 | 25 | 6.45 | 4.30 |
| 4 | | (a) | 15 | 12.10 | 4.55 | 26 | 6.20 | 4.90 |
| 5 | | 4.50 | 16 | 13.05 | 4.25 | 27 | 6.00 | 5.10 |
| 6 | | 4 45 | 17 | 12.60 | 4.30 | 28 | 5.75 | 5.10 |
| 7 | | 4.00 | 18 | 10.85 | 4.10 | 29 | 5.55 | 4.50 |
| 8 | | 4.05 | 19 | 9.60 | 4.30 | 30 | (a) | 4.85 |
| 9 | | 4.05 | 20 | 8.50 | 4.25 | 31 | | 4.50 |
| 10 | | 4.10 | 21 | 7.55 | 4.30 | | | |
| 11 | | 4.25 | 22 | 7.40 | 4.25 | | | |

(a) No readings taken.

## BLACK RIVER DRAINAGE BASIN.

Black River rises in Taylor County, Wis., and flows southwest, emptying into the Mississippi about 20 miles above La Crosse. The United States Geological Survey is maintaining a station on this river at Melrose.

### BLACK RIVER AT MELROSE, WIS.

This station was established November 12, 1902, by L. R. Stockman. It is located 1 mile south of Melrose, Wis., on the highway bridge. The river at this point flows in two channels, which at present have practically the same elevation. The gage is a plain staff, graduated to feet and tenths, nailed to the piling of the bridge. It is read daily by William H. Westfall. The channel is straight both above and below the station for about 500 feet. The right bank is high and rocky; the left bank is also high. The bed of the stream is sandy and shifting. The initial point for soundings is a nail in the footboard on the right bank. Bench mark No. 1 consists of a nail driven into the root of a 16-inch black oak 50 feet west of the north end of the bridge; elevation 15.23 feet above zero of the gage. Bench mark No. 2 has an elevation of 14.72 above zero of gage. Assuming the elevation of bench mark No. 1 at 1,000, then elevation of bench mark No. 2 is 999.49.

The following discharge measurements were made during 1902:

November 12: Gage height, 4.5 feet; discharge, 1,042 second-feet.
December 26: Gage height, 5.70 feet; discharge, 1,557 second-feet.

*Daily gage height, in feet, of Black River at Melrose, Wis.*

| Day. | Dec. | Day. | Dec. | Day. | Dec. | Day. | Dec. |
|---|---|---|---|---|---|---|---|
| 1902. | | 1902. | | 1902. | | 1902. | |
| 1 | | 9 | 4.35 | 17 | 4.00 | 25 | 5.85 |
| 2 | | 10 | 4.30 | 18 | 4.00 | 26 | 5.80 |
| 3 | | 11 | 4.35 | 19 | 4.05 | 27 | 5.65 |
| 4 | 3.75 | 12 | 4.20 | 20 | 4.25 | 28 | 5.50 |
| 5 | 3.95 | 13 | 4.20 | 21 | 4.60 | 29 | 5.35 |
| 6 | 4.00 | 14 | 4.10 | 22 | 4.95 | 30 | 5.20 |
| 7 | 3.80 | 15 | 4.15 | 23 | 5.80 | | |
| 8 | 4.35 | 16 | 4.10 | 24 | 6.05 | | |

## WISCONSIN RIVER DRAINAGE BASIN.

Wisconsin River is the largest river in the State of Wisconsin. It rises in the northern part and flows south through the central portion of the State to Portage, where it turns at nearly a right angle and flows west, emptying into the Mississippi about 60 miles above Dubuque.

Gaging stations have been established in this basin at Necedah, Muscoda, and Merrill. These stations divide the river into three nearly equal reaches of about 90 miles each, so furnishing ample opportunity for a systematic study.

### WISCONSIN RIVER AT MUSCODA, WIS.

This station was established December 20, 1902, by L. R. Stockman. It is situated three-fourths of a mile north of Muscoda on the toll highway bridge. The gage is a horizontal wire with a scale board graduated to feet and tenths and fastened to the top of the bridge. The initial point of sounding is on the left bank, at the end of the drawbridge. The channel is straight for 1,500 feet and 1,000 feet below. The right bank is low and liable to overflow. The water is confined to the bridge opening. The left bank is high and rocky. The bed of the stream is rocky, with spots of gravel. The gage is read twice a day by Charles H. Lovell, the bridge tender. Bench mark No. 1, elevation 684 feet above sea level; bolt in south end of east guard rail at south end of bridge. Bench mark No. 2, elevation 681.17 feet; nail in root on north side of 20-inch black oak tree standing about 40 paces south by east from the south end of the drawbridge. Bench mark No. 3, elevation 680.95 feet; a projecting point on a sandstone rock on the east end of south abutment near the supporting wheel at end of drawbridge. On the vertical face of the stone is an arrow pointing upward to this point. The stone is also marked B. M. Bench mark No. 4, elevation 684.25 feet; a point marked X on a

foundation stone at the southeast corner of Lampi's brewery. The 15-foot mark has an elevation of 668.62 feet.

The following measurement was made in 1902:

December 20: Gage height, 15 feet; discharge, 6,924 second-feet.

*Daily gage height, in feet, of Wisconsin River at Muscoda, Wis.*

| Day. | Dec. | Day. | Dec. | Day. | Dec. | Day. | Dec. |
|---|---|---|---|---|---|---|---|
| 1902. | | 1902. | | 1902, | | 1902. | |
| 1 | | 9 | | 17 | | 25 | 14.85 |
| 2 | | 10 | | 18 | | 26 | 14.80 |
| 3 | | 11 | | 19 | | 27 | 14.70 |
| 4 | | 12 | | 20 | | 28 | 14.55 |
| 5 | | 13 | | 21 | 15.05 | 29 | 14.55 |
| 6 | | 14 | | 22 | 15.00 | 30 | 14.75 |
| 7 | | 15 | | 23 | 15.05 | 31 | 14.75 |
| 8 | | 16 | | 24 | 15.05 | | |

WISCONSIN RIVER NEAR NECEDAH, WIS.

This station was established December 2, 1902, by L. R. Stockman. It is located on the highway toll bridge 3 miles east of Necedah, Wis. The gage is a plain staff, graduated to feet and tenths, fastened to the center pier of the bridge. It is read twice daily by Edward Bundy, whose post-office address is Strongs Prairie. The channel is straight both above and below the station. The right bank is high. The left bank is low, but the water is confined to the channel by the bridge except when the gage reads above 11 feet. The bed of the stream is gravel and sand, somewhat liable to shift. The bench mark is a nail in a red-oak stump about 60 feet south of the roadway and 50 feet from the river. Bench mark No. 2, elevation 998.91 feet, is a nail in the root of a large cottonwood tree 28 feet south of the bridge and about 80 feet from the river.

The following discharge measurements were made during 1902:

December 2: Gage height, 4.90 feet; discharge, 3,875 second-feet.
December 23: Gage height, 5.40 feet; discharge, 3,534 second-feet.

*Daily gage height of Wisconsin River near Necedah, Wis.*

| Day. | Dec. | Day. | Dec. | Day. | Dec. | Day. | Dec. |
|---|---|---|---|---|---|---|---|
| 1902. | | 1902. | | 1902. | | 1902. | |
| 1 | | 9 | 4.85 | 17 | 5.65 | 25 | 6.40 |
| 2 | 4.90 | 10 | 5.25 | 18 | 5.30 | 26 | 6.35 |
| 3 | 4.95 | 11 | 5.20 | 19 | 5.50 | 27 | 6.60 |
| 4 | 5.10 | 12 | 5.40 | 20 | 5.45 | 28 | 6.15 |
| 5 | 4.85 | 13 | 5.25 | 21 | 5.30 | 29 | 6.05 |
| 6 | 4.75 | 14 | 5.30 | 22 | 5.30 | 30 | 6.20 |
| 7 | 4.70 | 15 | 5.35 | 23 | 5.40 | 31 | 5.95 |
| 8 | 4.30 | 16 | 5.65 | 24 | 5.62 | | |

### WISCONSIN RIVER AT MERRILL, WIS.

This station was established November 17, 1902, by L. R. Stockman. It is located on the highway bridge at the east end, in the city of Merrill, Wis., three blocks from the court-house. The gage is a plain staff, graduated to feet and tenths. It is fastened to the mill abutment, and is read twice daily by A. F. Lueck. The channel is straight both above and below the station. The right bank is high and the left bank is low. The river very seldom overflows its banks. The bed of the river is rocky and gravelly. The bench mark is a cross, cut in the seat of the abutment nearest to the city. Elevation, 1,000. The initial point of sounding is a nail in the footboard on the left bank of the bridge. Elevation of zero of gage is 983.75.

The following discharge measurements were made during 1902:

November 17: Gage height, 7.6 feet; discharge, 9,015 second-feet.
December 10: Gage height, 3.8 feet; discharge, 1,394 second-feet.

*Daily gage height, in feet, of Wisconsin River at Merrill, Wis.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 10 | ..... | 4.00 | 18 | 2.50 | 3.90 | 26 | 0.55 | 3.95 |
| 11 | ..... | 3.95 | 19 | 2.50 | 3.85 | 27 | .15 | 3.90 |
| 12 | ..... | 4.00 | 20 | 1.90 | 4.05 | 28 | .10 | 3.85 |
| 13 | ..... | 4.00 | 21 | 1.85 | 3.80 | 29 | .10 | 3.70 |
| 14 | ..... | 3.85 | 22 | 1.55 | 3.80 | 30 | ..... | 3.70 |
| 15 | ..... | 3.65 | 23 | 1.50 | 3.75 | 31 | ..... | 3.65 |
| 16 | 3.55 | 3.85 | 24 | .90 | 3.85 | | | |
| 17 | 3.35 | 3.85 | 25 | 1.10 | 4.05 | | | |

## ROCK RIVER DRAINAGE BASIN.

Rock River rises in the northern part of Dodge County, Wis. It flows southwest across Jefferson and Rock counties to the Illinois border; thence it flows across the northwestern portion of Illinois, emptying into the Mississippi a little below Rock Island. Its principal tributary is Catfish River, which rises in Lake Mendota and enters the Black near Jamestown, Wis. The United States Geological Survey maintains a river station on Catfiish River at Madison, and gage heights of Lake Mendota are also taken at the same place.

### CATFISH RIVER AT MADISON, WIS.

This station was established December 18, 1902, by L. R. Stockman. The gage is located on the lower side of the Main Street bridge. An additional gage is maintained a few blocks away at the outlet of Lake Mendota, in order to keep a record of its water surface. Both

gages are plain staffs, graduated to feet and tenths. That on the bridge is nailed to the middle pier. Both gages are read once daily by James Mackin. The channel is straight both above and below the gaging station for over 1,000 feet, and the river is confined to its banks.

Bench mark No. 1, elevation assumed 1,000 feet, water table at the northwest corner of Nievuhr's saloon. Bench mark No. 2, elevation 1,004.46 feet, water table at the west corner of Hausmann's malt house. The 17-foot mark on gage at Main Street bridge has an elevation of 992.15 feet. The 16-foot mark on gage in Lake Mendota has an elevation of 997.27 feet, or 7.19 feet below bench mark No. 2. The 16-foot mark at the dam is 6.12 feet above the 16-foot mark of Main street gage.

The following discharge measurement was made in 1902:

December 18: Gage height, 13.9 feet; discharge, 60 second-feet.

*Daily gage height, in feet, of Catfish River at Madison, Wis.*

| Day. | Dec. | Day. | Dec. | Day. | Dec. | Day. | Dec. |
|---|---|---|---|---|---|---|---|
| 1902. | | 1902. | | 1902. | | 1902. | |
| 18 | 13.9 | 22 | 13.9 | 26 | 14.3 | 30 | 14.3 |
| 19 | 13.9 | 23 | 14.0 | 27 | 14.3 | 31 | 14.3 |
| 20 | 13.9 | 24 | 14.1 | 28 | 14.3 | | |
| 21 | 13.9 | 25 | 14.1 | 29 | 14.3 | | |

## ILLINOIS RIVER DRAINAGE BASIN.

Illinois River is formed by the Desplaines and Kankakee rivers, which unite about 4 miles below the point where Dupage River enters the Desplaines. The principal tributaries to these rivers are Vermilion River, which enters the Illinois proper a short distance below Lasalle; Sangamon River; Dupage River, which enters the Desplaines below Joliet; Mazon River, which enters the Illinois near Morris, and Fox River. In the latter part of 1902 M. O. Leighton visited this section in company with E. H. Heilbron, an engineer of the Chicago sanitary district. Mr. Heilbron was afterwards appointed resident hydrographer, and several stations were established, but on account of the closing of the rivers by ice soon after, few gage heights and discharge measurements were obtained during 1902. The following list gives the stations at which during 1903 measurements will be made. The descriptions of the following stations will be found on the following pages: Illinois River at Peoria, Illinois River at Lasalle, Illinois River at Ottawa, Fox River at Ottawa, Illinois River near Seneca, Illinois River near Minooka, Desplaines River near Channahon, Desplaines River above mouth of Jackson Creek near Channahon.

ILLINOIS RIVER NEAR PEORIA, ILL.

This station was originally established by Jacob Harmon. It was reestablished March 10, 1903, by E. H. Heilbron. It is located on the Peoria and Pekin Union Railroad bridge over the Illinois River, 1½ miles southwest of Peoria, Ill., and can be reached by street cars. The gage is a plain staff graduated to feet and tenths and fastened to the central pier of the bridge. It is read twice daily by the superintendent of the bridge, William Carrothers. The measurements are taken from the bridge, and the initial point for sounding is on the right bank. The river is straight for 3,000 feet above and 2,000 feet below the station. The right bank is high, and the railroad embankment is along this shore. The left bank is low and liable to overflow. The bed of the stream is composed of gravel. The bench mark is the southwest corner of the top stone of the west abutment of the bridge; elevation, 126.8 feet (approximately) below the Chicago datum. The gage at this point has for its zero a point 153.814 feet below the Chicago city datum. The gage reads up from this point, and in order to obtain the height of the river, referred to the Chicago datum, it is necessary to subtract the gage reading from 153.814 feet.

ILLINOIS RIVER AT LASALLE, ILL.

This station was established November 23, 1902, by E. H. Heilbron. It is located at the highway bridge at Shipping Sport, 1½ miles southeast of the Chicago, Rock Island and Pacific Railroad depot, Lasalle, Ill. The gage is a plain staff graduated to feet and tenths, and fastened to the southwest corner of the south pier of the bridge. The observer is James Desper, who reads the gage twice daily. The gagings are taken from the bridge, and the initial point for sounding is on the left bank. The channel is straight for a thousand feet above the station and slightly curved for a thousand feet below the station. The right bank is low and is overflowed at extreme high water. The left bank is high. The bed of the stream is composed of gravel. The Big and Little Vermilion rivers enter the Illinois just above this station. Bench mark No. 1 is at the east end of the north abutment on the second stone step from the east wing wall. It is a square marked "U. S." cut in the stone. Elevation, 114.704 feet below the Chicago datum. Bench mark No. 2 is at the east end of the south pier and is a square marked "U. S." cut in the stone. Elevation, 113.243 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

ILLINOIS RIVER AT OTTAWA, ILL.

This station is located at the Chicago, Burlington and Quincy Railroad bridge at Ottawa, Ill., below the mouth of Fox River. It was

established November 11, 1902, by E. H. Heilbron. The gage is a plain staff graduated to feet and tenths, and fastened to the center pier of the bridge, and is read twice daily by D. C. Woods. The channel is straight for a thousand feet above and below the station. The banks of the river are made up of the railroad embankment. The bed of the stream is composed of gravel. The bench mark is "U. O S." cut in the east point of the north pier of the Chicago, Burlington and Quincy Railroad bridge. Elevation, 48.638 feet above the Hennepin datum, and 103.156 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

### FOX RIVER AT OTTAWA, ILL.

This station was established November 10, 1902, by E. H. Heilbron. It is located at the Main street highway bridge over Fox River at Ottawa, Ill. The gage is a plain staff fastened to the abutment of the bridge, graduated to feet and tenths, and is read twice daily by D. C. Woods. The measurements are taken from the bridge. The channel is straight for 300 feet above and 600 feet below the station. The banks are both high. The bed of the stream is rock and gravel. The bench mark is the top step of the east concrete abutment of the street railway bridge over Fox River at Main street, Ottawa, Ill. It is on the south wing wall at the south end of the parapet wall. Elevation, 99.940 feet below the Chicago city datum, and 51.854 feet above the Hennepin datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

### ILLINOIS RIVER NEAR SENECA, ILL.

This station was established November 9, 1902, by E. H. Heilbron. It is located at the Kansas and Southern Railroad bridge, 2 miles from Seneca, Ill. The gage is a vertical staff graduated to feet and tenths and fastened to the center pier of the bridge. It is read twice daily by Augusta Ebeling. The measurements are taken from the bridge. The initial point for sounding is on the left bank. The channel is straight both above and below the station. Both banks of the stream are high. The bed of the stream is composed of gravel. The bench mark is a cut in the southwest corner of the south abutment of the Kansas and Southern Railroad bridge marked ⊙ S. D. B. M. Elevation, 77.220 feet below the Chicago city datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established to show the discharge of the Mazon River, which enters the Illinois a short distance above the station.

ILLINOIS RIVER NEAR MINOOKA, ILL.

This station was established November 7, 1902, by E. H. Heilbron. It is located at the Elgin, Joliet and Eastern Railroad bridge, which crosses the river a short distance below the Kankakee cut-off and 5 miles south of Minooka, Ill. The gage is a plain staff fastened to the center pier of the bridge and graduated to feet and tenths. It is read twice daily by Jesse A. Lyons. The measurements are taken from a cable and boat. The initial point for sounding is on the left bank. The channel is straight for 1,000 feet above the station and 2,000 feet below. The right bank is low and liable to overflow. The left bank is high. The bed of the stream is gravel. The bench mark is a cut in the stone on the south abutment of the Elgin, Joliet and Eastern Railroad bridge. It is marked S. D. ⊡ P. B. M. Its elevation is 85.030 feet above the Hennepin datum and 66.764 feet below the Chicago city datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established to determine the flow of Kankakee River.

DESPLAINES RIVER ABOVE THE MOUTH OF KANKAKEE RIVER, NEAR CHANNAHON, ILL.

This station was established October 24, 1902, by E. H. Heilbron. It is located just above the mouth of the Kankakee cut-off, and 2 miles below the mouth of Dupage River, near Channahon, Ill. The gage is a plain staff graduated to feet and tenths and nailed to a tree. It is read twice daily by E. A. Himes. The measurements are taken from a cable and boat. The initial point for sounding is on the left bank. The channel is straight for a thousand feet above the station and slightly curved for a thousand feet below. The right bank is high and rocky, and the I. and M. Canal runs along the bank. The left bank is high, and the Kankakee cut-off enters the river just below the gaging station. The bed of the stream is gravel. Bench mark No. 1 is a nail driven into the north side of an elm tree about 2 inches in diameter, on the Illinois and Michigan Canal towpath, 150 feet north of the Kankakee cut-off. Elevation, 81.501 feet above the Hennepin datum and 70.293 feet below the Chicago city datum. Bench mark No. 2 is a nail in the east root of an elm tree on the east bank of Desplaines River, 50 feet east of the water edge and 200 feet north of the Kankakee cut-off, opposite the point where the I. and M. Canal and Desplaines River are separated. Elevation, 74.204 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established in order to determine the flow of Dupage River.

### DESPLAINES RIVER ABOVE THE MOUTH OF JACKSON CREEK, NEAR CHANNAHON, ILL.

This station was established October 23, 1902, by E. H. Heilbron. It is located just above the mouth of Jackson Creek, 2½ miles southwest of Millsdale, Ill. The gage is a vertical staff graduated to feet and tenths, and is read daily by Ruth Alexander. The measurements are taken from a cable and boat. The initial point for sounding is a red hub, driven in the ground on the left bank near the end of the cable. The channel is straight for about 3,000 feet both above and below the station. Both banks of the stream are low and liable to overflow, but a few feet from the top of the banks on either side are high ridges, which never overflow. Measurements can be made at all stages. The bed of the stream is gravel. The bench mark is the top of a red-oak hub (the initial point for sounding) driven in the bluff between Jackson Creek and the south bank of the Desplaines River. It is about 300 feet west of the west line of sec. 15, T. 37 N., R. 9 E., third principal meridian, and is on the farm owned by George Alexander. Elevation, 64.262 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum. This station was located to give the discharge of the upper Desplaines River.

## WABASH RIVER DRAINAGE BASIN.

The drainage basin of the Wabash embraces an area of about 33,000 square miles, distributed as follows: In Ohio, 400 square miles; in Indiana, 24,350 square miles; in Illinois, 8,250 square miles. It drains, therefore, slightly more than two-thirds of Indiana, the area of the State being 35,910 square miles. Of the portion in Indiana, about one-half is embraced in the drainage areas of the East and West White rivers. By including these drainage areas with the Wabash, the entire basin has a nearly symmetrical, broadly ovate form. Not including the White River system, the Wabash Basin is an unsymmetrical, elongated tract, curving around White River.

The length of the valley occupied by the Wabash is about 450 miles, but the length of the stream is fully 500 miles, for the river in its lower course makes several oxbow curves within the valley. The source of the river is about 1,000 feet above tide, while its mouth at low water is but 311 feet. The average fall, if we estimate the stream to have a length of 500 miles, is therefore about 16.5 inches per mile. The rate of descent is far from uniform, being much more rapid in the upper portion than in the lower. There are also many rapids, separated by pools or sluggish portions of the stream. The elevation of the stream is accurately determined at many points, but in the absence of a careful measurement of the length of the stream the rate of fall

is only approximately known. The section above the point where the river enters the old lake outlet, estimated to have a length of 100 miles, has a fall of about 300 feet, or 3 feet per mile. Railway levels and canal surveys at the point where the river joins the old lake outlet show its elevation to be nearly 700 feet above sea level, the altitudes reported varying between 696 and 699 feet.

The following table gives the elevation and fall at various points in this basin:

*Tables of altitudes and distances along Wabash River.*

| Location. | Estimated distance. | Altitude. | Fall per mile. |
|---|---|---|---|
| | *Miles.* | *Feet.* | *Feet.* |
| Source | 0.0 | 1,000.0 | 0.00 |
| Huntington | 100.0 | 699.0 | 36.00 |
| Mouth of Salamonie River | 15.0 | 667.0 | 25.56 |
| Mouth of Mississinewa River | 20.0 | 633.0 | 20.40 |
| Lógansport | 20.0 | 583.0 | 30.00 |
| Lafayette | 50.0 | 506.0 | 18.48 |
| Attica | 25.0 | 487.0 | 9.12 |
| Covington | 20.0 | 470.0 | 10.20 |
| Terre Haute | 55.0 | 447.7 | 4.80 |
| State line | 14.6 | 440.6 | 5.80 |
| Hutsonville, Ill | 29.0 | 424.6 | 6.60 |
| Vincennes | 46.4 | 398.8 | 6.60 |
| Mouth of White River | 32.5 | 376.5 | 8.30 |
| Grayville, Ill | 28.0 | 365.0 | 5.00 |
| Mouth of Little Wabash | 46.0 | 323.0 | 11.00 |
| Mouth of Wabash River | 16.0 | 311.0 | 9.00 |

During 1902 the United States Geological Survey maintained stations in this basin at Terre Haute and at Lafayette, Ind.

### WABASH RIVER AT TERRE HAUTE, IND.

Gage heights of the Wabash River have been observed at the Terre Haute water works since August 2, 1902, by D. M. Raubarger, as shown in the following table:

*Daily gage height, in feet, of Wabash River at Terre Haute, Ind.*

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | 1902. | | | | | |
| 1 | ..... | 0.60 | 5.00 | 1.00 | 4.10 | 17 | 2.65 | 0.30 | 3.45 | 3.35 | 8.50 |
| 2 | ..... | .55 | 5.25 | 1.00 | 4.70 | 18 | 2.60 | .40 | 2.55 | 3.14 | 9.15 |
| 3 | 5.20 | .50 | 5.00 | 1.00 | 6.40 | 19 | 2.30 | .35 | 2.80 | 4.40 | 9.55 |
| 4 | 5.15 | .50 | 5.85 | 1.00 | 7.40 | 20 | 2.65 | .40 | 2.50 | 5.15 | 10.40 |
| 5 | 4.20 | .45 | 6.90 | 1.20 | 7.60 | 21 | 2.80 | .35 | 2.65 | 5.80 | 12.80 |
| 6 | 5.05 | .70 | 7.35 | 1.50 | 8.90 | 22 | 2.85 | .30 | 2.45 | 5.20 | 14.35 |
| 7 | 4.45 | .90 | 7.65 | 1.90 | 8.40 | 23 | 2.50 | .30 | 2.80 | 4.85 | 15.30 |
| 8 | 4.05 | .75 | 8.65 | 2.60 | 6.65 | 24 | 2.15 | .40 | 2.55 | 4.25 | 15.65 |
| 9 | 3.75 | .50 | 8.00 | 3.20 | 5.85 | 25 | 1.80 | 2.80 | 2.10 | 3.90 | 15.10 |
| 10 | 3.05 | .30 | 6.70 | 3.25 | 4.95 | 26 | 1.55 | 3.80 | 1.90 | 3.45 | 16.00 |
| 11 | 2.90 | .20 | 5.70 | 3.30 | 4.65 | 27 | 1.20 | 2.80 | 1.60 | 3.30 | 15.35 |
| 12 | 2.50 | .25 | 4.45 | 4.05 | 5.60 | 28 | 1.50 | 4.50 | 1.60 | 2.50 | 14.50 |
| 13 | 2.30 | .10 | 3.50 | 4.00 | 5.75 | 29 | .95 | 4.80 | 1.45 | 2.80 | 9.30 |
| 14 | 2.30 | .45 | 3.45 | 4.00 | 6.30 | 30 | .80 | 3.60 | 1.35 | 5.40 | 7.40 |
| 15 | 2.40 | .35 | 3.50 | 3.75 | 5.70 | 31 | .80 | ..... | 1.15 | ..... | 6.80 |
| 16 | 2.70 | .40 | 4.10 | 3.45 | 8.40 | | | | | | |

WABASH RIVER AT LAFAYETTE, IND.

This station was established May 2, 1901, by George E. Waesche, and is carried on in connection with the Civil Engineering College of Purdue University. It is about one-half mile above Brown street bridge, Lafayette, Ind., and about one-fourth mile below the West Lafayette Pumping Station. The gage is on the left bank and is in two parts. The lower portion is a 2-inch by 4-inch white pine plank, graduated to feet and hundredths, extending down into an 18-inch sewer pipe, into which the water from the river is admitted. The upper portion of the gage is graduated to feet and tenths and is nailed to a large sycamore tree.

The measurements are made by means of a boat held in place by a wire cable. The cable is adjustable so that it can be placed at any height above the surface of the water. The initial point for sounding is a gas-pipe plug set firmly in the west bank 25 feet east of the pole which supports the west end of the cable. The channel is straight both above and below the station, and is unobstructed except for a small sand bar at the mouth of a small stream which enters the river 1,500 feet above the station. The current is uniform. The banks are low and overflow at high water. The bed of the stream is a gravelly mixture, comparatively smooth, and slightly shifting. The bench mark is the head of a brass rod embedded in a block of concrete placed about 150 feet upstream from the gage. Its elevation is 515.046 feet above sea level and 14.31 feet above the zero of the gage. The gage is read by the students of Purdue University.

*List of discharge measurements of Wabash River at Lafayette, Ind.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1901. | | *Feet.* | *Second-feet.* |
| May 9 | S. A. Coffin and H. B. Holman | 2.70 | 3,850 |
| May 15 | .....do | 2.13 | 2,832 |
| May 20 | .....do | 1.63 | 2,212 |
| Sept. 28 | G. H. Cook and L. W. Dinsmore | .36 | 530 |
| Oct. 4 | .....do | .31 | 497 |
| Nov. 9 | .....do | .75 | 887 |
| 1902. | | | |
| Mar. 22 | G. H. Cook and L. W. Dinsmore | 3.50 | 5,244 |
| Mar. 24 | .....do | 1.40 | 1,822 |
| May 3 | .....do | 2.00 | 2,496 |
| June 4 | Geo. E. Waesche | 7.35 | 11,692 |
| June 4 | .....do | 7.35 | 12,160 |
| July 26 | .....do | 3.12 | 3,953 |
| July 26 | .....do | 3.12 | 4,089 |

*Daily gage height, in feet, of Wabash River at Lafayette, Ind.*

| Day. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | |
| 1 | ..... | 1.52 | 5.30 | 2.90 | 6.10 | 2.05 | 0.32 | 0.56 | 0.33 | 0.84 | 0.87 |
| 2 | 1.65 | 1.72 | 5.35 | 2.65 | 5.20 | 1.80 | .30 | .55 | .31 | .82 | .88 |
| 3 | 2.10 | 3.10 | 4.85 | 2.50 | 4.22 | 1.55 | .29 | .54 | .31 | .81 | .88 |
| 4 | 2.18 | 4.25 | 5.37 | 2.46 | 3.20 | 1.50 | .28 | .55 | .31 | .80 | .87 |
| 5 | 1.90 | 4.90 | 4.70 | 2.30 | 3.05 | 1.55 | .27 | .54 | .31 | .81 | .85 |
| 6 | 1.80 | 4.70 | 3.88 | 2.16 | 3.47 | 1.52 | .28 | .54 | .34 | .83 | .85 |
| 7 | 1.78 | 4.45 | 3.47 | 2.25 | 3.44 | 1.40 | .28 | .55 | .38 | .82 | .85 |
| 8 | 1.80 | 5.15 | 3.67 | 2.30 | 3.02 | 1.25 | .27 | .56 | .40 | .79 | .93 |
| 9 | 1.80 | 5.92 | 3.75 | 2.40 | 2.73 | 1.12 | .26 | .57 | .41 | .77 | .97 |
| 10 | 1.78 | 11.70 | 3.45 | 2.75 | 2.45 | 1.02 | .26 | .57 | .43 | .78 | 1.10 |
| 11 | 1.77 | 16.65 | 3.22 | 2.78 | 2.12 | .98 | .27 | .57 | .45 | .85 | 1.20 |
| 12 | 1.67 | 17.22 | 3.00 | 2.82 | 1.97 | .97 | .26 | .58 | .90 | .87 | 1.30 |
| 13 | 1.62 | 16.15 | 2.82 | 2.60 | 1.90 | .90 | .25 | .59 | 1.85 | .88 | 2.25 |
| 14 | 1.61 | 14.64 | 2.72 | 2.30 | 1.75 | .85 | .25 | .56 | 2.25 | .86 | 4.20 |
| 15 | 1.60 | 13.00 | 2.85 | 2.20 | 1.58 | .77 | .24 | .50 | 3.65 | .88 | 5.40 |
| 16 | 1.60 | 11.20 | 2.87 | 2.05 | 1.50 | .73 | .25 | .50 | 3.31 | .88 | 5.10 |
| 17 | 1.68 | 9.51 | 2.87 | 1.83 | 1.48 | .71 | .25 | .49 | 2.84 | .88 | 6.62 |
| 18 | 2.13 | 9.65 | 3.50 | 1.72 | 1.38 | .69 | .24 | .46 | 2.43 | .86 | 6.80 |
| 19 | 2.15 | 8.85 | 6.30 | 1.68 | 1.47 | .70 | .25 | .43 | 2.03 | .84 | 6.26 |
| 20 | 2.58 | 8.55 | 8.30 | 1.70 | 1.78 | .69 | .26 | .44 | 1.78 | .83 | 6.17 |
| 21 | 2.50 | 8.87 | 8.15 | 1.68 | 2.68 | .61 | .27 | .45 | 1.57 | .85 | 6.15 |
| 22 | 2.10 | 7.70 | 7.40 | 1.70 | 3.55 | .56 | .27 | .46 | 1.40 | .86 | 6.15 |
| 23 | 2.27 | 6.70 | 5.45 | 1.77 | 3.40 | .52 | .28 | .45 | 1.28 | .88 | 6.13 |
| 24 | 2.20 | 7.00 | 5.21 | 1.83 | 2.97 | .48 | .26 | .43 | 1.18 | .88 | 6.07 |
| 25 | 2.04 | 10.50 | 5.80 | 2.04 | 2.60 | .46 | .30 | .41 | 1.11 | .88 | 6.05 |
| 26 | 1.82 | 12.95 | 5.50 | 2.60 | 2.40 | .41 | .78 | .41 | 1.04 | .89 | 6.04 |
| 27 | 1.70 | 11.40 | 4.80 | 2.63 | 2.41 | .39 | .73 | .40 | 1.00 | .90 | 5.98 |
| 28 | 1.61 | 9.25 | 4.20 | 2.58 | 2.53 | .39 | .70 | .38 | .96 | .89 | 5.95 |
| 29 | ..... | 7.32 | 3.80 | 4.65 | 2.65 | .39 | .68 | .36 | .93 | .88 | 5.93 |
| 30 | ..... | 6.06 | 3.30 | 7.80 | 2.32 | .37 | .55 | .35 | .91 | .87 | 5.80 |
| 31 | ..... | 5.10 | ..... | 7.10 | ..... | .35 | .56 | ..... | .88 | ..... | 5.65 |

*Daily gage height, in feet, of Wabash River at Lafayette, Ind.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 5.40 | ..... | ..... | 7.50 | 1.85 | 1.60 | 17.85 | 5.80 | 1.20 | 5.60 | 1.91 | 3.25 |
| 2 | 5.30 | ..... | ..... | 5.95 | 1.95 | 1.75 | 17.35 | 5.92 | 1.37 | 5.28 | 1.87 | 4.50 |
| 3 | 4.65 | ..... | ..... | 5.05 | 1.85 | 3.65 | 16.35 | 4.40 | 1.62 | 4.58 | 1.83 | 6.25 |
| 4 | 3.65 | ..... | ..... | 4.20 | 2.10 | 7.05 | 15.60 | 3.60 | 1.60 | 5.80 | 1.78 | 8.00 |
| 5 | 3.50 | ..... | ..... | 3.90 | 2.15 | 6.93 | 13.60 | 3.00 | 1.38 | 7.15 | 1.79 | 7.70 |
| 6 | 3.15 | ..... | ..... | 3.75 | 2.35 | 6.10 | 11.10 | 2.75 | 1.24 | 7.60 | 2.12 | 6.04 |
| 7 | 3.00 | ..... | ..... | 3.60 | 2.60 | 5.73 | 9.10 | 2.55 | 1.12 | 6.72 | 2.78 | 5.20 |
| 8 | 2.85 | ..... | ..... | 3.50 | 2.50 | 6.95 | 8.70 | 2.40 | 1.13 | 5.65 | 3.00 | 4.66 |
| 9 | 2.75 | ..... | ..... | 3.30 | 2.45 | 8.37 | 7.50 | 2.22 | 1.10 | 4.81 | 2.76 | 3.92 |
| 10 | 2.65 | ..... | ..... | 3.00 | 2.35 | 6.55 | 6.75 | 2.10 | 1.08 | 4.25 | 2.53 | 3.45 |
| 11 | 2.55 | ..... | ..... | 2.85 | 2.10 | 5.55 | 5.80 | 2.05 | 1.09 | 4.12 | 2.75 | 3.56 |
| 12 | 2.00 | ..... | ..... | 2.65 | 1.90 | 5.00 | 5.00 | 1.88 | 1.14 | 3.72 | 3.19 | 3.74 |
| 13 | 1.80 | ..... | ..... | 2.40 | 1.80 | 4.40 | 4.34 | 1.75 | 1.16 | 3.73 | 3.33 | 3.85 |
| 14 | 1.80 | ..... | ..... | 2.20 | 1.70 | 4.60 | 3.87 | 1.72 | 1.24 | 4.50 | 3.15 | 3.65 |
| 15 | 1.80 | ..... | ..... | 2.05 | ..... | 5.05 | 3.60 | 1.70 | 1.28 | 4.12 | 3.08 | 3.75 |
| 16 | 1.85 | ..... | ..... | 1.90 | ..... | 5.20 | 2.95 | 1.54 | 1.36 | 3.38 | 3.04 | 4.90 |
| 17 | 1.80 | ..... | ..... | 1.80 | ..... | 4.45 | 2.65 | 1.40 | 1.18 | 3.08 | 3.18 | 7.70 |
| 18 | 1.80 | ..... | ..... | 1.75 | 1.56 | 3.57 | 2.60 | 1.30 | 1.14 | 2.85 | 4.20 | 9.12 |
| 19 | 1.75 | ..... | 5.00 | 1.70 | ..... | 3.00 | 2.70 | 1.21 | 1.10 | 2.82 | 5.68 | 8.35 |
| 20 | 1.75 | ..... | 4.50 | 1.60 | ..... | 2.50 | 4.80 | 1.67 | 1.05 | 3.20 | 5.53 | 7.95 |
| 21 | 1.65 | ..... | 3.70 | 1.60 | 1.75 | 2.05 | 5.50 | 1.92 | 1.02 | 3.24 | 5.80 | 10.70 |
| 22 | 1.60 | ..... | 3.50 | 1.60 | 1.90 | 1.87 | 5.00 | 1.80 | 1.05 | 3.08 | 4.30 | 14.38 |
| 23 | 1.60 | ..... | 3.30 | 1.45 | 2.00 | 1.94 | 4.35 | 1.60 | 1.32 | 2.77 | 3.82 | 15.46 |
| 24 | 1.60 | ..... | 2.95 | 1.40 | ..... | 1.78 | 4.20 | 1.40 | 2.02 | 2.50 | 3.37 | 14.40 |
| 25 | ..... | ..... | 2.75 | 1.40 | ..... | 2.00 | 3.65 | 1.31 | 3.15 | 2.30 | 3.07 | 11.75 |
| 26 | ..... | ..... | 2.50 | 1.38 | ..... | 2.12 | 3.08 | 1.25 | 4.92 | 2.22 | 2.95 | 9.14 |
| 27 | ..... | ..... | 2.40 | 1.40 | ..... | 2.00 | 2.80 | 1.20 | 4.75 | 2.18 | 2.84 | 7.90 |
| 28 | ..... | ..... | 2.60 | 1.45 | ..... | 4.80 | 3.20 | 1.20 | 5.45 | 2.15 | 2.81 | 6.65 |
| 29 | ..... | ..... | 2.87 | 1.75 | ..... | 12.10 | 3.55 | 1.17 | 5.45 | 1.98 | 2.90 | 6.08 |
| 30 | ..... | ..... | 4.55 | 1.95 | ..... | 16.20 | 3.60 | 1.12 | 5.25 | 1.91 | 3.12 | 5.37 |
| 31 | ..... | ..... | 7.90 | ..... | ..... | ..... | 3.50 | 1.12 | ..... | 1.91 | ..... | 4.47 |

*Rating table for Wabash River at Lafayette, Ind., for 1901 and 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.00 | 260 | 1.75 | 2,160 | 3.50 | 5,080 | 6.00 | 9,780 |
| .25 | 430 | 2.00 | 2,550 | 3.75 | 5,560 | 7.00 | 11,660 |
| .50 | 645 | 2.25 | 2,940 | 4.00 | 6,020 | 8.00 | 13,540 |
| .75 | 880 | 2.50 | 3,340 | 4.25 | 6,490 | 9.00 | 15,420 |
| 1.00 | 1,170 | 2.75 | 3,760 | 4.50 | 6,960 | | |
| 1.25 | 1,490 | 3.00 | 4,180 | 4.75 | 7,430 | | |
| 1.50 | 1,810 | 3.25 | 4,620 | 5.00 | 7,900 | | |

*Estimated monthly discharge of Wabash River at Lafayette, Ind.*

[Drainage area, 7,314 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| January [a] | ---------- | ---------- | ---------- | ---------- | -------- |
| February 2 to 28 | 3,490 | 1,950 | 2,322 | 0.32 | 0.33 |
| March | 30,850 | 1,840 | 14,607 | 2.00 | 2.31 |
| April | 14,110 | 3,710 | 7,031 | .96 | 1.07 |
| May | 13,170 | 2,060 | 3,686 | .50 | .58 |
| June | 9,970 | 1,650 | 3,777 | .52 | .58 |
| July | 2,630 | 510 | 1,098 | .15 | .17 |
| August | 930 | 430 | 518 | .07 | .08 |
| September | 730 | 510 | 638 | .09 | .10 |
| October | 5,370 | 480 | 1,571 | .21 | .24 |
| November | 1,060 | 910 | 1,003 | .14 | .16 |
| December | 11,280 | 1,000 | 6,121 | .84 | .97 |
| 1902. | | | | | |
| January 1 to 24 [a] | ---------- | ---------- | 3,596 | 0.49 | 0.44 |
| February [a] | ---------- | ---------- | ---------- | ---------- | -------- |
| March 19 to 31 [a] | ---------- | ---------- | 5,567 | .76 | .37 |
| April | 12,600 | 1,650 | 3,771 | .52 | .58 |
| May 1 to 14; 18, 21, 22, 23 [a] | ---------- | ---------- | 2,632 | .36 | .24 |
| June | 28,950 | 2,230 | 7,708 | 1.05 | 1.17 |
| July | 32,050 | 3,510 | 10,924 | 1.49 | 1.72 |
| August | 9,620 | 1,320 | 2,882 | .39 | .45 |
| September | 8,740 | 1,190 | 2,706 | .37 | .41 |
| October | 12,780 | 2,410 | 5,796 | .79 | .91 |
| November | 9,410 | 2,210 | 4,530 | .62 | .69 |
| December | 27,550 | 4,620 | 11,587 | 1.58 | 1.82 |

[a] Missing record due to ice.

## MUSKINGUM RIVER DRAINAGE BASIN.

Muskingum River is formed by the junction of Walhonding and Tuscarawas rivers in the east central part of Ohio; flows south, and enters Ohio River at Marietta, Ohio. In this drainage basin the United States Geological Survey has two stations—one on Jonathan Creek at Powells, Ohio, and the other on Licking River at Pleasant Valley, Ohio. These two streams enter the main river near Zanesville. The hydrographic work during 1902 was under the direction of the late B. H. Flynn.

### JONATHAN CREEK AT POWELLS, OHIO.

Jonathan Creek flows into Muskingum River a short distance below Zanesville, Ohio.

The gaging station at Powells was established November 15, 1902, by Benjamin H. Flynn. It is located on the railroad bridge one-fourth of a mile north of the railroad station. The gage is a plain staff graduated to feet and tenths. The channel is straight both above and below the station. The river is confined to its channel by the railroad embankments. The bed of the stream is rocky. Low-water discharge measurements are made by wading; high-water measurements, from the bridge. The bench mark is a cut on the downstream side of the wing wall of the left abutment; elevation, 7 feet above the zero of the gage.

The following discharge measurements were made during 1902:

November 15: Gage height, 0.80 feet; discharge, 19 second-feet.
December 12: Gage height, 2.18 feet; discharge, 702 second-feet.

*Daily gage height, in feet, of Jonathan Creek at Powells, Ohio.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | ..... | 0.90 | 12 | ..... | 2.70 | 23 | 1.00 | 1.40 |
| 2 | ..... | .90 | 13 | ..... | 2.20 | 24 | .90 | 1.00 |
| 3 | ..... | 1.70 | 14 | ..... | 1.80 | 25 | 1.00 | .90 |
| 4 | ..... | 1.00 | 15 | ..... | 1.30 | 26 | 1.00 | .90 |
| 5 | ..... | 1.00 | 16 | 0.80 | 8.00 | 27 | 1.00 | 1.40 |
| 6 | ..... | 1.00 | 17 | .80 | 2.70 | 28 | .90 | 1.40 |
| 7 | ..... | .90 | 18 | 1.30 | 1.80 | 29 | .90 | 1.10 |
| 8 | ..... | .90 | 19 | .95 | 1.60 | 30 | .90 | 1.00 |
| 9 | ..... | .90 | 20 | .90 | 1.30 | 31 | ..... | 1.40 |
| 10 | ..... | .90 | 21 | .85 | 1.60 | | | |
| 11 | ..... | 1.00 | 22 | .95 | 1.70 | | | |

### LICKING RIVER AT PLEASANT VALLEY, OHIO.

Licking River flows into the Muskingum at Zanesville.

The gaging station at Pleasant Valley was established November 14, 1902, by Benjamin H. Flynn. It is located at the highway bridge 300 feet north of the railroad station at Pleasant Valley, Ohio. The lower part of the gage is inclined and spiked to a post driven into the bank. The upper part is vertical and spiked to a tree. It is graduated to read direct to feet and tenths. The channel is straight for 200 feet above and 300 feet below the station. The banks are high and not liable to overflow except in extreme floods. The bed of the stream is gravel and clay. The low-water measurements are made by wading and the high-water measurements from the highway bridge. There are three bench marks. The first is a copper nail on the gage tree; elevation, 13 feet above the zero of the gage. The second is some copper nails on a walnut tree 200 feet west of the gage; elevation, 15 to 17 feet above the zero of the gage. The third consists of copper nails on a

telephone pole north of the tree; elevation, 13 to 16 feet above the zero of the gage. The initial point for sounding is a cross on the top stone of the down stream side of the right abutment of the highway bridge.

The following discharge measurements were made during 1902:

November 14: Gage height, 1.58 feet; discharge, 121 second-feet.
December 13: Gage height, 5.49 feet; discharge, 2,281 second-feet.

*Daily gage height, in feet, of Licking River at Pleasant Valley, Ohio.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | ..... | 2.50 | 12 | ..... | 7.00 | 23 | 2.00 | 3.80 |
| 2 | ..... | 2.30 | 13 | ..... | 5.70 | 24 | 2.00 | 4.00 |
| 3 | ..... | 2.80 | 14 | 1.60 | 5.60 | 25 | 2.10 | 3.90 |
| 4 | ..... | 4.00 | 15 | 1.60 | 4.50 | 26 | 2.40 | 3.00 |
| 5 | ..... | 3.30 | 16 | 1.50 | 9.60 | 27 | 2.70 | 3.00 |
| 6 | ..... | 3.00 | 17 | 1.50 | 11.40 | 28 | 2.90 | 2.70 |
| 7 | ..... | 2.70 | 18 | 3.70 | 6.50 | 29 | 2.80 | 2.70 |
| 8 | ..... | 2.70 | 19 | 3.30 | 4.90 | 30 | 2.50 | 2.60 |
| 9 | ..... | 2.60 | 20 | 2.60 | 4.00 | 31 | ..... | 2.60 |
| 10 | ..... | 2.60 | 21 | 2.30 | 3.90 | | | |
| 11 | ..... | 2.50 | 22 | 2.10 | 4.20 | | | |

## MONONGAHELA RIVER DRAINAGE BASIN.

Monongahela River rises in the central part of West Virginia and, flowing north, crosses into Pennsylvania. At Pittsburg it unites with the Allegheny, forming the Ohio. Its principal tributaries are the Youghiogheny, which flows into it about 15 miles above Pittsburg, and the Cheat, which joins it just north of the Pennsylvania line. Under the direction of E. G. Paul, the United States Geological Survey is maintaining a station on the Youghiogheny, at Friendsville, Md., and one on the Cheat, at Uneva, near Morgantown, W. Va.

### YOUGHIOGHENY RIVER AT FRIENDSVILLE, MD.

This river rises in Garrett County, Md., and flows in a northwesterly direction into Pennsylvania, where it empties into Monongahela River 15 miles above Pittsburg. Its source is on the western slope of the Allegheny Mountains, at an elevation of about 2,900 feet. The average fall of the stream for 19 miles above its mouth is about 2 feet per mile, but above this point it soon increases to an average fall of nearly 5 feet per mile. The bank height above low water ranges between 15 and 28 feet, and the average width between banks from the mouth to West Newton, Pa., is 546 feet. The following heights of the high water of February, 1897, above low-water stage, at various points in Pennsylvania, were furnished by George M. Lehman: Whikett, 13 feet; Jacobs Creek, 10 feet; Smithton, 14 feet; Port Royal, 17 feet; Snyder, 16 feet; West Newton, 20 feet; Suterville, 22 feet; Buena Vista, 26.5 feet; Coulterville, 28.5 feet; Boston, 29 feet; McKeesport, 28.5 feet.

A measurement of Youghiogheny River was made October 13, 1892, with surface floats, at Ohio Pyle, Pa., by Kenneth Allen, in connection with an investigation of a water supply for the works of the H. C. Frick Coke Company. It was during a period of extreme drought, and the discharge was found to be 106 second-feet.

The station at Friendsville, Md., was established by E. G. Paul, on August 17, 1898. Measurements are made from the iron highway bridge connecting the east and the west portion of the village. The wire gage is 20 feet from zero to the end of the weight, and is referred to a scale board 14 feet long, graduated to feet and tenths. The channel is straight for several hundred feet above and below the bridge. The bed is rocky and the banks are high and not subject to overflow. The observer is J. H. Cuppet, a merchant residing within a short distance of the gage.

The following discharge measurement was made in 1902 by R. B. Hayes:

August 22: Gage height, 4.4 feet; discharge, 208 second-feet.

*Daily gage height, in feet, of Youghiogheny River at Friendsville, Md.*

| Day | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 6.00 | 5.60 | 10.02 | 5.30 | 4.90 | 5.00 | 6.80 | 4.50 | 3.90 | 4.20 | 4.20 | 5.80 |
| 2 | 5.80 | 5.40 | 8.80 | 5.40 | 4.90 | 4.80 | 6.70 | 4.60 | 3.90 | 4.20 | 4.20 | 5.80 |
| 3 | 5.40 | 5.20 | 8.10 | 5.60 | 4.80 | 4.70 | 6.70 | 4.90 | 3.90 | 4.30 | 4.20 | 5.90 |
| 4 | 5.40 | 5.10 | 6.30 | 5.70 | 4.70 | 4.60 | 6.60 | 4.80 | 3.90 | 4.40 | 4.10 | 5.90 |
| 5 | 5.30 | 5.00 | 6.10 | 6.40 | 4.70 | 4.50 | 6.00 | 4.50 | 3.80 | 4.30 | 4.10 | 5.80 |
| 6 | 5.20 | 5.00 | 5.90 | 6.40 | 4.60 | 4.50 | 5.10 | 4.40 | 3.80 | 4.30 | 4.10 | 5.80 |
| 7 | 5.00 | 5.00 | 5.70 | 6.50 | 4.60 | 4.50 | 4.80 | 4.30 | 3.90 | 4.30 | 4.20 | 5.90 |
| 8 | 5.00 | 5.00 | 5.50 | 6.60 | 4.60 | 4.50 | 4.60 | 4.30 | 3.90 | 4.20 | 4.20 | 5.70 |
| 9 | 4.90 | 5.00 | 5.40 | 6.60 | 4.60 | 4.50 | 4.80 | 4.20 | 3.90 | 4.20 | 4.20 | 5.60 |
| 10 | 4.80 | 5.00 | 5.60 | 6.50 | 4.60 | 4.40 | 5.00 | 4.20 | 3.90 | 4.40 | 4.20 | 5.60 |
| 11 | 4.80 | 5.00 | 6.20 | 7.40 | 4.50 | 4.30 | 4.90 | 4.20 | 3.90 | 4.40 | 4.20 | 5.50 |
| 12 | 4.80 | 5.00 | 7.10 | 8.20 | 4.50 | 4.30 | 4.70 | 4.20 | 3.90 | 5.30 | 4.20 | 8.50 |
| 13 | 4.80 | 5.00 | 8.50 | 7.80 | 4.50 | 4.50 | 4.50 | 4.10 | 3.80 | 5.30 | 4.20 | 7.90 |
| 14 | 4.80 | 5.00 | 8.10 | 7.40 | 4.50 | 4.50 | 4.40 | 4.10 | 3.80 | 5.00 | 4.20 | 7.50 |
| 15 | 4.70 | 5.00 | 7.80 | 7.10 | 4.40 | 4.60 | 4.30 | 4.10 | 3.80 | 5.00 | 4.20 | 7.30 |
| 16 | 4.70 | 5.00 | 7.30 | 6.70 | 4.40 | 4.70 | 4.30 | 4.10 | 3.80 | 4.70 | 4.20 | 8.20 |
| 17 | 4.70 | 5.00 | 6.90 | 6.80 | 4.40 | 4.70 | 4.30 | 4.10 | 3.80 | 4.60 | 4.20 | 8.60 |
| 18 | 4.80 | 5.00 | 6.40 | 6.80 | 4.50 | 4.70 | 4.50 | 4.10 | 3.80 | 4.60 | 4.20 | 8.30 |
| 19 | 4.90 | 5.00 | 6.10 | 6.60 | 4.80 | 4.60 | 4.70 | 4.20 | 3.80 | 4.50 | 4.20 | 8.00 |
| 20 | 5.00 | 5.00 | 5.90 | 6.30 | 4.90 | 4.60 | 4.80 | 4.30 | 3.80 | 4.50 | 4.10 | 7.30 |
| 21 | 5.00 | 5.00 | 5.60 | 5.80 | 4.70 | 4.60 | 4.70 | 4.40 | 3.90 | 4.40 | 4.10 | 6.50 |
| 22 | 5.00 | 5.00 | 5.50 | 5.40 | 4.80 | 4.50 | 4.60 | 4.40 | 3.90 | 4.40 | 4.10 | 6.10 |
| 23 | 5.00 | 5.00 | 5.40 | 5.20 | 5.00 | 4.50 | 4.40 | 4.40 | 3.90 | 4.20 | 4.30 | 6.10 |
| 24 | 5.40 | 5.00 | 5.30 | 5.00 | 5.30 | 4.60 | 4.20 | 4.30 | 3.90 | 4.20 | 4.50 | 6.00 |
| 25 | 5.60 | 5.00 | 5.20 | 4.80 | 5.60 | 4.80 | 4.20 | 4.20 | 4.00 | 4.10 | 5.40 | 6.00 |
| 26 | 7.10 | 7.40 | 5.10 | 4.70 | 5.70 | 4.80 | 4.20 | 4.00 | 4.00 | 4.10 | 6.20 | 5.90 |
| 27 | 7.30 | 6.50 | 5.10 | 4.70 | 5.80 | 4.90 | 4.40 | 4.00 | 4.00 | 4.20 | 6.00 | 5.80 |
| 28 | 6.90 | 7.30 | 5.00 | 4.70 | 5.80 | 4.70 | 4.50 | 3.90 | 4.00 | 4.40 | 6.00 | 5.50 |
| 29 | 6.30 | ..... | 5.10 | 4.80 | 5.30 | 4.90 | 4.60 | 3.90 | 4.00 | 4.40 | 6.00 | 5.30 |
| 30 | 6.00 | ..... | 5.10 | 4.90 | 5.30 | 5.70 | 4.50 | 3.90 | 4.00 | 4.50 | 6.00 | 5.20 |
| 31 | 5.80 | ..... | 5.10 | ..... | 5.20 | ..... | 4.50 | 3.90 | ..... | 4.30 | ..... | 5.10 |

*Rating table for Youghiogheny River at Friendsville, Md., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 3.6 | 12 | 4.6 | 340 | 5.6 | 1,150 | 7.5 | 3,310 |
| 3.8 | 45 | 4.8 | 464 | 5.8 | 1,372 | 8.0 | 3,880 |
| 4.0 | 90 | 5.0 | 600 | 6.0 | 1,600 | 9.0 | 5,020 |
| 4.2 | 150 | 5.2 | 770 | 6.5 | 2,170 | | |
| 4.4 | 230 | 5.4 | 955 | 7.0 | 2,740 | | |

*Estimated monthly discharge of Youghiogheny River at Friendsville, Md.*

[Drainage area, 295 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 3,082 | 400 | 992 | 3.36 | 3.87 |
| February | 3,196 | 600 | 879 | 2.98 | 3.10 |
| March | 6,183 | 600 | 1,970 | 6.68 | 7.70 |
| April | 4,108 | 400 | 1,742 | 5.91 | 6.59 |
| May | 1,372 | 230 | 551 | 1.87 | 2.16 |
| June | 1,260 | 185 | 382 | 1.29 | 1.44 |
| July | 2,512 | 150 | 638 | 2.16 | 2.49 |
| August | 530 | 65 | 181 | .61 | .70 |
| September | 90 | 45 | 63 | .21 | .23 |
| October | 862 | 120 | 280 | .95 | 1.10 |
| November | 1,828 | 120 | 426 | 1.44 | 1.61 |
| December | 4,564 | 685 | 2,066 | 7.00 | 8.07 |
| The year | 6,183 | 45 | 848 | 2.87 | 39.06 |

## CHEAT RIVER NEAR MORGANTOWN, W. VA.

A cable gaging station was established July 8, 1889, by E. G. Paul, at Uneva, near Morgantown. It was found desirable, after one or two measurements, to move the cable a mile down the river to a place where a more satisfactory cross section and better facilities for making gage-height observations could be secured. An inclined timber gage was established at the present station on August 21, 1902. The present observer is Miss Anna Hastings.

The following discharge measurement was made in 1902 by E. G. Paul:

August 20: Discharge, 299 second-feet.

*Daily gage height, in feet, of Cheat River near Morgantown, W. Va.*

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | 1902. | | | | | |
| 1 | ..... | 1.70 | 2.80 | 2.50 | 4.65 | 17 | ..... | 1.40 | 3.00 | 2.20 | 10.45 |
| 2 | ..... | 1.70 | 4.80 | 2.20 | 4.50 | 18 | ..... | 1.40 | 2.80 | 2.20 | 8.45 |
| 3 | ..... | 1.70 | 3.65 | 2.20 | 6.15 | 19 | ..... | 1.50 | 2.65 | 2.00 | 7.50 |
| 4 | ..... | 1.80 | 3.40 | 2.20 | 6.40 | 20 | ..... | 1.40 | 2.45 | 2.00 | 5.65 |
| 5 | ..... | 1.65 | 3.40 | 2.05 | 5.35 | 21 | 1.80 | 1.40 | 2.45 | 2.15 | 4.40 |
| 6 | ..... | 2.30 | 3.45 | 1.90 | 4.60 | 22 | 1.90 | 1.30 | 2.35 | 2.40 | 5.20 |
| 7 | ..... | 2.00 | 3.05 | 2.15 | 4.15 | 23 | 2.60 | 1.30 | 2.20 | 2.35 | 5.50 |
| 8 | ..... | 1.85 | 2.85 | 2.20 | 4.10 | 24 | 2.70 | 1.30 | 2.20 | 2.75 | 4.80 |
| 9 | ..... | 1.70 | 2.60 | 2.40 | 3.95 | 25 | 3.30 | 1.30 | 2.20 | 4.35 | 4.30 |
| 10 | ..... | 1.70 | 2.35 | 2.25 | 3.55 | 26 | 2.05 | 1.45 | 2.10 | 8.00 | 3.95 |
| 11 | ..... | 1.70 | 2.20 | 2.20 | 5.70 | 27 | 1.90 | 1.70 | 2.20 | 6.60 | 3.45 |
| 12 | ..... | 1.60 | 5.45 | 2.20 | 10.90 | 28 | 1.80 | 1.60 | 2.75 | 5.35 | 3.20 |
| 13 | ..... | 1.60 | 4.95 | 2.20 | 10.50 | 29 | 1.70 | 2.00 | 2.60 | 4.55 | 3.35 |
| 14 | ..... | 1.50 | 4.40 | 2.25 | 10.50 | 30 | 1.70 | 2.05 | 2.60 | 4.05 | 4.75 |
| 15 | ..... | 1.50 | 3.75 | 2.20 | 8.95 | 31 | 1.70 | ..... | 2.50 | ..... | 4.55 |
| 16 | ..... | 1.45 | 3.30 | 2.20 | 6.70 | | | | | | |

## KANAWHA RIVER DRAINAGE BASIN.

The Kanawha River flows north through West Virginia, joining the Ohio River at Point Pleasant, W. Va. In its upper course it is known as the New River, which rises in Watauga, Ashe, and Alleghany counties, N. C. The area of the latter two counties is comprised wholly within the drainage basin of the New River; their boundaries, being along the mountain ridges, form the divides between the drainage basin of this river and Yadkin River on the east and of Holston River on the west. The general direction of the river is northwesterly. At first the upper tributaries have a general northeasterly and southwesterly direction, draining narrow valleys of the Greater Appalachian Valley in Virginia. The main river cuts the Alleghany fronts just below Pearisburg, Va., and the remainder of the drainage area is confined to the State of West Virginia. For some distance the basin divide follows the State line between Virginia and West Virginia, both north and south of the point where the river pierces the Alleghany front. The basin of New River is as beautiful and picturesque a section of country as any in the eastern part of the United States. The river itself is rapid. The country on its lower courses, through which the Chesapeake and Ohio Railway passes, is noted for its scenic beauty.

The principal tributaries of the New River are Little River, which empties near Radford, Va., and the Greenbrier, which rises in the eastern part of West Virginia and joins the New at Hinton, W. Va. The following is a list of the stations maintained in this drainage basin by the United States Geological Survey, under the supervision of E. W. Myers and D. C. Humphreys: New River at Fayette, W. Va.; Greenbrier River at Alderson, W. Va.; New River at Radford, Va.; New River near Oldtown, Va.; New River (North Fork) at Weaversford, N. C.; New River (South Fork) at New River, N. C.

NEW RIVER AT FAYETTE, W. VA.

This station, established by C. C. Babb and D. C. Humphreys July 29, 1895, is located just below the mouth of Wolf Creek, on the highway bridge of one span at Fayette, W. Va. The wire gage is on the guard rail on the upper side of the bridge, about the middle of the span, the scale being graduated to feet and tenths. The gage is referred to four bench marks: First, the top of the bottom plate of the lower plate girder at the end of the first panel from the left bank, downstream side, 55.13 feet above the zero of the gage; second, the top of the lower end of the coping on the main pier, right bank, downstream side, 52.13 feet above the zero of the gage; third, the bridge seat on the right bank, downstream side, 54.58 feet above the zero of the gage; fourth, the west corner of the abutment stone by the Chesapeake and Ohio Railway station, 58.62 feet above the zero of the gage. The channel is straight above and below the station, the current is swift and without obstructions, except for immense bowlders in the bottom. The banks are high, rocky, and not subject to overflow. The bed is constant in section. The observer is M. W. Brellahan, manager of coal mine, Fayette, W. Va. The station was discontinued May 22, 1901. On August 11, 1902, it was reestablished. The zero of the new gage is at the same elevation as the zero of the old gage.

The following discharge measurements were made during 1902 by D. C. Humphreys:

July 17: Gage height, 2.26 feet; discharge, 4,032 second-feet.
August 14: Gage height, 1.10 feet; discharge, 2,022 second-feet.

*Daily gage height, in feet, of New River at Fayette, W. Va.*

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | 1902. | | | | | |
| 1 | ..... | 0.08 | 0.81 | 1.30 | 4.05 | 17 | 0.80 | 0.05 | 1.50 | 0.59 | 8.96 |
| 2 | ..... | .10 | .56 | .90 | 3.95 | 18 | .60 | .03 | 1.10 | .57 | 9.90 |
| 3 | ..... | .02 | .59 | .71 | 6.30 | 19 | .78 | .09 | .40 | .72 | 8.39 |
| 4 | ..... | .00 | .95 | .56 | 6.56 | 20 | 1.15 | .00 | .60 | 1.30 | 6.86 |
| 5 | ..... | .08 | 1.10 | .32 | 6.95 | 21 | 1.35 | .03 | .56 | 2.80 | 5.50 |
| 6 | ..... | .49 | .91 | .73 | 6.01 | 22 | .10 | .12 | .50 | 2.22 | 4.80 |
| 7 | ..... | 1.20 | 4.30 | .71 | 6.15 | 23 | .25 | .18 | .20 | 1.65 | 4.68 |
| 8 | ..... | .88 | 2.71 | .70 | 5.52 | 24 | .75 | .19 | .24 | 1.40 | 5.50 |
| 9 | ..... | 1.10 | 1.85 | 1.31 | 4.72 | 25 | .70 | .35 | .29 | 1.50 | 5.00 |
| 10 | ..... | .28 | 1.18 | 1.28 | 4.15 | 26 | .68 | .22 | .25 | 2.47 | 4.38 |
| 11 | 1.25 | .23 | .75 | 1.12 | 3.67 | 27 | .50 | .29 | .24 | 3.02 | 4.00 |
| 12 | 1.20 | 1.04 | .81 | .96 | 3.27 | 28 | .28 | .00 | .20 | 5.30 | 2.90 |
| 13 | 1.10 | 1.69 | .76 | .80 | 4.08 | 29 | 15 | 1.12 | .26 | 5.08 | 2.50 |
| 14 | 1.10 | 1.00 | 1.05 | .71 | 7.95 | 30 | .48 | 1.15 | 56 | 3.90 | 2.40 |
| 15 | 1.00 | 1.10 | 2.20 | .62 | 8.86 | 31 | 28 | ..... | 1.60 | ..... | 2.30 |
| 16 | .95 | 1.30 | 2.00 | .60 | 8.90 | | | | | | |

*Rating table for New River at Fayette, W. Va., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.0[a] | 600 | 4.0 | 7,400 | 8.0 | 17,148 | 15.0 | 38,960 |
| .2[a] | 828 | 4.2 | 7,800 | 8.2 | 17,700 | 16.0 | 42,760 |
| .4[a] | 1,068 | 4.4 | 8,200 | 8.4 | 18,300 | 17.0 | 46,560 |
| .6[a] | 1,316 | 4.6 | 8,600 | 8.6 | 18,900 | 18.0 | 50,360 |
| .8[a] | 1,576 | 4.8 | 9,040 | 8.8 | 19,500 | 19.0 | 54,160 |
| 1.0 | 1,862 | 5.0 | 9,480 | 9.0 | 20,100 | 20.0 | 57,960 |
| 1.2 | 2,194 | 5.2 | 9,930 | 9.2 | 20,700 | 21.0 | 61,760 |
| 1.4 | 2,539 | 5.4 | 10,390 | 9.4 | 21,300 | 22.0 | 65,560 |
| 1.6 | 2,887 | 5.6 | 10,850 | 9.6 | 21,900 | 23.0 | 69,360 |
| 1.8 | 3,235 | 5.8 | 11,350 | 9.8 | 22,500 | 24.0 | 73,160 |
| 2.0 | 3,583 | 6.0 | 11,850 | 10.0 | 23,100 | 25.0 | 76,960 |
| 2.2 | 3,933 | 6.2 | 12,350 | 10.5 | 24,600 | 26.0 | 80,760 |
| 2.4 | 4,293 | 6.4 | 12,850 | 11.0 | 26,100 | 27.0 | 84,560 |
| 2.6 | 4,669 | 6.6 | 13,350 | 11.5 | 27,600 | 28.0 | 88,360 |
| 2.8 | 5,053 | 6.8 | 13,850 | 12.0 | 29,100 | 29.0 | 92,160 |
| 3.0 | 5,439 | 7.0 | 14,398 | 12.5 | 30,600 | 30.0 | 95,960 |
| 3.2 | 5,827 | 7.2 | 14,946 | 13.0 | 32,100 | 31.0 | 99,760 |
| 3.4 | 6,216 | 7.4 | 15,494 | 13.5 | 33,600 | 32.0 | 103,560 |
| 3.6 | 6,608 | 7.6 | 16,044 | 14.0 | 35,160 | 33.0 | 107,360 |
| 3.8 | 7,004 | 7.8 | 16,596 | 14.5 | 37,060 | 34.0 | 111,160 |

[a] Discharge below 1 foot gage height is not well determined and must be considered as approximate.

*Estimated monthly discharge of New River at Fayette, W. Va.*

[Drainage area, 6,200 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| August 11 to 31 | ..... | ..... | 1,536 | 0.25 | 0.20 |
| September | 3,061 | 600 | 1,224 | .20 | .22 |
| October | 8,000 | 828 | 1,999 | .32 | .37 |
| November | 10,160 | 948 | 2,893 | .47 | .52 |
| December | 22,800 | 4,111 | 10,972 | 1.77 | 2.04 |

GREENBRIER RIVER AT ALDERSON, W. VA.

This river rises on the western slope of the Allegheny Mountains, in Pocahontas County, W. Va., and flows in a southwesterly direction, emptying into New River near Hinton, Summers County, W. Va. The station was established by C. C. Babb and D. C. Humphreys, at Alderson, W. Va., 21 miles above Hinton, August 1, 1895. Greenbrier River receives many short tributaries from the Allegheny Range, and flows for the most part through a broken, hilly, and mountainous country well covered with forests. The station is located one-half mile above the mouth of Muddy Creek, on the county bridge at Alderson. The wire gage, length 28.37 feet, is in the third panel of the second span, downstream side of the bridge. This gage is referred to three bench marks: the first, on the upper end of the coping of the first pier from the left bank, 21.75 feet above the zero of the gage; the second, on the upper end of the bridge seat of the left bank abutment, 21.61 feet above the zero of the gage; the third, on the stone foundation of the water tank of the Chesapeake and Ohio Railway, 23.48 feet above the zero of the gage. A temporary bench mark has been established on the lower end of the third floor beam, in the second span from the left bank. Its elevation is 22.47 feet above the zero of the gage. The bridge consists of four spans 435 feet long. At ordinary stages the water flows in two channels, between which is an island 600 feet long and 75 feet wide. The banks are high and not subject to overflow. The bed is of rock and gravel and fairly constant. The observer is W. J. Hancock, clerk in a hardware store at Alderson, W. Va.

The following discharge measurements were made during 1902 by D. C. Humphreys:

July 17: Gage height, 1.63 feet; discharge, 211 second-feet.
August 12: Gage height, 1.46 feet; discharge, 156 second-feet.
August 12: Gage height, 1.46 feet; discharge, 154 second-feet.

*Daily gage height, in feet, of Greenbrier River at Alderson, W. Va.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 4.85 | 5.20 | 11.75 | 4.45 | 2.20 | 2.30 | 2.35 | 1.50 | 1.36 | 1.70 | 1.55 | 2.70 |
| 2 | 4.05 | 4.80 | 7.00 | 3.85 | 2.22 | 2.18 | 2.30 | 1.50 | 1.33 | 1.60 | 1.55 | 4.05 |
| 3 | 3.60 | 5.05 | 5.60 | 3.53 | 2.23 | 2.10 | 2.35 | 1.70 | 1.32 | 1.90 | 1.55 | 3.65 |
| 4 | 3.30 | 4.00 | 4.50 | 3.30 | 2.24 | 2.05 | 2.38 | 1.60 | 1.35 | 2.00 | 1.60 | 4.25 |
| 5 | 3.00 | 3.92 | 3.90 | 4.04 | 2.25 | 2.00 | 2.30 | 1.55 | 1.33 | 1.90 | 1.55 | 3.50 |
| 6 | 2.58 | 3.00 | 3.45 | 3.87 | 2.25 | 1.92 | 2.00 | 1.53 | 1.32 | 1.70 | 1.53 | 3.35 |
| 7 | 2.48 | 2.98 | 3.45 | 4.35 | 2.26 | 1.90 | 2.00 | 1.50 | 1.35 | 1.65 | 1.47 | 3.15 |
| 8 | 2.53 | 2.88 | 3.45 | 5.45 | 2.23 | 1.85 | 2.05 | 1.50 | 1.32 | 1.55 | 1.47 | 3.05 |
| 9 | 2.63 | 2.90 | 4.12 | 5.35 | 2.20 | 1.80 | 2.10 | 1.50 | 1.28 | 1.52 | 1.42 | 2.85 |
| 10 | 2.55 | 3.13 | 5.77 | 4.80 | 2.15 | 1.78 | 2.15 | 1.50 | 1.25 | 1.52 | 1.43 | 2.85 |
| 11 | 2.50 | 2.30 | 5.40 | 5.00 | 2.10 | 1.75 | 2.00 | 1.50 | 1.22 | 1.52 | 1.45 | 2.75 |
| 12 | 2.35 | 2.35 | 6.05 | 4.67 | 2.05 | 1.73 | 1.93 | 1.50 | 1.22 | 1.55 | 1.45 | 2.45 |
| 13 | 2.25 | 2.30 | 7.58 | 4.50 | 2.00 | 1.75 | 1.82 | 1.46 | 1.22 | 1.75 | 1.45 | 3.10 |
| 14 | 2.15 | 2.33 | 7.76 | 3.15 | 1.98 | 1.78 | 1.80 | 1.42 | 1.25 | 2.12 | 1.45 | 5.15 |
| 15 | 2.00 | 2.30 | 5.24 | 3.65 | 1.98 | 1.80 | 1.80 | 1.40 | 1.25 | 2.10 | 1.43 | 4.65 |
| 16 | 2.15 | 2.15 | 5.45 | 3.40 | 1.90 | 1.83 | 1.77 | 1.40 | 1.28 | 1.95 | 1.43 | 4.50 |
| 17 | 2.12 | 2.20 | 7.65 | 3.28 | 1.90 | 1.84 | 1.75 | 1.40 | 1.25 | 1.83 | 1.43 | 5.00 |
| 18 | 2.10 | 2.15 | 6.00 | 3.05 | 1.92 | 1.85 | 1.75 | 1.40 | 1.25 | 1.80 | 1.44 | 5.10 |
| 19 | 2.00 | 2.15 | 4.65 | 2.95 | 1.85 | 1.86 | 1.74 | 1.39 | 1.25 | 1.80 | 1.44 | 4.30 |
| 20 | 1.95 | 2.10 | 3.90 | 2.90 | 1.85 | 1.97 | 1.74 | 1.38 | 1.20 | 1.75 | 1.45 | 3.50 |
| 21 | 2.08 | 2.15 | 3.50 | 2.85 | 2.07 | 1.95 | 1.70 | 1.38 | 1.20 | 1.65 | 1.45 | 3.30 |
| 22 | 2.00 | 2.15 | 3.25 | 2.77 | 2.05 | 2.00 | 1.68 | 1.36 | 1.20 | 1.55 | 1.45 | 3.00 |
| 23 | 2.17 | 2.45 | 3.00 | 2.70 | 2.28 | 2.10 | 1.60 | 1.35 | 1.20 | 1.55 | 1.55 | 3.35 |
| 24 | 2.05 | 3.10 | 2.95 | 2.65 | 2.15 | 2.16 | 1.55 | 1.35 | 1.20 | 1.55 | 1.60 | 3.20 |
| 25 | 1.95 | 7.82 | 2.93 | 2.60 | 2.13 | 2.15 | 1.50 | 1.30 | 1.22 | 1.55 | 1.64 | 3.00 |
| 26 | 2.10 | 8.42 | 3.03 | 2.50 | 2.85 | 2.08 | 1.50 | 1.30 | 1.20 | 1.55 | 3.24 | 2.80 |
| 27 | 6.15 | 6.45 | 2.95 | 2.45 | 3.50 | 1.95 | 1.50 | 1.27 | 1.25 | 1.55 | 3.60 | 2.58 |
| 28 | 6.95 | 11.53 | 2.85 | 2.30 | 3.08 | 2.85 | 1.50 | 1.25 | 1.75 | 1.55 | 3.45 | 2.30 |
| 29 | 4.75 | ..... | 6.10 | 2.30 | 2.80 | 2.80 | 1.50 | 1.18 | 1.65 | 1.55 | 3.40 | 2.30 |
| 30 | 4.90 | ..... | 7.75 | 2.25 | 2.60 | 2.40 | 1.50 | 1.25 | 1.70 | 1.55 | 2.73 | 2.45 |
| 31 | 6.60 | ..... | 5.90 | ..... | 2.45 | ..... | 1.50 | 1.33 | ..... | 1.55 | ..... | 2.35 |

*Rating table for Greenbrier River at Alderson, W. Va., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.2 | 60 | 3.0 | 1,900 | 4.8 | 6,180 | 7.5 | 14,000 |
| 1.4 | 120 | 3.2 | 2,330 | 5.0 | 6,700 | 8.0 | 15,600 |
| 1.6 | 220 | 3.4 | 2,770 | 5.2 | 7,220 | 9.0 | 19,000 |
| 1.8 | 350 | 3.6 | 3,240 | 5.4 | 7,740 | 10.0 | 22,500 |
| 2.0 | 505 | 3.8 | 3,720 | 5.6 | 8,300 | 11.0 | 26,500 |
| 2.2 | 685 | 4.0 | 4,200 | 5.8 | 8,900 | 12.0 | 31,200 |
| 2.4 | 920 | 4.2 | 4,680 | 6.0 | 9,500 | 13.0 | 36,200 |
| 2.6 | 1,205 | 4.4 | 5,160 | 6.5 | 11,000 | 14.0 | 41,200 |
| 2.8 | 1,535 | 4.6 | 5,560 | 7.0 | 12,500 | 15.0 | 46,200 |

*Estimated monthly discharge of Greenbrier River at Alderson, W. Va.*

[Drainage area, 1,344 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 12,350 | 465 | 2,585 | 1.92 | 2.21 |
| February | 28,850 | 590 | 4,324 | 3.22 | 3.35 |
| March | 29,950 | 1,622 | 7,339 | 5.46 | 6.29 |
| April | 7,870 | 740 | 3,175 | 2.36 | 2.63 |
| May | 3,000 | 387 | 821 | .61 | .70 |
| June | 4,080 | 315 | 677 | .50 | .56 |
| July | 920 | 170 | 412 | .31 | .36 |
| August | 280 | 60 | 138 | .10 | .12 |
| September | 315 | 60 | 96 | .07 | .08 |
| October | 590 | 170 | 356 | .26 | .30 |
| November | 3,240 | 120 | 565 | .92 | .47 |
| December | 7,090 | 795 | 2,865 | 2.13 | 2.46 |
| The year | 29,950 | 60 | 1,946 | 1.45 | 19.53 |

## NEW RIVER AT RADFORD, VA.

This river rises in Watauga, Ashe, and Alleghany counties, N. C., and flows in a northwesterly direction into West Virginia, where, after meeting the Gauley, near Kanawha Falls, it is known as the Kanawha. The station at Radford is located at the highway bridge close to the Norfolk and Western Railway station. It was established by D. C. Humphreys August 1, 1898. The gage used was erected by the United States Weather Bureau. It consists of a vertical board graduated to feet and tenths, and is attached to the iron framework connecting the pair of iron concrete cylinders which form the first pier from the right bank. The bench mark is the bottom of the lowest horizontal brace connecting the two cylinders, the elevation being 3.88 feet above the zero of the gage. The discharge measurements are made from the upstream side of the bridge. The initial point for soundings is on the right bank of the river 50 feet from the first pier. The bottom is of solid rock and gravel and is smooth and regular. On the left bank there is a steep, rocky bluff. The right bank is low and subject to overflow for about 100 yards, but all the water must pass under the bridge, which is about 85 feet above low water. On account of the inaccessibility of the Weather Bureau gage, a wire gage was put in

February 23, 1900, the zero being on the same level as that of the old gage. The observer is T. M. Brady, saddler and harness dealer.

The following discharge measurements were made during 1902 by D. C. Humphreys:

July 12: Gage height, —0.40 feet; discharge, 2,820 second-feet.
August 22: Gage height, —0.68 feet; discharge, 2,233 second-feet.

*Daily gage height, in feet, of New River at Radford, Va.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 4.00 | 3.20 | 12.00 | 1.80 | 0.70 | 0.20 | 1.50 | 0.40 | —1.00 | —0.80 | —0.20 | 0.70 |
| 2 | 3.00 | 3.30 | 6.00 | 1.60 | .70 | .30 | 1.10 | .40 | —1.00 | — .80 | .00 | .60 |
| 3 | 2.20 | 4.00 | 4.20 | 1.50 | .70 | .30 | .70 | .30 | —1.10 | — .70 | .10 | .60 |
| 4 | 2.00 | 3.80 | 3.00 | 1.50 | .70 | .40 | .50 | .30 | — .80 | — .70 | .10 | .80 |
| 5 | 1.80 | 2.50 | 3.00 | 2.00 | .60 | .50 | .20 | .30 | — .60 | — .70 | .20 | 1.40 |
| 6 | 1.80 | 1.30 | 2.50 | 2.20 | .60 | .60 | .20 | .20 | — .60 | .00 | .20 | 1.20 |
| 7 | 1.60 | 1.20 | 2.20 | 2.00 | .60 | .60 | .20 | .30 | — .60 | — .10 | .20 | 1.00 |
| 8 | 1.50 | 1.00 | 1.80 | 1.90 | .60 | .60 | .10 | .30 | — .70 | — .10 | .10 | 1.00 |
| 9 | 1.50 | 1.00 | 1.80 | 1.90 | .50 | .50 | —.10 | .40 | — .80 | — .30 | .10 | .90 |
| 10 | 1.60 | 1.20 | 1.60 | 1.80 | .50 | .50 | —.20 | .30 | — .80 | — .30 | .10 | .70 |
| 11 | 1.20 | 1.10 | 1.60 | 1.80 | .40 | .50 | —.20 | .20 | — .30 | — .40 | .20 | .60 |
| 12 | 1.20 | 1.00 | 1.60 | 1.60 | .40 | .40 | —.20 | .20 | — .40 | — .40 | .20 | .50 |
| 13 | 1.10 | 1.90 | 1.50 | 1.60 | .30 | .40 | —.20 | .10 | — .60 | — .40 | .20 | .30 |
| 14 | 1.10 | .90 | 1.50 | 1.50 | .20 | .40 | —.10 | .10 | — .60 | — .50 | .10 | .20 |
| 15 | 1.10 | .80 | 1.50 | 1.50 | .20 | .20 | —.10 | .10 | — .70 | — .60 | .10 | .20 |
| 16 | 1.10 | .80 | 1.50 | 1.40 | .20 | .50 | —.00 | .20 | — .80 | — .70 | .20 | .30 |
| 17 | 1.00 | .90 | 3.00 | 1.30 | .20 | 3.40 | —.10 | .00 | — .80 | — .80 | .20 | .40 |
| 18 | 1.00 | .90 | 2.60 | 1.30 | .10 | 2.50 | —.20 | —.20 | — .90 | — .80 | .20 | .40 |
| 19 | 1.00 | 1.00 | 2.40 | 1.20 | .10 | 1.80 | —.40 | —.40 | —1.00 | — .80 | .40 | 1.00 |
| 20 | .90 | 1.00 | 2.00 | 1.20 | .00 | 1.40 | —.30 | —.60 | —1.00 | — .90 | .30 | .80 |
| 21 | .90 | 1.10 | 1.60 | 1.20 | 1.00 | .80 | —.20 | —.70 | —1.00 | — .90 | .30 | .80 |
| 22 | 1.00 | 1.20 | 1.50 | 1.00 | .80 | .60 | —.20 | —.60 | — .90 | — .90 | .20 | .70 |
| 23 | 1.00 | 2.00 | 1.40 | 1.00 | .80 | .40 | .00 | —.70 | — .90 | —1.00 | .20 | .70 |
| 24 | 1.00 | 3.00 | 1.40 | 1.00 | .60 | .40 | .00 | —.80 | — .80 | —1.00 | .20 | .60 |
| 25 | 1.00 | 6.83 | 1.20 | .90 | .30 | .30 | .10 | —.80 | — .80 | —1.00 | .20 | .60 |
| 26 | 1.10 | 6.50 | 1.10 | .90 | .20 | .20 | .20 | —.80 | — .80 | — .90 | .90 | .60 |
| 27 | 1.20 | 3.20 | 1.00 | .90 | .20 | .10 | .20 | —.90 | — .80 | — .80 | 1.20 | .50 |
| 28 | 1.60 | 15.06 | 1.00 | .80 | .10 | 3.50 | .20 | —.90 | — .80 | — .80 | 1.00 | .50 |
| 29 | 2.00 | ..... | 2.50 | .80 | .00 | 2.30 | .20 | —.90 | — .90 | — .60 | .80 | .50 |
| 30 | 3.00 | ..... | 2.50 | .80 | .10 | 2.00 | .30 | —.90 | — .90 | — .40 | .80 | .40 |
| 31 | 3.40 | ..... | 2.00 | ..... | .20 | ..... | .30 | —.90 | — .90 | — .30 | ..... | .40 |

NEW RIVER NEAR OLDTOWN, VA.

This station, like those on the North and South Forks of New River, was established to aid in the hydrographic investigations undertaken by the United States Geological Survey in the Southern Appalachian area. It was established July 31, 1900, and is located about 2 miles west of Oldtown. Oldtown is 30 miles from the railroad at Mount Airy, N. C., and 9 miles from a branch of the Norfolk and Western Railway, and can only be reached by private conveyance.

The gaging station was located at Austin's ferry. The wire gage is fixed in an overhanging tree on the left bank, about 50 yards upstream from the ferry. The scale is so placed that the zero mark is next the bank, the distance from the index on the wire to the end of the weight being 16.1 feet. The initial point for soundings is on the right bank and the measurements of discharge are made from the ferryboat. The channel above and below the station is straight and the current swift. The right bank is high and rocky and is never submerged, but the left bank is lower, and at times floods cover it for a considerable distance.

Since the gage rod at this station is so placed that the zero mark is next to the bank the gage readings were reversed, a rise in the water surface being indicated by a decrease in the gage reading, and vice versa. This is true of all figures for gage heights for this station published in Water Supply Papers Nos. 48 and 65. As this arrangement is apt to be misleading and inconvenient, these figures for gage height are reprinted here and are rectified so that an increase in gage height means an increase in volume of flow.

This rectification was made by subtracting all observed gage heights from 7.3 feet, this being the length of the gage, and also the gage height which corresponded to the lowest stage of the stream. Gage heights, as printed herewith, above 7.3 feet are estimated by the observer. The only exception to this rule is the height of the flood of May 22, 1901, which was determined directly by leveling. This was the greatest flood since 1878, when the river rose some 4 or 5 feet higher. Owing to the inaccessibility of this station, no measurements of the flow were made during 1902, though daily records of the stage of the surface have been maintained. This station will shortly be made more accessible by a railroad now nearly completed, when discharge measurements will be begun.

The following discharge measurements were made during 1900, 1901, and 1903:

*List of discharge measurements of New River near Oldtown Va.*

| Date. | Hydrographer | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet* | *Second-feet.* |
| July 31 | N. C. Curtis | 0.70 | 1,541 |
| Oct. 29 | do | 1.00 | 2,293 |
| 1901. | | | |
| June 29 | N. C. Curtis | 4.45 | 6,916 |
| 1903. | | | |
| Feb. 6 | E. W. Myers | 1.70 | 3,533 |

*Daily gage height, in feet, of New River near Oldtown, Va.*

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | | 1900. | | | | | |
| 1 | 0.60 | 0.50 | 0.40 | 0.70 | 1.00 | 17 | 0.30 | 1.50 | 0.40 | 0.50 | 0.80 |
| 2 | .60 | .40 | .50 | .70 | .90 | 18 | .30 | .80 | .30 | .50 | .70 |
| 3 | .50 | .30 | .60 | 1.90 | .80 | 19 | .20 | .50 | .30 | .50 | .70 |
| 4 | .70 | .20 | .70 | 2.20 | 1.50 | 20 | .40 | .40 | .30 | .50 | .60 |
| 5 | .60 | .20 | .90 | 1.70 | 2.70 | 21 | .40 | .50 | .30 | .50 | .60 |
| 6 | .40 | .20 | .90 | 1.30 | 1.80 | 22 | .80 | .50 | .30 | .60 | .80 |
| 7 | .40 | .20 | .80 | 1.00 | 1.50 | 23 | .70 | .50 | .30 | .60 | .80 |
| 8 | .30 | .20 | .70 | .90 | 1.40 | 24 | .60 | .60 | a 8.20 | .70 | .80 |
| 9 | .30 | .10 | .60 | .80 | 1.40 | 25 | .60 | .50 | 3.00 | .70 | .50 |
| 10 | .20 | .10 | .60 | .80 | 1.20 | 26 | .40 | .80 | 1.90 | 4.90 | .60 |
| 11 | .20 | .10 | .50 | .80 | 1.20 | 27 | .30 | .50 | 1.40 | 2.70 | .60 |
| 12 | .10 | .10 | .40 | .70 | 1.10 | 28 | .30 | .40 | 1.20 | 1.50 | .60 |
| 13 | .00 | .10 | .40 | .60 | 1.00 | 29 | .30 | .40 | 1.00 | 1.30 | .60 |
| 14 | .10 | .50 | .50 | .70 | 1.00 | 30 | 1.00 | .50 | 1.00 | 1.10 | 1.00 |
| 15 | .60 | 1.60 | .40 | .70 | .80 | 31 | .70 | ..... | .80 | ..... | .90 |
| 16 | .50 | 3.40 | .40 | .60 | .80 | | | | | | |

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | 0.90 | 0.80 | 0.90 | 1.60 | 1.60 | 2.20 | 3.20 | 1.20 | 4.10 | 2.10 | 0.80 | 0.80 |
| 2 | .80 | .70 | .80 | 2.50 | 1.40 | 2.00 | 2.20 | 1.10 | 3.10 | 3.10 | .80 | .80 |
| 3 | .70 | .60 | .70 | 6.10 | 1.40 | 1.90 | 1.90 | .90 | 2.60 | 2.30 | .80 | 1.10 |
| 4 | .70 | 1.00 | .80 | 3.80 | 1.30 | 1.80 | 1.90 | .90 | 2.40 | 1.90 | .90 | 1.50 |
| 5 | .60 | .80 | .70 | 2.60 | 1.20 | 1.70 | 1.90 | .90 | 2.20 | 1.70 | .90 | 1.50 |
| 6 | .60 | .80 | .70 | 2.10 | 1.20 | 1.60 | 1.80 | a 13.00 | 2.10 | 1.50 | .90 | 1.00 |
| 7 | .70 | .80 | .60 | 2.00 | 1.30 | 2.50 | 2.00 | 4.90 | 2.00 | 1.50 | .80 | .90 |
| 8 | .70 | .90 | .60 | 1.70 | 1.40 | 2.20 | 1.90 | 2.90 | 1.90 | 1.50 | .80 | .80 |
| 9 | .80 | 1.00 | .50 | 1.60 | 1.50 | 1.70 | 1.60 | 2.00 | 1.90 | 1.40 | .80 | .80 |
| 10 | .80 | 1.00 | .90 | 1.40 | 1.60 | 1.60 | 1.50 | 1.70 | 1.70 | 1.30 | .70 | 1.50 |
| 11 | 1.00 | .90 | 1.40 | 1.30 | 1.60 | 1.60 | 1.50 | 1.80 | 1.70 | 1.30 | .70 | 1.30 |
| 12 | 3.00 | 1.00 | 1.30 | 1.20 | 1.50 | 1.50 | 1.40 | 1.90 | 1.60 | 1.20 | .70 | 1.10 |
| 13 | 2.40 | .90 | 1.00 | 1.10 | 1.20 | 1.40 | 1.30 | 4.30 | 1.60 | 2.40 | .70 | 1.00 |
| 14 | 1.80 | .70 | .90 | 1.90 | 1.10 | 2.40 | 2.60 | 6.10 | 1.50 | 3.30 | .60 | 2.00 |
| 15 | 1.40 | .80 | .80 | 1.80 | 1.10 | 4.60 | 1.40 | 4.20 | 1.50 | 1.90 | .60 | a 10.00 |
| 16 | 1.10 | .80 | .80 | 1.50 | 1.00 | 3.80 | 1.60 | 5.20 | 1.60 | 1.60 | .60 | 4.10 |
| 17 | 1.10 | .80 | .70 | 1.40 | 1.50 | 4.60 | 1.60 | 6.20 | 1.90 | 1.40 | .60 | 3.00 |
| 18 | .90 | .80 | .70 | 1.20 | 1.30 | 3.50 | 2.40 | 5.20 | 2.00 | 1.20 | .50 | 1.90 |
| 19 | .80 | .70 | .60 | 1.20 | 1.60 | 2.90 | 2.30 | 4.10 | 1.90 | 1.10 | .50 | 1.70 |
| 20 | .70 | .70 | .70 | ..... | 1.40 | 2.40 | 2.40 | 3.60 | 1.70 | 1.20 | .50 | 1.50 |
| 21 | 1.00 | .60 | 1.10 | 6.10 | 1.30 | 3.00 | 1.40 | 3.90 | 1.50 | 1.10 | .40 | 1.60 |
| 22 | 1.00 | .60 | 1.00 | 3.70 | 16.70 | 3.80 | 1.30 | 3.10 | 1.40 | 1.00 | .40 | 1.50 |
| 23 | .90 | b .70 | .80 | 2.80 | 6.10 | 6.10 | 1.20 | 6.10 | 1.40 | 1.00 | 1.40 | 1.40 |
| 24 | .90 | ..... | .70 | 2.60 | 3.90 | 4.60 | 1.10 | 3.80 | 1.20 | 1.00 | 1.40 | 2.50 |
| 25 | .80 | ..... | 1.00 | 2.40 | 3.10 | 3.00 | 1.00 | 3.00 | 1.10 | 1.00 | 1.20 | 2.30 |
| 26 | .80 | ..... | 4.00 | 2.30 | 2.70 | 2.80 | 1.00 | 2.80 | 1.10 | .90 | 1.10 | 2.00 |
| 27 | .70 | ..... | 3.00 | 2.20 | 4.40 | 2.60 | 1.10 | 3.10 | 2.20 | .90 | 1.00 | 1.70 |
| 28 | .70 | 1.10 | 1.90 | 2.10 | 3.60 | 2.30 | 1.20 | 5.90 | 2.00 | .90 | 1.00 | 1.90 |
| 29 | .60 | ..... | 1.50 | 2.00 | 3.30 | 2.50 | 1.00 | 3.70 | 5.10 | .90 | .90 | a 10.00 |
| 30 | .70 | ..... | 2.00 | 1.80 | 2.70 | 2.10 | 1.00 | 3.00 | 2.80 | .80 | .70 | 6.00 |
| 31 | .80 | ..... | 2.00 | ..... | 2.40 | ..... | .90 | 3.10 | ..... | .80 | ..... | 3.80 |

a Estimated.

b Frozen February 24 to 27.

*Daily gage height, in feet, of New River near Oldtown, Va.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 3.00 | 2.20 | 6.20 | 2.10 | 1.00 | 0.60 | 1.90 | 0.50 | 0.30 | 0.40 | 0.40 | 1.00 |
| 2 | 2.70 | 2.50 | 3.70 | 1.80 | 1.00 | .70 | 1.60 | .70 | .30 | .40 | .40 | 1.10 |
| 3 | 2.00 | 2.30 | 2.80 | 1.70 | 1.00 | .70 | 1.40 | .70 | .50 | .60 | .40 | 1.40 |
| 4 | 2.00 | 1.90 | 2.40 | 1.60 | .90 | .70 | 1.10 | .70 | 1.00 | .50 | .40 | 1.50 |
| 5 | 1.70 | 1.90 | 2.00 | 1.90 | .90 | .60 | 1.00 | .60 | .80 | .80 | .40 | 1.50 |
| 6 | 1.90 | 1.70 | 1.90 | 1.70 | 1.00 | .60 | .80 | .60 | .80 | 1.00 | .50 | 1.40 |
| 7 | 1.80 | 1.50 | 1.90 | 1.60 | 1.00 | .60 | .90 | 1.40 | .40 | .70 | .60 | 1.20 |
| 8 | 1.70 | 1.40 | 1.80 | 1.90 | 1.10 | .90 | 1.10 | .80 | .40 | .60 | .70 | 1.10 |
| 9 | 1.50 | 1.10 | 1.80 | 1.70 | 1.00 | 1.00 | 1.20 | .70 | 1.00 | .40 | .60 | .90 |
| 10 | 1.50 | .90 | 2.00 | 1.60 | .90 | 1.00 | .80 | .50 | 2.00 | .40 | .50 | .90 |
| 11 | 1.40 | 1.00 | 1.90 | 1.50 | .80 | .90 | .80 | .50 | .90 | .60 | .50 | .90 |
| 12 | 1.30 | 1.20 | 1.70 | 1.50 | .90 | .90 | .70 | .40 | .60 | .90 | .40 | .80 |
| 13 | 1.10 | 1.20 | 1.90 | 1.40 | .80 | .60 | .70 | 2.00 | .50 | 1.00 | .40 | .80 |
| 14 | 1.10 | 1.10 | 1.60 | 1.40 | .80 | 2.10 | .80 | 1.10 | .40 | .90 | .30 | .90 |
| 15 | 1.00 | 1.00 | 1.50 | 1.50 | 1.00 | 1.90 | 1.00 | .50 | .40 | .70 | .30 | .80 |
| 16 | .40 | 1.10 | 1.90 | 1.50 | 1.10 | 3.10 | .80 | .70 | .40 | .50 | .30 | 1.00 |
| 17 | 1.30 | 1.10 | 2.40 | 1.40 | 1.00 | 2.80 | .80 | .90 | .40 | .50 | .30 | 1.60 |
| 18 | 1.20 | 1.20 | 2.10 | 1.30 | 1.00 | 1.70 | .60 | .80 | .40 | .40 | .80 | 1.30 |
| 19 | 1.20 | 2.00 | 1.90 | 1.20 | 1.50 | 1.40 | .60 | .60 | .40 | .40 | 1.10 | 1.20 |
| 20 | 1.10 | 1.90 | 1.70 | 1.50 | 1.00 | 1.20 | .60 | .50 | .40 | .40 | .70 | 1.00 |
| 21 | 1.00 | 2.20 | 1.60 | 1.50 | 1.10 | 1.10 | .50 | .50 | .50 | .40 | .60 | 1.00 |
| 22 | 1.20 | 1.90 | 1.50 | 1.40 | .90 | 1.00 | .50 | .60 | .50 | .20 | .50 | 1.20 |
| 23 | 1.10 | 1.50 | 1.40 | 1.30 | .90 | .90 | .60 | .60 | .40 | .20 | .50 | 1.10 |
| 24 | 1.10 | 1.40 | 1.40 | 1.20 | 1.00 | .80 | .50 | .40 | .40 | .20 | .50 | 1.00 |
| 25 | 1.20 | 3.60 | 1.30 | 1.20 | 1.00 | .80 | .50 | .40 | .50 | .20 | .60 | .80 |
| 26 | 1.20 | 3.90 | 1.20 | 1.10 | 1.20 | .90 | .40 | .40 | .80 | .20 | 1.00 | .60 |
| 27 | 1.00 | 2.60 | 1.20 | 1.00 | 1.00 | 2.60 | .40 | .40 | .60 | .40 | 1.20 | [b]1.00 |
| 28 | 2.00 | [a]11.00 | 1.40 | 1.00 | .90 | 3.90 | .40 | .40 | .50 | .90 | 1.00 | ..... |
| 29 | 1.70 | ..... | 1.90 | 1.00 | .90 | 4.10 | .50 | .40 | .50 | 1.10 | .80 | ..... |
| 30 | 1.90 | ..... | 3.90 | 1.00 | .70 | 2.20 | .70 | .30 | .40 | .70 | .70 | ..... |
| 31 | 3.00 | ..... | 2.50 | ..... | .70 | ..... | .60 | .30 | ..... | .50 | ..... | ..... |

[a] Estimated.

[b] Frozen December 28 to 31.

## NEW RIVER (NORTH FORK) AT WEAVERSFORD, N. C.

During the summer and autumn of 1900, and during a part of the same period in 1901, a special investigation of the hydrographic conditions of the Southern Appalachian region was made by the United States Geological Survey, and as an aid in this work temporary stations were established on a number of the larger streams. Among these were the North and South Forks of New River, while another station was also established below the confluence of these streams, near Oldtown, Va.

The station at Weaversford was established July 27, 1900, by Cleveland Abbe, jr., and N. C. Curtis, and was located about one-fourth of a mile distant from Weaversford post-office and near Dixon's mill. The gage rod is 12.6 feet long and is nailed to the downstream vertical

timber of the forebay of Dixon's mill. The discharge measurements are made by wading at a comparatively shallow ford not on a public road, about 400 yards below the house of Mr. Dixon. The initial point for soundings was on the right bank, and the bed of the stream is rocky and gravelly and constant in form. The banks of the river are high, and previous to the establishment of the station had been overflowed only once, in 1878.

This station was abandoned December 31, 1901.

The following discharge measurements were made in 1900 and 1901:

*List of discharge measurements of New River (North Fork) at Weaversford, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| July 28 | N. C. Curtis | 0.60 | 536 |
| Oct. 27 | do | .90 | 708 |
| 1901. | | | |
| June 27 | N. C. Curtis | 1.40 | 1,377 |

*Daily gage height, in feet, of New River (North Fork) at Weaversford, N. C.*

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | |
| 1 | | | 0.10 | 0.10 | 0.70 | 0.70 | 0.80 |
| 2 | | | .10 | .90 | .80 | .60 | .90 |
| 3 | | | .10 | .90 | .75 | 2.10 | .90 |
| 4 | | | .10 | .90 | .45 | 1.00 | 1.80 |
| 5 | | | | .90 | .30 | .85 | 1.20 |
| 6 | | | | .90 | .70 | .80 | .50 |
| 7 | | | | .90 | | .70 | .50 |
| 8 | | | | .90 | | .70 | .70 |
| 9 | | | | 1.00 | | .60 | .70 |
| 10 | | | | 1.00 | | .60 | .70 |
| 11 | | | | 1.00 | | .60 | .70 |
| 12 | | | .10 | 1.00 | | .60 | .80 |
| 13 | | | .10 | .65 | | .70 | .80 |
| 14 | | | .30 | .90 | .90 | .70 | .90 |
| 15 | | | .20 | .75 | .90 | .80 | .90 |
| 16 | | | .20 | .65 | .90 | .80 | .70 |
| 17 | | | .10 | .55 | .90 | .90 | .70 |
| 18 | | | .10 | .65 | .90 | .90 | .70 |
| 19 | | | .10 | .75 | 1.00 | .90 | .70 |
| 20 | | | .10 | .80 | 1.00 | .90 | .80 |
| 21 | | | .20 | .80 | 1.00 | .90 | .80 |
| 22 | | | .40 | .90 | 1.10 | 1.00 | .80 |
| 23 | | | .60 | 1.00 | 7.30 | 1.00 | .90 |
| 24 | | | .40 | .10 | 5.50 | 1.00 | .90 |
| 25 | | | .10 | .30 | 1.70 | 1.00 | .90 |
| 26 | | | .10 | .40 | 1.00 | 3.00 | .90 |

*Daily gage height, in feet, of New River (Novth Fork) at Weaversford, N. C.*—Continued.

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | |
| 27 | ..... | 1.00 | 0.10 | 0.60 | 0.90 | 1.00 | 1.00 |
| 28 | ..... | .50 | .10 | .80 | 1.00 | 2.00 | 1.00 |
| 29 | ..... | 3.30 | 4.10 | .90 | .90 | .50 | 1.00 |
| 30 | ..... | .20 | .10 | .65 | .90 | .60 | ..... |
| 31 | ..... | .20 | .10 | ..... | .80 | ..... | ..... |
| 1901. | | | | | | | |
| 1 | ..... | 1.70 | .40 | 1.80 | .60 | .20 | .20 |
| 2 | ..... | .90 | .20 | 1.70 | .50 | .20 | .20 |
| 3 | ..... | .60 | .10 | 1.30 | .40 | .20 | .60 |
| 4 | ..... | .80 | .10 | 1.00 | .40 | .20 | .40 |
| 5 | ..... | .70 | 2.35 | .80 | .60 | .20 | .30 |
| 6 | ..... | .60 | 5.75 | .70 | 2.30 | .20 | .30 |
| 7 | ..... | 2.00 | 2.15 | .60 | 1.00 | .20 | .30 |
| 8 | ..... | .70 | 9.00 | .50 | .80 | .20 | .20 |
| 9 | ..... | .50 | 7.00 | .50 | .60 | .20 | .30 |
| 10 | ..... | .40 | 7.50 | .70 | .40 | .20 | .70 |
| 11 | ..... | .40 | 5.90 | .70 | .40 | .20 | .40 |
| 12 | ..... | .30 | 3.75 | .60 | .40 | .20 | .30 |
| 13 | ..... | .40 | 3.00 | .60 | .50 | .30 | .30 |
| 14 | ..... | .30 | 3.70 | .60 | .40 | .30 | 2.00 |
| 15 | ..... | .30 | 3.00 | .60 | .40 | .20 | 7.60 |
| 16 | ..... | .40 | 3.15 | .50 | .60 | .20 | 1.50 |
| 17 | ..... | 1.20 | 3.40 | .50 | 1.00 | .20 | 1.00 |
| 18 | ..... | 1.50 | 3.60 | .80 | .70 | .30 | .80 |
| 19 | ..... | .70 | 2.00 | .50 | .60 | .30 | .60 |
| 20 | ..... | .60 | 2.60 | .40 | .30 | .30 | .60 |
| 21 | ..... | .30 | 3.00 | .60 | .20 | .30 | .40 |
| 22 | ..... | .20 | 2.60 | .40 | .20 | .20 | .40 |
| 23 | ..... | .20 | 1.25 | .60 | .20 | .20 | .40 |
| 24 | ..... | .20 | 3.00 | .40 | .20 | .40 | .30 |
| 25 | ..... | .20 | 1.00 | .40 | .20 | .40 | .30 |
| 26 | ..... | .70 | 1.50 | .30 | .20 | .30 | .60 |
| 27 | 1.00 | .70 | 1.60 | .30 | .20 | .30 | 1.50 |
| 28 | 1.00 | .10 | 1.80 | .70 | .20 | .30 | 1.60 |
| 29 | .90 | .10 | 1.80 | .40 | .20 | .30 | 10.50 |
| 30 | 1.00 | .10 | 1.20 | 1.20 | .20 | .30 | 4.40 |
| 31 | ..... | .20 | 1.90 | ..... | .20 | ..... | 3.40 |

*Rating table for New River (North Fork) at Weaversford, N. C., for 1900 and 1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.0 | ..... | 1.6 | 1,745 | 3.2 | 4,705 | 4.8 | 7,665 |
| .1 | 260 | 1.7 | 1,930 | 3.3 | 4,890 | 4.9 | 7,850 |
| .2 | 300 | 1.8 | 2,115 | 3.4 | 5,075 | 5.0 | 8,035 |
| .3 | 350 | 1.9 | 2,300 | 3.5 | 5,260 | 5.1 | 8,220 |
| .4 | 400 | 2.0 | 2,485 | 3.6 | 5,445 | 5.2 | 8,405 |
| .5 | 455 | 2.1 | 2,670 | 3.7 | 5,630 | 5.3 | 8,590 |
| .6 | 515 | 2.2 | 2,855 | 3.8 | 5,815 | 5.4 | 8,775 |
| .7 | 580 | 2.3 | 3,040 | 3.9 | 6,000 | 5.5 | 8,960 |
| .8 | 650 | 2.4 | 3,225 | 4.0 | 6,185 | 5.6 | 9,145 |
| .9 | 720 | 2.5 | 3,410 | 4.1 | 6,370 | 5.7 | 9,330 |
| 1.0 | 810 | 2.6 | 3,595 | 4.2 | 6,555 | 5.8 | 9,515 |
| 1.1 | 920 | 2.7 | 3,780 | 4.3 | 6,740 | 5.9 | 9,700 |
| 1.2 | 1,040 | 2.8 | 3,965 | 4.4 | 6,925 | 6.0 | 9,885 |
| 1.3 | 1,200 | 2.9 | 4,150 | 4.5 | 7,110 | | |
| 1.4 | 1,375 | 3.0 | 4,335 | 4.6 | 7,295 | | |
| 1.5 | 1,560 | 3.1 | 4,520 | 4.7 | 7,480 | | |

*Estimated monthly discharge of New River (North Fork) at Weaversford, N. C.*

[Drainage area, 278 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1900. | | | | | |
| July [a] | ..... | ..... | 443 | 1.59 | 0.28 |
| August [b] | ..... | ..... | 541 | 1.95 | 1.74 |
| September | 810 | 260 | 626 | 2.25 | 2.51 |
| October [b] | ..... | ..... | 1,571 | 5.65 | 5.05 |
| November | 4,335 | 455 | 901 | 3.24 | 3.61 |
| December [c] | ..... | ..... | 717 | 2.58 | 2.97 |
| 1901. | | | | | |
| June [d] | ..... | ..... | 788 | 2.83 | .42 |
| July | 2,485 | 260 | 596 | 2.14 | 2.47 |
| August | 15,435 | 260 | 4,211 | 15.15 | 17.46 |
| September | 2,115 | 350 | 643 | 2.31 | 2.58 |
| October | 3,040 | 300 | 511 | 1.84 | 2.12 |
| November | 400 | 300 | 325 | 1.17 | 1.31 |
| December | 18,210 | 300 | 1,942 | 6.98 | 8.06 |

[a] 5 days. [b] 24 days. [c] 29 days. [d] June 27–30.

## NEW RIVER (SOUTH FORK) AT NEW RIVER, N. C.

This station was established July 28, 1900, by Cleveland Abbe, jr., and N. C. Curtis, and was located near New River post-office and about 75 yards upstream from Warden's store.

The gage is a wire cord running over a bolt driven into a locust tree and the stage of the water surface is referred to a horizontal scale, divided into feet and tenths, by means of a pointer securely fastened to the wire 10.55 feet distant from the end of the double sash weights which are lowered to touch the surface of the water when an observation of its height is to be made. The stage is then read direct on the gage rod.

The initial point for soundings at this station was marked by a notch cut in a small poplar tree at the point of gaging, which was at a ford about 1 mile downstream from the gage. The measurements of discharge are made by wading.

The channel is straight, the banks seldom overflow, and the bed of the stream rocky and covered with cobbles and bowlders. This station was abandoned December 31, 1901.

The following discharge measurements were made in 1900 and 1901:

*List of discharge measurements of New River (South Fork) at New River, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| July 28 | N. C. Curtis | 2.70 | 751 |
| Oct. 28 | do | 2.60 | 1,035 |
| 1901. | | | |
| June 27 | N. C. Curtis | 3.90 | 1,976 |

*Daily gage height, in feet, of New River (South Fork) at New River, N. C.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | | | 1900. | | | | | | |
| 1 | ..... | 2.45 | 2.30 | 2.30 | 2.60 | 2.70 | 17 | ..... | 2.20 | 2.80 | 2.25 | 2.40 | 2 60 |
| 2 | ..... | 2.35 | 2.25 | 2.30 | 2.60 | 2.70 | 18 | ..... | 2.20 | 2.40 | 2.20 | 2.40 | 2.60 |
| 3 | ..... | 2.30 | 2.20 | 2.45 | 3.50 | 2.70 | 19 | ..... | 2.20 | 2.40 | 2.20 | 2.40 | 2.60 |
| 4 | ..... | 2.30 | 2.20 | 2.80 | 3.80 | 3.95 | 20 | ..... | 2.20 | 2.30 | 2.20 | 2.40 | 2.60 |
| 5 | ..... | 2.30 | 2.20 | 2.75 | 3.30 | 3.70 | 21 | ..... | 2.20 | 2.30 | 2.20 | 2.35 | 2.60 |
| 6 | ..... | 2.30 | 2.20 | 2.70 | 2.80 | 3.20 | 22 | ..... | 2.30 | 2.30 | 2.20 | 2.30 | 2.60 |
| 7 | ..... | 2.30 | 2.20 | 2.55 | 2.65 | 2.85 | 23 | ..... | 2.30 | 2.30 | 7.90 | 2.30 | 2.70 |
| 8 | ..... | 2.30 | 2.20 | 2.50 | 2.60 | 2.80 | 24 | ..... | 2.30 | 2.30 | 6.70 | 2.30 | 2.60 |
| 9 | ..... | 2.30 | 2.20 | 2.45 | 2.60 | 2.80 | 25 | ..... | 2.30 | 2.30 | 3.75 | 2.70 | 2.60 |
| 10 | ..... | 2.30 | 2.20 | 2.40 | 2.60 | 2.75 | 26 | ..... | 2.25 | 2.30 | 3.05 | 5.20 | 2.60 |
| 11 | ..... | 2.30 | 2.20 | 2.40 | 2.60 | 2.70 | 27 | ..... | 2.20 | 2.30 | 2.90 | 3.60 | 2.60 |
| 12 | ..... | 2.30 | 2.15 | 2.35 | 2.55 | 2.70 | 28 | ..... | 2.20 | 2.30 | 2.70 | 3.05 | 2.60 |
| 13 | ..... | 2.35 | 2.10 | 2.30 | 2.50 | 2.60 | 29 | ..... | 2.65 | 2.50 | 2.30 | 2.60 | 2.95 | 2.60 |
| 14 | ..... | 2.40 | 2.55 | 2.30 | 2.50 | 2.60 | 30 | ..... | 2.50 | 2.45 | 2.30 | 2.60 | 2.80 | 2.60 |
| 15 | ..... | 2.35 | 2.60 | 2.30 | 2.45 | 2.60 | 31 | ..... | 2.50 | 2.35 | ..... | 2.60 | ..... | 2.80 |
| 16 | ..... | 2.30 | 3.70 | 2.30 | 2.40 | 2.60 | | | | | | | | |

*Daily gage height, in feet, of New River (South Fork) at New River, N. C.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | 2.75 | 2.55 | 2.60 | 3.05 | 3.40 | ..... | 3.95 | 2.85 | 4.80 | 3.80 | 2.95 | 2.70 |
| 2 | 2.70 | 2.50 | 2.60 | 4.45 | 3.30 | ..... | 3.70 | 2.80 | 4.30 | 3.70 | 2.90 | 2.70 |
| 3 | 2.70 | 2.55 | 2.55 | 5.65 | 3.30 | ..... | 3.60 | 2.75 | 4.10 | 3.70 | 2.90 | 3.15 |
| 4 | 2.65 | 2.80 | 2.50 | 4.25 | 3.25 | ..... | 3.70 | 2.70 | 4.05 | 3.50 | 2.90 | 3.15 |
| 5 | 2.60 | 2.70 | 2.50 | 3.70 | 3.30 | ..... | 3.65 | 3.95 | 3.85 | 3.40 | 3.00 | 2.95 |
| 6 | 2.55 | 2.50 | 2.50 | 3.60 | 3.30 | ..... | 4.05 | 9.47 | 3.70 | 3.30 | 2.95 | 2.85 |
| 7 | 2.50 | 2.55 | 2.50 | 3.55 | 3.20 | ..... | 3.65 | 5.30 | 3.65 | 3.25 | 2.90 | 2.75 |
| 8 | 2.50 | 2.70 | 2.50 | 3.40 | 3.20 | ..... | 3.55 | 4.00 | 3.60 | 3.20 | 2.90 | 2.70 |
| 9 | 2.50 | 3.05 | 2.50 | 3.10 | 3.55 | ..... | 3.45 | 3.55 | 3.60 | 3.15 | 2.90 | 2.80 |
| 10 | 2.55 | 2.95 | 2.60 | 3.05 | 3.45 | ..... | 3.30 | 3.35 | 3.60 | 3.10 | 2.90 | 3.80 |
| 11 | 3.20 | 2.80 | 3.15 | 3.00 | 3.65 | ..... | 3.20 | 3.35 | 3.55 | 3.10 | 2.90 | 3.40 |
| 12 | 3.55 | 2.65 | 2.95 | 2.95 | 3.45 | ..... | 3.20 | 4.65 | 3.55 | 3.10 | 2.90 | 3.00 |
| 13 | 3.50 | 2.60 | 2.70 | 3.05 | 3.20 | ..... | 3.15 | 6.25 | 3.60 | 4.90 | 2.90 | 2.90 |
| 14 | 2.95 | 2.60 | 2.65 | 3.80 | 3.00 | ..... | 3.20 | 5.60 | 3.60 | 4.20 | 2.85 | 5.90 |
| 15 | 2.90 | 2.60 | 2.60 | 3.40 | 3.00 | ..... | 3.25 | 5.60 | 3.60 | 3.25 | 2.80 | 13.00 |
| 16 | 2.80 | 2.60 | 2.60 | 3.10 | 3.00 | ..... | 3.40 | 5.35 | 3.60 | 3.10 | 2.80 | 5.40 |
| 17 | 2.80 | 2.60 | 2.60 | 3.05 | 3.00 | ..... | 3.50 | 7.20 | 3.60 | 3.10 | 2.80 | 4.30 |
| 18 | 2.70 | 2.60 | 2.50 | 3.00 | 3.10 | ..... | 3.50 | 6.15 | 3.75 | 3.10 | 2.80 | 3.95 |
| 19 | 2.70 | 2.60 | 2.50 | 4.70 | 3.25 | ..... | 3.45 | 5.75 | 3.60 | 3.00 | 2.80 | 3.85 |
| 20 | 2.70 | 2.60 | 2.55 | 13.30 | 3.30 | ..... | 2.95 | 4.70 | 3.55 | 3.00 | 2.80 | 3.55 |
| 21 | 2.70 | 2.55 | 3.00 | 6.65 | 8.00 | ..... | 3.00 | 5.05 | 3.45 | 3.00 | 2.80 | 3.45 |
| 22 | 2.70 | 2.55 | 2.90 | 4.95 | 15.00 | ..... | 2.90 | 4.85 | 3.40 | 3.00 | 2.80 | 3.35 |
| 23 | 2.70 | 2.50 | 2.65 | 4.55 | ..... | ..... | 2.90 | 5.00 | 3.40 | 3.00 | 3.50 | 3.25 |
| 24 | 2.70 | 2.55 | 2.60 | 4.45 | ..... | ..... | 2.85 | 5.25 | 3.30 | 3.00 | 3.20 | 3.25 |
| 25 | 2.65 | 2.75 | 2.85 | 4.25 | ..... | ..... | 2.80 | 4.45 | 3.30 | 3.00 | 2.95 | 3.45 |
| 26 | 2.55 | 2.70 | 5.20 | 4.05 | ..... | ..... | 2.80 | 5.05 | 3.25 | 3.00 | 2.80 | 3.55 |
| 27 | 2.65 | 2.60 | 5.00 | 3.75 | ..... | ..... | 2.80 | 4.60 | 3.15 | 3.00 | 2.80 | 3.60 |
| 28 | 2.60 | 2.55 | 3.70 | 3.70 | ..... | ..... | 2.80 | 5.00 | 3.40 | 3.00 | 2.80 | 3.70 |
| 29 | 2.65 | ..... | 3.20 | 3.60 | ..... | ..... | 2.90 | 4.80 | 5.50 | 3.00 | 2.80 | 3.70 |
| 30 | 2.60 | ..... | 3.40 | 3.55 | ..... | ..... | 2.90 | 4.55 | 4.20 | 3.00 | 2.75 | 6.20 |
| 31 | 2.60 | ..... | 3.45 | ..... | ..... | ..... | 2.90 | 5.00 | ..... | 3.00 | ..... | 4.80 |

*Rating table for New River (South Fork) at New River, S. C., for 1900 and 1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.2 | 240 | 4.0 | 2,090 | 5.8 | 4,070 | 10.0 | 8,690 |
| 2.4 | 440 | 4.2 | 2,310 | 6.0 | 4,290 | 11.0 | 9,790 |
| 2.6 | 640 | 4.4 | 2,530 | 6.2 | 4,510 | 12.0 | 10,890 |
| 2.8 | 840 | 4.6 | 2,750 | 6.4 | 4,730 | 13.0 | 11,990 |
| 3.0 | 1,040 | 4.8 | 2,970 | 6.6 | 4,950 | 14.0 | 13,090 |
| 3.2 | 1,240 | 5.0 | 3,190 | 6.8 | 5,170 | 15.0 | 14,190 |
| 3.4 | 1,440 | 5.2 | 3,410 | 7.0 | 5,390 | | |
| 3.6 | 1,650 | 5.4 | 3,630 | 8.0 | 6,490 | | |
| 3.8 | 1,870 | 5.6 | 3,850 | 9.0 | 7,590 | | |

*Estimated monthly discharge of New River (South Fork) at New River, N. C.*

[Drainage area, 327 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1900. | | | | | |
| July[a] | | | 590 | 1.80 | 0.20 |
| August | 540 | 240 | 342 | 1.05 | 1.21 |
| September | 1,760 | 200 | 389 | 1.19 | 1.33 |
| October | 6,380 | 240 | 878 | 2.68 | 3.09 |
| November | 3,410 | 340 | 820 | 2.51 | 2.80 |
| December | 2,035 | 640 | 789 | 2.41 | 2.78 |
| 1901. | | | | | |
| January | 1,595 | 540 | 779 | 2.38 | 2.75 |
| February | 1,090 | 540 | 677 | 2.07 | 2.16 |
| March | 3,410 | 540 | 957 | 2.93 | 3.37 |
| April | 12,320 | 990 | 2,275 | 6.96 | 8.88 |
| May[b] | | | 2,123 | 6.49 | 5.31 |
| June | | | | | |
| July | 2,145 | 840 | 1,302 | 3.99 | 5.75 |
| August | 8,000 | 740 | 2,659 | 8.13 | 9.37 |
| September | 3,740 | 1,190 | 1,489 | 4.55 | 5.07 |
| October | 3,080 | 1,040 | 1,305 | 3.99 | 4.60 |
| November | 1,540 | 790 | 932 | 2.85 | 3.17 |
| December | 11,990 | 740 | 2,187 | 6.69 | 7.71 |

[a] Three days. [b] May (1-22).

## CUMBERLAND DRAINAGE BASIN.

Cumberland River rises in the eastern part of Kentucky and flows west till it meets the South Fork, which rises in northern Tennessee and flows northward. After this junction the Cumberland turns toward the southwest into Tennessee, and, after flowing through the north-central part, again enters Kentucky in Trigg County, flows across the State, and enters the Ohio River at Smithland, about 15 miles above the mouth of Tennessee River. The gaging station on this river is located at Nashville, Tenn., and is under the care of B. M. Hall.

### CUMBERLAND RIVER AT NASHVILLE, TENN.

The gage, which belongs to the United States Engineer Corps, is at the foot of Broad street. It is in three sections, two of which are upright and one inclined. The lowest section, extending from −0.2 foot to +46 feet, is on the slope of the bank and consists of timbers

embedded in the ground, bearing an iron strap, into which the markings are cut. The section extending from gage height 46 to 53 feet is fastened to a small building at the top of the bank, and consists of a timber painted white with black markings. The top section of the gage, extending from 52 feet to 55.3 feet, is on the corner of Temperance Hall, painted on the stones in white with black markings. In addition there is a vertical section reading from −1.2 feet to +2 feet. The datum of the gage corresponds to elevation 110.3 feet of the city levels. A cross, cut on the upper face of the corner stone in the southeast corner of Temperance Hall, on Broad street, near Front street, is 52 feet above the zero of the gage, and 366.6 feet above mean sea level. The highest observed water was 55.3 feet on January 22, 1882. The lowest occurred on October 15 and 16, 1878, at a gage height of −0.4 foot. The danger line is at 40 feet.

Records have been kept for a number of years by the United States Weather Bureau, from which readings previous to those here published may be obtained.

*Daily gage height, in feet, of Cumberland River at Nashville, Tenn.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 27.40 | 39.00 | 16.80 | 44.00 | 15.40 | 3.60 | 7.60 | 1.70 | 1.60 | 5.50 | 1.60 | 19.40 |
| 2 | 29.10 | 40.30 | 16.90 | 45.40 | 24.00 | 3.50 | 7.20 | 2.80 | 2.50 | 5.40 | 1.60 | 18.00 |
| 3 | 29.40 | 40.30 | 20.70 | 46.00 | 22.20 | 3.30 | 7.70 | 2.60 | 2.10 | 4.60 | 1.50 | 17.20 |
| 4 | 27.90 | 40.80 | 21.70 | 46.00 | 21.90 | 3.20 | 8.40 | 2.20 | 2.50 | 4.30 | 1.40 | 18.60 |
| 5 | 24.30 | 40.10 | 22.50 | 46.10 | 21.60 | 3.00 | 9.00 | 2.10 | 2.30 | 3.30 | 1.50 | 19.20 |
| 6 | 19.10 | 38.20 | 26.00 | 45.20 | 17.00 | 3.00 | 8.80 | 2.00 | 2.10 | 3.00 | 1.50 | 21.50 |
| 7 | 14.90 | 30.80 | 27.80 | 39.70 | 13.50 | 2.80 | 7.80 | 2.00 | 1.90 | 2.50 | 1.50 | 20.50 |
| 8 | 12.10 | 22.60 | 30.10 | 30.20 | 13.80 | 2.80 | 7.30 | 1.80 | 1.80 | 2.20 | 1.40 | 19.60 |
| 9 | 10.60 | 16.00 | 32.10 | 21.40 | 10.40 | 2.60 | 6.40 | 4.20 | 1.90 | 2.10 | 1.40 | 18.70 |
| 10 | 9.60 | 12.70 | 32.30 | 16.60 | 8.80 | 2.50 | 4.40 | 4.10 | 1.70 | 1.90 | 1.40 | 17.40 |
| 11 | 8.70 | 11.10 | 31.60 | 14.50 | 7.90 | 2.50 | 3.50 | 3.70 | 1.50 | 2.00 | 1.50 | 15.80 |
| 12 | 7.90 | 9.80 | 29.60 | 13.20 | 7.80 | 2.90 | 3.30 | 2.20 | 1.40 | 2.60 | 1.40 | 13.70 |
| 13 | 7.30 | 8.80 | 28.20 | 11.80 | 7.20 | 2.40 | 3.10 | 2.00 | 1.30 | 3.20 | 1.40 | 11.40 |
| 14 | 6.90 | 7.60 | 25.20 | 10.70 | 6.90 | 2.30 | 3.10 | 2.20 | 1.20 | 5.10 | 1.30 | 9.40 |
| 15 | 6.30 | 7.10 | 21.50 | 9.80 | 6.70 | 2.30 | 3.00 | 2.10 | 1.10 | 6.80 | 1.30 | 12.80 |
| 16 | 6.00 | 6.90 | 19.00 | 9.10 | 6.60 | 2.20 | 2.70 | 2.10 | 1.10 | 6.40 | 1.30 | 26.50 |
| 17 | 5.70 | 6.60 | 19.60 | 8.50 | 6.60 | 2.10 | 2.30 | 2.20 | 1.00 | 5.80 | 1.30 | 30.30 |
| 18 | 5.30 | 6.20 | 20.60 | 8.10 | 6.40 | 2.10 | 2.20 | 2.10 | 1.00 | 5.20 | 1.40 | 31.20 |
| 19 | 5.30 | 6.00 | 21.30 | 7.70 | 5.60 | 2.00 | 2.00 | 2.10 | 1.20 | 5.10 | 1.40 | 31.30 |
| 20 | 5.40 | 5.90 | 21.60 | 7.40 | 5.10 | 2.00 | 2.10 | 2.10 | 1.20 | 4.40 | 1.50 | 32.80 |
| 21 | 6.00 | 5.80 | 21.20 | 6.90 | 5.20 | 2.10 | 2.50 | 2.00 | 1.10 | 4.10 | 1.80 | 33.30 |
| 22 | 9.90 | 5.90 | 20.50 | 5.80 | 4.80 | 2.20 | 1.90 | 2.00 | 1.00 | 3.60 | 1.90 | 32.40 |
| 23 | 10.70 | 6.00 | 19.20 | 5.70 | 4.70 | 2.20 | 2.20 | 1.90 | 1.00 | 3.40 | 2.10 | 31.20 |
| 24 | 11.70 | 8.80 | 14.30 | 5.60 | 4.60 | 2.20 | 1.90 | 1.80 | 1.10 | 3.10 | 2.10 | 23.20 |
| 25 | 11.90 | 10.50 | 12.30 | 5.60 | 4.40 | 2.00 | 1.80 | 1.90 | 1.50 | 2.80 | 3.60 | 21.00 |
| 26 | 12.40 | 13.10 | 10.90 | 5.90 | 4.20 | 2.10 | 1.70 | 1.90 | 2.60 | 2.40 | 11.80 | 18.40 |
| 27 | 17.50 | 13.00 | 9.90 | 6.00 | 3.90 | 2.40 | 1.60 | 1.80 | 3.20 | 2.10 | 15.20 | 16.20 |
| 28 | 22.70 | 15.00 | 10.10 | 6.20 | 3.60 | 2.50 | 1.60 | 1.90 | 3.10 | 2.00 | 17.50 | 13.80 |
| 29 | 24.80 | ..... | 32.70 | 7.00 | 3.50 | 2.90 | 1.90 | 1.80 | 2.80 | 2.00 | 18.80 | 12.30 |
| 30 | 31.20 | ..... | 43.40 | 9.10 | 3.40 | 6.70 | 2.20 | 1.70 | 2.90 | 1.80 | 19.60 | 13.40 |
| 31 | 35.20 | ..... | 44.70 | ..... | 3.30 | ..... | 1.80 | 1.60 | ..... | 1.70 | ..... | 12.90 |

MISCELLANEOUS MEASUREMENTS IN CUMBERLAND DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in the Cumberland drainage basin in 1902 by B. M. Hall and his assistants:

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| May 19.. | Clear Fork of Cumberland River. | One-half mile from Clearfield, Tenn. | 12 |
| Dec. 11.. | Cumberland River ..... | Burnside, Ky ..... | 3,295 |

## TENNESSEE RIVER DRAINAGE BASIN.

Tennessee River is formed by the junction of the French Broad and the Holston about 4 miles above Knoxville, Tenn. It flows southwest, crossing into Alabama about 40 miles below Chattanooga, Tenn., and, after crossing the northern part of Alabama, again enters Tennessee in Harding County. It then flows north, crossing Tennessee and Kentucky, and enters the Ohio River at Paducah, about 40 miles above Cairo. Its principal tributary on the north is Clinch River, which enters it near Kingston, Roan County, Tenn. The principal tributaries on the south are Hiwassee and Little Tennessee rivers. The Hiwassee rises in the northern part of Georgia and flows into the Tennessee about 30 miles above Chattanooga. Its principal tributaries are the Ocoee and the Nottely. Little Tennessee River rises in the northern part of Georgia, flows across the southwestern part of North Carolina, and enters the Tennessee near Loudon, Tenn. Its principal tributary is the Tuckasegee. French Broad River rises in the western part of North Carolina. Its principal tributaries are the Pigeon and the Nolichucky. Holston River rises in the western part of Virginia. Its principal tributary is Watauga River, into which stream Roan Creek enters. During 1902 the United States Geological Survey maintained the following stations in this basin under the supervision of B. M. Hall and E. W. Myers, resident hydrographers for this section: On the Tennessee at Chattanooga, Tenn.; on the Hiwassee at Charleston, Tenn.; on the Toccoa (Okoee), near Blueridge, Ga.; on the Hiwassee at Reliance, Tenn.; on the Nottely at Ranger, N. C.; on the Hiwassee at Murphy, N. C.; on the Little Tennessee at Judson, N. C.; on the Tuckasegee at Bryson, N. C.; on the Tennessee at Knoxville, Tenn.; on the French Broad at Oldtown, near Newport, Tenn.; on the Pigeon at Newport, Tenn.; on the Nolichucky River, near Chucky Valley, Tenn.; on the Holston (S. F.) at Bluff City, Tenn.; on the Watauga at Butler, Tenn.; on Roan Creek at Butler, Tenn.

## TENNESSEE RIVER AT CHATTANOOGA, TENN.

This station was established in 1879, at the foot of Lookout street, just below Chattanooga Island, by the Signal Corps of the United States Army; but since July 1, 1891, it has been in charge of the Weather Bureau. During the year 1900 a new gage was established. It is a vertical rod bolted to the south side of the third stone pier from the south end of the Hamilton County highway bridge. During the present year the self-registering gage invented by Professor Fulton, of Tennessee University, has been in use at this station. The gage is connected by wire with the Weather Bureau office, and a continuous electrical record of river height is made in the same manner as the record of wind, sunshine, etc. Gage heights are furnished to the Geological Survey through L. M. Pindell.

The following discharge measurements were made during 1902:

June 25: Gage height, 3.80 feet; discharge, 17,773 second-feet.
October 9: Gage height, 2.00 feet; discharge, 10,678 second-feet.
November 14: Gage height, 1.55 feet; discharge, 9,282 second-feet.

*Daily gage height, in feet, of Tennessee River at Chattanooga, Tenn.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 40.10 | 20.10 | 24.00 | 30.90 | 5.60 | 4.00 | 9.80 | 2.20 | 1.40 | 3.90 | 1.30 | 5.20 |
| 2 | 40.80 | 21.80 | 31.90 | 27.00 | 8.50 | 3.80 | 10.20 | 2.00 | 1.20 | 3.70 | 1.30 | 5.10 |
| 3 | 37.60 | 23.20 | 35.80 | 18.00 | 9.30 | 3.60 | 8.80 | 2.10 | 1.20 | 3.90 | 1.40 | 6.70 |
| 4 | 26.80 | 21.70 | 38.00 | 12.30 | 8.00 | 3.50 | 7.50 | 2.40 | 1.50 | 3.30 | 1.50 | 7.40 |
| 5 | 15.00 | 18.00 | 35.90 | 10.70 | 6.80 | 3.40 | 6.50 | 2.40 | 1.30 | 3.00 | 1.50 | 7.80 |
| 6 | 10.90 | 14.50 | 30.30 | 10.00 | 6.00 | 3.40 | 5.50 | 2.80 | 1.40 | 2.80 | 1.50 | 7.50 |
| 7 | 9.70 | 11.70 | 25.50 | 9.50 | 5.60 | 3.20 | 4.50 | 2.50 | 1.50 | 2.40 | 1.40 | 7.50 |
| 8 | 8.90 | 10.00 | 20.70 | 9.80 | 5.60 | 3.20 | 4.00 | 2.10 | 1.50 | 2.10 | 1.80 | 6.60 |
| 9 | 8.00 | 8.80 | 17.90 | 9.90 | 5.50 | 3.30 | 3.70 | 1.90 | 1.50 | 2.00 | 2.20 | 6.00 |
| 10 | 7.70 | 8.10 | 15.60 | 9.50 | 5.20 | 3.40 | 3.50 | 2.20 | 1.50 | 1.90 | 2.10 | 5.30 |
| 11 | 7.30 | 7.50 | 14.20 | 8.90 | 5.00 | 3.20 | 3.40 | 2.80 | 1.40 | 2.20 | 1.90 | 4.70 |
| 12 | 6.90 | 6.90 | 12.90 | 8.40 | 4.80 | 3.40 | 3.40 | 2.70 | 1.50 | 2.90 | 1.80 | 4.20 |
| 13 | 6.50 | 6.40 | 12.10 | 8.00 | 4.60 | 3.50 | 3.60 | 2.40 | 1.90 | 2.70 | 1.80 | 3.90 |
| 14 | 6.20 | 6.00 | 11.20 | 7.50 | 4.50 | 3.30 | 4.80 | 2.00 | 2.10 | 2.70 | 1.60 | 3.60 |
| 15 | 5.80 | 6.00 | 10.50 | 7.30 | 4.50 | 3.10 | 5.00 | 1.70 | 2.00 | 3.30 | 1.50 | 3.40 |
| 16 | 5.50 | 6.10 | 10.00 | 7.10 | 4.60 | 3.00 | 4.20 | 1.60 | 1.90 | 3.40 | 1.40 | 3.50 |
| 17 | 5.30 | 6.00 | 12.20 | 6.90 | 4.70 | 3.00 | 3.80 | 1.50 | 1.80 | 3.50 | 1.40 | 4.80 |
| 18 | 5.10 | 5.80 | 14.50 | 6.80 | 4.50 | 3.00 | 3.30 | 1.50 | 1.50 | 3.00 | 1.40 | 7.40 |
| 19 | 5.10 | 5.60 | 14.90 | 6.70 | 4.50 | 4.00 | 3.10 | 1.50 | 1.40 | 2.80 | 1.70 | 7.80 |
| 20 | 5.20 | 5.50 | 14.10 | 6.60 | 4.40 | 4.50 | 2.90 | 1.40 | 1.40 | 2.60 | 1.90 | 7.20 |
| 21 | 5.40 | 5.20 | 12.30 | 6.50 | 4.40 | 4.60 | 2.60 | 1.50 | 1.40 | 2.20 | 2.10 | 7.00 |
| 22 | 6.20 | 5.70 | 10.60 | 6.30 | 4.50 | 4.40 | 2.70 | 1.60 | 2.00 | 2.00 | 1.90 | 8.70 |
| 23 | 6.50 | 6.80 | 9.50 | 6.10 | 4.80 | 4.00 | 2.90 | 1.60 | 2.60 | 1.80 | 1.90 | 9.60 |
| 24 | 6.70 | 7.90 | 8.90 | 6.00 | 4.60 | 3.90 | 2.60 | 1.50 | 2.60 | 1.80 | 2.00 | 8.70 |
| 25 | 6.60 | 8.10 | 8.30 | 5.90 | 4.60 | 3.70 | 2.30 | 1.40 | 2.80 | 1.60 | 2.10 | 7.20 |
| 26 | 6.10 | 8.50 | 7.80 | 5.70 | 4.50 | 3.50 | 2.00 | 1.40 | 3.30 | 1.50 | 3.50 | 6.50 |
| 27 | 6.30 | 8.60 | 7.50 | 5.50 | 4.20 | 4.00 | 2.00 | 1.50 | 3.60 | 1.40 | 6.10 | 5.70 |
| 28 | 8.50 | 13.30 | 7.20 | 5.40 | 4.00 | 3.90 | 1.90 | 1.50 | 3.60 | 1.40 | 6.30 | 5.10 |
| 29 | 12.60 | ..... | 12.90 | 5.20 | 4.40 | 4.00 | 1.90 | 1.60 | 3.60 | 1.30 | 5.80 | 4.50 |
| 30 | 15.80 | ..... | 26.50 | 5.20 | 4.50 | 5.00 | 2.00 | 1.90 | 3.50 | 1.20 | 5.40 | 4.30 |
| 31 | 18.90 | ..... | 31.00 | ..... | 4.30 | ..... | 2.30 | 1.70 | ..... | 1.20 | ..... | 4.60 |

*Rating table for Tennessee River at Chattanooga, Tenn., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.2 | 8,040 | 5.2 | 28,240 | 14.0 | 85,200 | 24.0 | 150,200 |
| 1.4 | 8,820 | 5.4 | 29,480 | 14.5 | 88,450 | 24.5 | 153,450 |
| 1.6 | 9,620 | 5.6 | 30,720 | 15.0 | 91,700 | 25.0 | 156,700 |
| 1.8 | 10,430 | 5.8 | 31,960 | 15.5 | 94,950 | 25.5 | 159,950 |
| 2.0 | 11,250 | 6.0 | 33,200 | 16.0 | 98,200 | 26.0 | 163,200 |
| 2.2 | 12,080 | 6.5 | 36,450 | 16.5 | 101,450 | 27.0 | 169,700 |
| 2.4 | 12,930 | 7.0 | 39,700 | 17.0 | 104,700 | 28.0 | 176,200 |
| 2.6 | 13,800 | 7.5 | 42,950 | 17.5 | 107,950 | 29.0 | 182,700 |
| 2.8 | 14,680 | 8.0 | 46,200 | 18.0 | 111,200 | 30.0 | 189,200 |
| 3.0 | 15,600 | 8.5 | 49,450 | 18.5 | 114,450 | 31.0 | 195,700 |
| 3.2 | 16,550 | 9.0 | 52,700 | 19.0 | 117,700 | 32.0 | 202,200 |
| 3.4 | 17,550 | 9.5 | 55,950 | 19.5 | 120,950 | 33.0 | 208,700 |
| 3.6 | 18,550 | 10.0 | 59,200 | 20.0 | 124,200 | 34.0 | 215,200 |
| 3.8 | 19,600 | 10.5 | 62,450 | 20.5 | 127,450 | 35.0 | 221,700 |
| 4.0 | 20,800 | 11.0 | 65,700 | 21.0 | 130,700 | 36.0 | 228,200 |
| 4.2 | 22,040 | 11.5 | 68,950 | 21.5 | 133,950 | 37.0 | 234,700 |
| 4.4 | 23,280 | 12.0 | 72,200 | 22.0 | 137,200 | 38.0 | 241,200 |
| 4.6 | 24,520 | 12.5 | 75,450 | 22.5 | 140,450 | 39.0 | 247,700 |
| 4.8 | 25,760 | 13.0 | 78,700 | 23.0 | 143,700 | 40.0 | 254,200 |
| 5.0 | 27,000 | 13.5 | 81,950 | 23.5 | 146,950 | | |

*Estimated monthly discharge of Tennessee River at Chattanooga, Tenn.*

[Drainage area, 21,418 miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 259,400 | 27,620 | 70,567 | 3.29 | 3.79 |
| February | 145,000 | 28,240 | 60,106 | 2.81 | 2.93 |
| March | 241,200 | 41,000 | 108,411 | 5.06 | 5.83 |
| April | 195,050 | 28,240 | 54,811 | 2.56 | 2.86 |
| May | 54,650 | 20,800 | 28,283 | 1.32 | 1.52 |
| June | 27,000 | 15,600 | 19,043 | .89 | .99 |
| July | 60,500 | 10,840 | 22,414 | 1.05 | 1.21 |
| August | 14,680 | 8,820 | 10,892 | .51 | .59 |
| September | 18,550 | 8,040 | 11,376 | .53 | .59 |
| October | 20,200 | 8,040 | 13,260 | .62 | .71 |
| November | 35,150 | 8,430 | 13,298 | .62 | .69 |
| December | 56,600 | 17,550 | 33,763 | 1.58 | 1.82 |
| The year | 259,400 | 8,040 | 37,185 | 1.74 | 23.53 |

## HIWASSEE RIVER AT CHARLESTON, TENN.

The gaging station on this river is located at the bridge of the Southern Railway, 600 feet from the depot, in the town of Charleston, Tenn. It is 17 miles from the mouth of the river and 53 miles above Chattanooga, Tenn. This station was originally established by the United States Engineer Corps, but is now maintained half the year by the United States Weather Bureau and the other half by the United States Geological Survey. The gage rod is fastened to the downstream end of the south pier of the bridge, 125 feet from the shore. It is painted white, and marked in feet and tenths. The bench mark is a cross, cut in the top surface of the upper corner stone of the pier, and is 35 feet above the zero of the gage. The greatest height recorded at this point was on March 31, 1886, when the gage read 32.2 feet. The danger line is placed at 22 feet. The railroad bridge is an iron three-span bridge, with a total length of 390 feet. There are embankments at each end which confine the water, even at the highest stages. The observer is J. C. Bates, Charleston, Tenn.

In 1902 the following discharge measurement was made:

November 15: Gage height, 0.40 foot; discharge, 1,306 second-feet.

*Daily gage height, in feet, of Hiwassee River at Charleston, Tenn.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 17.00 | 10.20 | 23.00 | 9.50 | 3.20 | 1.60 | 1.30 | 0.80 | 0.50 | 1.50 | 0.30 | 1.60 |
| 2 | 15.90 | 12.00 | 15.10 | 6.50 | 5.00 | 1.60 | 1.10 | .70 | .50 | 1.30 | .30 | 1.90 |
| 3 | 11.30 | 11.70 | 14.60 | 5.00 | 4.10 | 1.70 | 1.10 | 1.20 | 1.00 | .90 | .30 | 6.00 |
| 4 | 5.50 | 7.90 | 14.50 | 4.70 | 3.30 | 1.60 | 1.00 | .90 | .60 | .70 | .30 | 5.00 |
| 5 | 4.60 | 6.00 | 12.70 | 4.70 | 2.90 | 1.50 | 1.00 | 1.60 | .60 | .60 | .30 | 3.70 |
| 6 | 4.20 | 5.00 | 11.10 | 4.20 | 2.80 | 1.40 | 1.10 | 1.00 | .70 | .60 | .30 | 3.20 |
| 7 | 3.90 | 4.50 | 8.10 | 4.70 | 2.70 | 1.50 | 1.00 | .60 | .40 | .80 | 1.60 | 2.40 |
| 8 | 3.70 | 4.10 | 6.50 | 5.90 | 3.20 | 1.60 | 1.00 | .50 | .40 | .60 | 1.10 | 2.00 |
| 9 | 3.50 | 3.80 | 7.20 | 5.40 | 2.60 | 2.10 | 1.00 | .40 | .30 | .50 | .80 | 1.80 |
| 10 | 3.30 | 3.50 | 6.60 | 4.50 | 2.50 | 1.70 | .90 | .40 | .30 | .40 | .60 | 1.60 |
| 11 | 3.20 | 3.30 | 5.80 | 4.10 | 2.40 | 1.50 | 1.00 | .60 | .30 | .60 | .60 | 1.50 |
| 12 | 3.00 | 3.10 | 5.30 | 3.90 | 2.30 | 1.40 | 1.00 | .80 | .40 | 1.60 | .50 | 1.40 |
| 13 | 2.80 | 3.10 | 5.00 | 3.70 | 2.20 | 1.30 | 1.70 | .60 | .60 | 1.40 | .50 | 1.30 |
| 14 | 2.70 | 3.00 | 5.10 | 3.60 | 2.50 | 1.30 | 1.90 | .40 | .90 | 2.30 | .40 | 1.30 |
| 15 | 2.70 | 3.10 | 4.50 | 3.60 | 2.50 | 1.40 | 2.00 | .40 | 1.00 | 1.50 | .40 | 1.20 |
| 16 | 2.60 | 3.10 | 5.50 | 3.50 | 2.30 | 1.40 | 2.00 | .40 | .60 | 1.20 | .40 | 1.50 |
| 17 | 2.60 | 3.00 | 10.00 | 3.40 | 2.20 | 1.30 | 1.20 | .50 | .30 | .90 | .40 | 3.40 |
| 18 | 2.50 | 2.90 | 7.00 | 3.60 | 2.30 | 1.30 | 1.00 | .40 | .40 | .70 | 1.10 | 3.30 |
| 19 | 2.70 | 2 80 | 5.60 | 3.40 | 2.30 | 1.30 | .80 | .30 | .40 | .60 | 1.60 | 2.40 |
| 20 | 3.00 | 2.80 | 5.00 | 3.30 | 2.30 | 1.40 | 1.00 | .30 | .50 | .60 | 1.00 | 2.00 |
| 21 | 2.80 | 3.00 | 4.60 | 3.20 | 2.20 | 1.30 | 1.30 | .30 | 1.20 | .50 | .80 | 2.10 |
| 22 | 3.80 | 4.70 | 4.40 | 3.00 | 2.10 | 2.00 | 1.30 | .30 | .40 | .50 | .60 | 6.20 |
| 23 | 3.40 | 4.60 | 4.20 | 2.90 | 1.90 | 1.50 | 1.20 | .30 | .40 | .50 | .60 | 4.40 |
| 24 | 2.90 | 3.90 | 4.00 | 2.90 | 1.90 | 1.20 | .80 | .20 | .30 | .40 | .60 | 3.10 |
| 25 | 2.80 | 3.90 | 3.80 | 2.80 | 1.90 | 1.10 | .70 | .10 | 2.10 | .40 | 1.00 | 2.50 |
| 26 | 2.80 | 4.70 | 3.70 | 2.70 | 1.80 | 2.00 | .70 | .60 | 2.40 | .40 | 6.60 | 2.30 |
| 27 | 2.90 | 4.20 | 3.50 | 2.70 | 1.90 | 2.20 | .60 | .30 | 1.70 | .40 | 3.30 | 2.00 |
| 28 | 5.00 | 17.60 | 3.70 | 2.70 | 1.80 | 1.80 | .60 | .70 | 1.40 | .40 | 2.20 | 1.70 |
| 29 | 4.70 | ..... | 11.50 | 2.60 | 1.70 | 1.40 | .90 | .80 | 1.30 | .40 | 1.70 | 1.70 |
| 30 | 4.70 | ..... | 16.30 | 3.40 | 1.60 | 1.40 | 1.30 | 1.00 | 1.30 | .30 | 1.50 | 2.60 |
| 31 | 6.50 | ..... | 11.60 | ..... | 1.60 | ..... | .90 | .60 | ..... | .30 | ..... | 2.70 |

*Rating table for Hiwassee River at Charleston, Tenn., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.2 | 1,200 | 3.4 | 5,580 | 7.5 | 11,525 | 15.5 | 23,125 |
| .4 | 1,380 | 3.6 | 5,870 | 8.0 | 12,250 | 16.0 | 23,850 |
| .6 | 1,580 | 3.8 | 6,160 | 8.5 | 12,975 | 16.5 | 24,575 |
| .8 | 1,820 | 4.0 | 6,450 | 9.0 | 13,700 | 17.0 | 25,300 |
| 1.0 | 2,100 | 4.2 | 6,740 | 9.5 | 14,425 | 17.5 | 26,025 |
| 1.2 | 2,390 | 4.4 | 7,030 | 10.0 | 15,150 | 18.0 | 26,750 |
| 1.4 | 2,680 | 4.6 | 7,320 | 10.5 | 15,875 | 19.0 | 28,200 |
| 1.6 | 2,970 | 4.8 | 7,610 | 11.0 | 16,600 | 20.0 | 29,650 |
| 1.8 | 3,260 | 5.0 | 7,900 | 11.5 | 17,325 | 21.0 | 31,100 |
| 2.0 | 3,550 | 5.2 | 8,190 | 12.0 | 18,050 | 22.0 | 32,550 |
| 2.2 | 3,840 | 5.4 | 8,480 | 12.5 | 18,775 | 23.0 | 34,000 |
| 2.4 | 4,130 | 5.6 | 8,770 | 13.0 | 19,500 | 24.0 | 35,450 |
| 2.6 | 4,420 | 5.8 | 9,060 | 13.5 | 20,225 | 25.0 | 36,900 |
| 2.8 | 4,710 | 6.0 | 9,350 | 14.0 | 20,950 | | |
| 3.0 | 5,000 | 6.5 | 10,075 | 14.5 | 21,675 | | |
| 3.2 | 5,290 | 7.0 | 10,800 | 15.0 | 22,400 | | |

*Estimated monthly discharge of Hiwassee River at Charleston, Tenn.*

[Drainage area, 2,297 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 25,300 | 4,275 | 7,339 | 3.20 | 3.69 |
| February | 26,170 | 4,710 | 8,185 | 3.56 | 3.71 |
| March | 34,000 | 5,725 | 12,320 | 5.36 | 6.18 |
| April | 14,425 | 4,420 | 6,455 | 2.81 | 3.14 |
| May | 7,900 | 2,970 | 4,205 | 1.83 | 2.11 |
| June | 3,840 | 2,245 | 2,864 | 1.25 | 1.39 |
| July | 3,550 | 1,580 | 2,265 | .99 | 1.14 |
| August | 2,970 | 1,120 | 1,598 | .70 | .81 |
| September | 4,130 | 1,285 | 1,859 | .81 | .90 |
| October | 3,985 | 1,285 | 1,837 | .80 | .92 |
| November | 10,220 | 1,285 | 2,260 | .98 | 1.09 |
| December | 9,640 | 2,390 | 4,383 | 1.91 | 2.20 |
| The year | 34,000 | 1,120 | 4,631 | 2.02 | 27.28 |

TOCCOA (OKOEE) RIVER NEAR BLUERIDGE, GA.

This stream, called Toccoa River in Georgia and Okoee River in Tennessee, has its source on the northern slopes of the Blue Ridge Mountains in Georgia and flows northwest into Hiwassee River. The area is covered with a fine growth of oak, hickory, and other hard woods. The station, established by B. M. Hall on November 25, 1898, is located at the Morganton bridge, about 4 miles east of the town of Blueridge, Ga. The gage is a 14-foot rod, in two 7-foot sections, nailed to a tree on the right bank just below the bridge. It is graduated to feet and tenths and is set to conform to bench marks which were established October 15, 1896, and October 26, 1898. The measurements during 1896 were made at the railroad bridge about 3 miles below, but are referred to the present gage by comparison of the bench marks at the two bridges. The bench mark at Morganton bridge is on the top of the bridge floor, on the downstream side, 50 feet from the initial point, and is 18 feet above the zero of the gage. The bridge was a wooden, queen-post, open bridge, in three spans, with a total length between abutments of 153 feet, but it has been remodeled and changed into a closed bridge, not suitable for use in making discharge measurements at such an irregular section. Measurements are now made at a ferry about 2½ miles below, but the gage at the bridge is still maintained. The observer is W. E. Rogers, a farmer living about a quarter of a mile east of the gage.

The following discharge measurements were made during 1902:

April 25: Gage height, 3.20 feet; discharge, 749 second-feet.
November 21: Gage height, 2.15 feet; discharge, 253 second-feet.

*Daily gage height, in feet, of Toccoa River near Blueridge, Ga.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 5.00 | 4.00 | 4.00 | 4.80 | 3.50 | 2.80 | 2.50 | 2.60 | 2.80 | 2.50 | 2.40 | 3.00 |
| 2 | 5.00 | 4.00 | 4.00 | 4.80 | 3.50 | 2.80 | 2.50 | 2.60 | 3.00 | 2.50 | 2.40 | 4.00 |
| 3 | 5.00 | 4.00 | 4.00 | 4.60 | 3.40 | 2.80 | 2.50 | 2.40 | 3.00 | 2.50 | 2.40 | 4.00 |
| 4 | 4.60 | 4.00 | 4.00 | 4.60 | 3.00 | 2.80 | 2.50 | 2.40 | 3.00 | 2.50 | 2.40 | 4.00 |
| 5 | 4.50 | 4.00 | 3.80 | 4.50 | 3.00 | 2.80 | 2.50 | 2.40 | 3.00 | 2.60 | 2.40 | 4.00 |
| 6 | 4.30 | 4.00 | 3.80 | 4.00 | 3.00 | 2.80 | 2.50 | 2.30 | 2.80 | 2.60 | 2.40 | 3.50 |
| 7 | 4.00 | 4.00 | 3.70 | 4.00 | 3.00 | 2.80 | 2.50 | 2.30 | 2.80 | 2.60 | 3.00 | 3.50 |
| 8 | 4.00 | 4.00 | 3.70 | 4.00 | 3.00 | 3.00 | 2.40 | 2.30 | 2.80 | 2.60 | 3.00 | 3.50 |
| 9 | 4.00 | 4.00 | 4.00 | 4.00 | 3.00 | 3.00 | 2.40 | 2.30 | 2.60 | 2.60 | 3.00 | 3.00 |
| 10 | 4.00 | 4.00 | 6.00 | 4.80 | 3.00 | 3.00 | 2.40 | 2.30 | 2.60 | 2.60 | 2.50 | 3.00 |
| 11 | 4.00 | 4.00 | 5.50 | 4.80 | 3.00 | 3.00 | 2.30 | 2.30 | 2.60 | 2.60 | 2.50 | 3.00 |
| 12 | 3.60 | 4.30 | 5.50 | 4.00 | 3.00 | 3.00 | 2.60 | 2.30 | 3.00 | 2.60 | 2.40 | 3.00 |
| 13 | 3.60 | 4.20 | 5.00 | 4.00 | 3.00 | 3.00 | 2.40 | 2.30 | 3.00 | 2.60 | 2.40 | 3.00 |
| 14 | 3.60 | 4.00 | 5.00 | 3.80 | 3.00 | 3.00 | 2.40 | 2.30 | 2.80 | 2.60 | 2.40 | 3.00 |
| 15 | 3.50 | 4.00 | 5.00 | 3.80 | 3.00 | 2.80 | 2.40 | 2.30 | 2.80 | 2.50 | 2.40 | 3.00 |
| 16 | 3.50 | 4.00 | 5.00 | 3.80 | 3.00 | 2.80 | 2.40 | 2.30 | 2.80 | 2.50 | 2.40 | 3.00 |
| 17 | 3.50 | 4.00 | 4.80 | 3.60 | 3.00 | 2.80 | 2.40 | 2.20 | 2.80 | 2.50 | 2.40 | 3.00 |

*Daily gage height, in feet, of Toccoa River near Blueridge, Ga.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 18 | 3.50 | 4.00 | 4.80 | 3.60 | 3.00 | 2.80 | 2.40 | 2.20 | 2.80 | 2.50 | 2.40 | 3.00 |
| 19 | 3.50 | 6.00 | 4.60 | 3.60 | 3.00 | 2.70 | 2.40 | 2.20 | 2.80 | 2.50 | 2.40 | 3.00 |
| 20 | 3.50 | 10.00 | 4.60 | 3.40 | 3.00 | 2.70 | 2.40 | 2.20 | 2.80 | 2.50 | 2.40 | 3.00 |
| 21 | 3.40 | 5.00 | 4.30 | 3.40 | 3.00 | 2.70 | 2.40 | 2.20 | 2.80 | 2.50 | 2.30 | 3.50 |
| 22 | 3.40 | 5.00 | 4.00 | 3.40 | 3.00 | 2.60 | 2.40 | 2.20 | 2.70 | 2.50 | 2.30 | 3.50 |
| 23 | 3.40 | 5.00 | 4.00 | 3.40 | 3.00 | 2.60 | 2.40 | 2.20 | 2.70 | 2.50 | 2.30 | 3.50 |
| 24 | 3.40 | 4.00 | 4.00 | 3.20 | 3.00 | 2.50 | 2.40 | 2.20 | 2.60 | 2.50 | 2.30 | 3.20 |
| 25 | 3.40 | 4.00 | 4.00 | 3.20 | 3.00 | 2.50 | 2.40 | 2.20 | 2.60 | 2.50 | 4.00 | 3.00 |
| 26 | 4.00 | 4.00 | 4.00 | 3.20 | 3.00 | 2.50 | 2.40 | 2.20 | 2.60 | 2.40 | 3.00 | 3.00 |
| 27 | 4.00 | 4.00 | 4.00 | 3.40 | 3.00 | 2.50 | 2.40 | 3.00 | 2.60 | 2.40 | 3.00 | 3.00 |
| 28 | 5.00 | 4.00 | 3.80 | 3.40 | 3.00 | 2.50 | 2.40 | 3.00 | 2.50 | 2.40 | 3.00 | 3.00 |
| 29 | 5.00 | ..... | 6.00 | 3.40 | 2.80 | 2.50 | 2.40 | 3.00 | 2.50 | 2.40 | 3.00 | 3.00 |
| 30 | 4.50 | ..... | 5.00 | 3.50 | 2.80 | 2.50 | 2.40 | 2.80 | 2.50 | 2.40 | 3.00 | 3.00 |
| 31 | 4.50 | ..... | 5.00 | ..... | 2.80 | ..... | 2.60 | 2.80 | ..... | 2.40 | ..... | 3.00 |

*Rating table for Toccoa (Okoee) River near Blueridge, Ga., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.2 | 270 | 3.6 | 1,162 | 5.0 | 2,660 | 6.8 | 4,586 |
| 2.3 | 312 | 3.7 | 1,269 | 5.1 | 2,767 | 7.0 | 4,800 |
| 2.4 | 355 | 3.8 | 1,376 | 5.2 | 2,874 | 7.2 | 5,014 |
| 2.5 | 400 | 3.9 | 1,483 | 5.3 | 2,981 | 7.4 | 5,228 |
| 2.6 | 447 | 4.0 | 1,590 | 5.4 | 3,088 | 7.6 | 5,442 |
| 2.7 | 497 | 4.1 | 1,697 | 5.5 | 3,195 | 7.8 | 5,656 |
| 2.8 | 550 | 4.2 | 1,804 | 5.6 | 3,302 | 8.0 | 5,870 |
| 2.9 | 606 | 4.3 | 1,911 | 5.7 | 3,409 | 9.0 | 6,940 |
| 3.0 | 666 | 4.4 | 2,018 | 5.8 | 3,516 | 10.0 | 8,010 |
| 3.1 | 732 | 4.5 | 2,125 | 5.9 | 3,623 | 11.0 | 9,080 |
| 3.2 | 804 | 4.6 | 2,232 | 6.0 | 3,730 | 12.0 | 10,150 |
| 3.3 | 883 | 4.7 | 2,339 | 6.2 | 3,944 | 13.0 | 11,220 |
| 3.4 | 969 | 4.8 | 2,446 | 6.4 | 4,158 | 14.0 | 12,290 |
| 3.5 | 1,062 | 4.9 | 2,553 | 6.6 | 4,372 | | |

*Estimated monthly discharge of Toccoa (Okoee) River near Blueridge, Ga.*

[Drainage area, 231 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 2,660 | 969 | 1,602 | 6.94 | 8.00 |
| February | 8,010 | 1,590 | 2,029 | 8.78 | 9.14 |
| March | 3,730 | 1,269 | 2,104 | 9.11 | 10.50 |
| April | 2,446 | 804 | 1,459 | 6.32 | 7.05 |
| May | 1,062 | 550 | 690 | 2.99 | 3.45 |
| June | 666 | 400 | 530 | 2.29 | 2.55 |
| July | 447 | 312 | 370 | 1.60 | 1.84 |
| August | 666 | 270 | 361 | 1.56 | 1.80 |
| September | 666 | 400 | 531 | 2.30 | 2.57 |
| October | 447 | 355 | 406 | 1.76 | 2.03 |
| November | 1,590 | 312 | 476 | 2.06 | 2.30 |
| December | 1,590 | 666 | 866 | 3.75 | 4.32 |
| The year | 8,010 | 270 | 952 | 4.12 | 55.55 |

## HIWASSEE RIVER AT RELIANCE, TENN.

This station was established by O. P. Hall on August 17, 1900. The gage is a vertical timber, graduated to feet and tenths, spiked to a tree on the right bank of the river about 200 feet above the Atlanta, Knoxville and Northern Railroad bridge, and very near the ferry landing. Measurements are made from the railroad bridge, a new steel structure of three spans of 140 feet each, which has recently been substituted for the old wooden bridge. Bench mark No. 1 is a nail in a notch cut in a hickory tree on the right bank of the river, about 75 feet above the end of the bridge and 5.82 feet above the zero of the gage. Bench mark No. 2 is the top of bridge girder downstream, 40 feet from the right-bank end of the bridge, and is 23.90 feet above the zero of the gage. At ordinary stages the river is about 350 feet wide at this point, and the section is a fairly good one, but at low stages the current becomes sluggish. The observer is C. V. Higdon, a farmer and ferryman, who lives near the gage.

During 1902 the following discharge measurements were made:

April 23: Gage height, 2.05 feet; discharge, 2,972 second-feet.
August 11: Gage height, 0.86 foot; discharge, 832 second-feet.
October 1: Gage height, 1.28 feet; discharge, 1,236 second-feet.
November 19: Gage height, 1.37 feet; discharge, 1,372 second-feet.

*Daily gage height, in feet, of Hiwassee River near Reliance, Tenn.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 3.40 | 4.50 | 6.30 | 3.00 | 2.10 | 1.50 | 1.30 | 1.00 | 0.90 | 1.20 | 0.90 | 1.50 |
| 2 | 3.00 | 5.70 | 3.30 | 2.80 | 2.40 | 1.40 | 1.30 | 1.10 | .80 | 1.20 | .90 | 1.60 |
| 3 | 2.80 | 4.30 | 3.60 | 2.70 | 2.10 | 1.40 | 1.30 | 1.00 | .80 | 1.10 | .90 | 3.00 |
| 4 | 2.60 | 3.30 | 3.20 | 2.70 | 2.00 | 1.50 | 1.30 | 1.20 | .90 | 1.00 | .90 | 2.50 |
| 5 | 2.40 | 2.90 | 3.60 | 2.60 | 2.00 | 1.40 | 1.40 | 1.00 | 1.20 | 1.00 | .90 | 2.20 |
| 6 | 2.40 | 2.70 | 3.30 | 2.50 | 1.90 | 1.40 | 1.30 | 1.00 | 1.00 | 1.00 | .90 | 2.00 |
| 7 | 2.30 | 2.50 | 3.00 | 2.60 | 1.90 | 1.40 | 1.10 | 1.00 | .90 | 1.10 | 1.50 | 1.70 |
| 8 | 2.20 | 2.40 | 2.90 | 3.20 | 1.90 | 1.50 | 1.20 | .90 | .80 | 1.00 | 1.20 | 1.60 |
| 9 | 2.20 | 2.30 | 2.40 | 2.80 | 1.90 | 1.40 | 1.10 | .80 | .80 | .90 | 1.00 | 1.50 |
| 10 | 2.10 | 2.20 | 2.10 | 2.60 | 1.80 | 1.60 | 1.10 | .80 | .90 | .90 | 1.00 | 1.40 |
| 11 | 2.00 | 2.20 | 2.90 | 2.50 | 1.80 | 1.50 | 1.20 | .80 | 1.20 | 1.00 | 1.00 | 1.50 |
| 12 | 2.00 | 2.10 | 2.80 | 2.40 | 1.70 | 1.40 | 1.30 | .80 | 1.00 | 1.20 | 1.00 | 1.40 |
| 13 | 1.90 | 2.10 | 2.70 | 2.60 | 1.80 | 1.40 | 1.90 | .80 | .90 | 1.50 | 1.00 | 1.40 |
| 14 | 1.90 | 2.00 | 2.70 | 2.30 | 1.90 | 1.30 | 1.40 | .80 | 1.20 | 1.40 | 1.00 | 1.40 |
| 15 | 1.90 | 2.00 | 2.60 | 2.40 | 1.90 | 1.30 | 1.90 | .80 | 1.00 | 1.40 | 1.00 | 1.30 |
| 16 | 1.90 | 2.10 | 2.90 | 2.30 | 1.90 | 1.40 | 1.50 | .90 | .90 | 1.20 | 1.00 | 1.60 |
| 17 | 1.90 | 2.10 | 3.80 | 2.30 | 1.80 | 1.30 | 1.20 | .80 | .90 | 1.10 | .90 | 2.60 |
| 18 | 1.80 | 2.00 | 3.00 | 2.30 | 1.80 | 1.30 | 1.10 | .80 | .80 | 1.00 | 1.40 | 2.10 |
| 19 | 2.00 | 1.90 | 2.80 | 2.20 | 1.80 | 1.40 | 1.10 | .80 | .80 | 1.00 | 1.50 | 1.80 |
| 20 | 2.10 | 1.90 | 2.70 | 2.20 | 1.80 | 1.40 | 1.10 | .80 | 1.50 | 1.00 | 1.20 | 1.70 |
| 21 | 2.10 | 2.10 | 2.60 | 2.20 | 1.70 | 1.30 | 1.10 | .80 | 1.20 | 1.00 | 1.10 | 1.80 |
| 22 | 2.50 | 2.70 | 2.60 | 2.20 | 1.70 | 1.60 | 1.10 | .80 | 1.10 | 1.00 | 1.10 | 3.10 |
| 23 | 2.10 | 2.50 | 2.50 | 2.10 | 1.60 | 1.30 | 1.00 | .80 | 1.00 | .90 | 1.10 | 2.30 |
| 24 | 2.00 | 2.30 | 2.40 | 2.10 | 1.60 | 1.20 | 1.00 | .70 | 1.00 | .90 | 1.00 | 2.00 |
| 25 | 1.90 | 2.40 | 2.40 | 2.00 | 1.60 | 1.20 | 1.00 | .70 | 1.10 | .90 | 1.70 | 1.90 |
| 26 | 1.90 | 2.50 | 2.30 | 2.00 | 1.70 | 1.40 | 1.00 | .70 | 1.70 | .90 | 3.00 | 1.70 |
| 27 | 2.00 | 2.40 | 2.30 | 2.00 | 1.70 | 1.70 | .90 | .90 | 1.50 | .90 | 2.00 | 1.60 |
| 28 | 2.60 | 10.00 | 2.40 | 1.90 | 1.60 | 1.40 | .90 | 1.20 | 1.30 | .90 | 1.70 | 1.60 |
| 29 | 2.50 | ..... | 5.50 | 2.00 | 1.50 | 1.40 | 1.00 | 1.20 | 1.30 | 1.00 | 1.50 | 1.60 |
| 30 | 2.50 | ..... | 4.50 | 2.10 | 1.50 | 1.30 | 1.10 | 1.10 | 1.10 | .90 | 1.50 | 1.90 |
| 31 | 3.10 | ..... | 3.50 | ..... | 1.50 | ..... | 1.10 | .90 | ..... | .90 | ..... | 1.80 |

*Rating table for Hiwassee River at Reliance, Tenn., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.8 | 780 | 2.4 | 3,620 | 4.0 | 9,300 | 5.6 | 16,880 |
| 1.0 | 970 | 2.6 | 4,190 | 4.2 | 10,190 | 5.8 | 17,840 |
| 1.2 | 1,205 | 2.8 | 4,800 | 4.4 | 11,120 | 6.0 | 18,800 |
| 1.4 | 1,485 | 3.0 | 5,450 | 4.6 | 12,080 | 6.5 | 21,200 |
| 1.6 | 1,805 | 3.2 | 6,140 | 4.8 | 13,040 | 7.0 | 23,600 |
| 1.8 | 2,170 | 3.4 | 6,870 | 5.0 | 14,000 | 8.0 | 28,400 |
| 2.0 | 2,600 | 3.6 | 7,640 | 5.2 | 14,960 | | |
| 2.2 | 3,090 | 3.8 | 8,450 | 5.4 | 15,920 | | |

*Estimated monthly discharge of Hiwassee River at Reliance, Tenn.*

[Drainage area, 1,180 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 6,870 | 2,170 | 3,320 | 2.81 | 3.24 |
| February | 38,000 | 2,375 | 5,729 | 4.86 | 5.06 |
| March | 20,240 | 2,840 | 6,070 | 5.14 | 5.92 |
| April | 6,140 | 2,375 | 3,634 | 3.08 | 3.44 |
| May | 3,620 | 1,640 | 2,205 | 1.87 | 2.16 |
| June | 1,980 | 1,205 | 1,491 | 1.26 | 1.41 |
| July | 2,375 | 870 | 1,239 | 1.05 | 1.21 |
| August | 1,205 | 700 | 875 | .74 | .85 |
| September | 1,980 | 780 | 1,054 | .89 | .99 |
| October | 1,640 | 870 | 1,034 | .88 | 1.01 |
| November | 5,450 | 870 | 1,351 | 1.14 | 1.27 |
| December | 5,790 | 1,340 | 2,388 | 2.02 | 2.33 |
| The year | 38,000 | 700 | 2,532 | 2.14 | 28.89 |

## NOTTELY RIVER AT RANGER, N. C.

The station was established by Olin P. Hall, on February 16, 1901. It is situated at the Nottely wagon bridge, about one-half mile from Ranger, N. C., on the Murphy division of the Atlanta, Knoxville and Northern Railway. The bridge is an old wooden structure, about 125 feet in length between abutments, and about 20 feet above low water. The bridge is supported on 2 wooden bents, dividing it into 3 spans. The gage is a 1 by 3 inch pine board in two sections, each 8 feet long, graduated to feet and tenths and fastened to the upstream side of the right wooden abutment. The bench mark is the top of the downstream end of the cap of the right abutment; its elevation is 20.05 feet above the zero of the gage. The initial point for sounding is the edge of the right abutment on the downstream side. The observer is A. D. Kilpatrick.

The following discharge measurements were made during 1902:

April 24: Gage height, 4.20 feet; discharge, 598 second-feet.
August 14: Gage height, 2.70 feet; discharge, 213 second-feet.
November 21: Gage height, 2.75 feet; discharge, 213 second-feet.

*Daily gage height, in feet, of Nottely River at Ranger, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 5.50 | 7.00 | 9.00 | 5.00 | 4.10 | 3.40 | 3.00 | 2.80 | 2.60 | 2.90 | 2.30 | 3.30 |
| 2 | 5.00 | 7.00 | 7.20 | 5.00 | 4.00 | 3.30 | 2.90 | 2.80 | 2.60 | 2.90 | 2.60 | 3.50 |
| 3 | 5.00 | 9.10 | 6.10 | 5.00 | 4.00 | 3.30 | 2.90 | 3.00 | 3.00 | 2.70 | 2.60 | 6.20 |
| 4 | 4.50 | 7.80 | 6.00 | 5.00 | 4.00 | 3.20 | 2.80 | 2.80 | 3.30 | 2.70 | 2.60 | 4.30 |
| 5 | 4.80 | 5.50 | 6.30 | 5.10 | 4.00 | 3.20 | 2.80 | 2.80 | 2.80 | 2.70 | 2.50 | 4.40 |
| 6 | 4.40 | 5.00 | 5.80 | 5.00 | 4.00 | 3.20 | 2.80 | 2.80 | 2.60 | 2.60 | 2.50 | 4.30 |
| 7 | 4.40 | 4.90 | 5.40 | 4.80 | 4.00 | 3.10 | 2.80 | 2.60 | 2.60 | 2.60 | 4.00 | 4.30 |
| 8 | 4.40 | 4.90 | 5.30 | 4.20 | 3.70 | 3.80 | 2.80 | 2.60 | 2.50 | 2.50 | 4.00 | 3.00 |
| 9 | 4.40 | 4.50 | 5.20 | 5.00 | 3.70 | 3.60 | 2.70 | 2.60 | 2.70 | 2.80 | 2.80 | 3.00 |
| 10 | 4.30 | 4.30 | 5.10 | 5.00 | 3.70 | 3.30 | 3.00 | 2.60 | 2.90 | 2.70 | 2.80 | 3.80 |
| 11 | 4.20 | 4.20 | 5.10 | 5.00 | 3.70 | 3.20 | 3.00 | 3.80 | 2.60 | 3.00 | 2.70 | 3.50 |
| 12 | 4.20 | 4.10 | 5.00 | 4.80 | 3.60 | 3.10 | 3.70 | 3.60 | 2.50 | 2.70 | 2.70 | 3.40 |
| 13 | 4.00 | 4.00 | 6.20 | 4.40 | 3.60 | 3.10 | 4.40 | 2.60 | 3.40 | 2.90 | 2.70 | 3.40 |
| 14 | 3.80 | 4.00 | 5.00 | 4.40 | 4.70 | 3.10 | 3.60 | 2.60 | 3.00 | 3.30 | 2.50 | 3.30 |
| 15 | 3.40 | 4.00 | 5.00 | 4.40 | 4.60 | 3.10 | 4.80 | 2.60 | 2.80 | 3.50 | 2.50 | 3.30 |
| 16 | 3.40 | 4.10 | 6.20 | 4.40 | 3.80 | 3.00 | 4.30 | 2.60 | 2.80 | 3.00 | 2.50 | 5.40 |
| 17 | 3.20 | 4.00 | 5.20 | 4.60 | 3.70 | 3.00 | 4.00 | 2.60 | 2.70 | 2.90 | 2.40 | 4.60 |
| 18 | 3.00 | 4.00 | 5.80 | 4.50 | 3.70 | 3.00 | 3.00 | 2.60 | 2.70 | 2.70 | 3.70 | 4.60 |
| 19 | 4.00 | 4.00 | 5.60 | 4.40 | 3.70 | 3.00 | 3.00 | 2.60 | 3.30 | 2.90 | 3.20 | 3.80 |
| 20 | 4.00 | 4.00 | 5.00 | 4.20 | 3.60 | 3.00 | 3.00 | 2.60 | 3.00 | 2.80 | 3.00 | 3.70 |
| 21 | 4.00 | 4.10 | 5.00 | 4.00 | 3.60 | 3.30 | 2.80 | 2.40 | 3.00 | 2.80 | 2.90 | 5.40 |
| 22 | 4.00 | 5.00 | 4.90 | 4.10 | 3.50 | 3.10 | 2.80 | 2.40 | 2.80 | 2.70 | 2.80 | 5.20 |
| 23 | 3.80 | 4.50 | 4.80 | 4.10 | 3.40 | 3.00 | 2.80 | 2.40 | 2.60 | 2.70 | 2.80 | 4.40 |
| 24 | 3.80 | 4.40 | 4.70 | 4.10 | 3.30 | 3.00 | 2.80 | 2.50 | 2.60 | 2.70 | 2.70 | 3.80 |
| 25 | 3.80 | 4.80 | 4.60 | 4.10 | 3.30 | 3.00 | 2.70 | 2.50 | 2.90 | 2.60 | 5.30 | 3.60 |
| 26 | 3.80 | 4.60 | 4.60 | 4.00 | 3.30 | 3.60 | 2.70 | 2.70 | 2.70 | 2.50 | 4.40 | 3.50 |
| 27 | 4.00 | 4.80 | 4.70 | 4.00 | 3.30 | 3.60 | 2.70 | 3.00 | 2.60 | 2.50 | 3.70 | 3.60 |
| 28 | 4.40 | 21.00 | 4.70 | 4.00 | 3.30 | 3.00 | 2.70 | 2.80 | 3.10 | 2.50 | 3.10 | 3.40 |
| 29 | 4.50 | ..... | 13.80 | 4.20 | 3.40 | 3.00 | 2.80 | 2.80 | 3.00 | 2.40 | 3.00 | 5.20 |
| 30 | 5.00 | ..... | 6.80 | 4.30 | 3.40 | 3.00 | 2.80 | 2.70 | 3.00 | 2.40 | 3.00 | 5.00 |
| 31 | 6.30 | ..... | 5.20 | ..... | 3.40 | ..... | 2.80 | 2.70 | ..... | 2.30 | ..... | 3.40 |

*Rating table for Nottely River at Ranger, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.4 | 155 | 5.2 | 920 | 8.0 | 1,760 | 12.0 | 2,960 |
| 2.6 | 190 | 5.4 | 980 | 8.2 | 1,820 | 12.5 | 3,110 |
| 2.8 | 229 | 5.6 | 1,040 | 8.4 | 1,880 | 13.0 | 3,260 |
| 3.0 | 272 | 5.8 | 1,100 | 8.6 | 1,940 | 13.5 | 3,410 |
| 3.2 | 322 | 6.0 | 1,160 | 8.8 | 2,000 | 14.0 | 3,560 |
| 3.4 | 380 | 6.2 | 1,220 | 9.0 | 2,060 | 14.5 | 3,710 |
| 3.6 | 440 | 6.4 | 1,280 | 9.2 | 2,120 | 15.0 | 3,860 |
| 3.8 | 500 | 6.6 | 1,340 | 9.4 | 2,180 | 15.5 | 4,010 |
| 4.0 | 560 | 6.8 | 1,400 | 9.6 | 2,240 | 16.0 | 4,160 |
| 4.2 | 620 | 7.0 | 1,460 | 9.8 | 2,300 | 17.0 | 4,460 |
| 4.4 | 680 | 7.2 | 1,520 | 10.0 | 2,360 | 18.0 | 4,760 |
| 4.6 | 740 | 7.4 | 1,580 | 10.5 | 2,510 | 19.0 | 5,060 |
| 4.8 | 800 | 7.6 | 1,640 | 11.0 | 2.660 | 20.0 | 5,360 |
| 5.0 | 860 | 7.8 | 1,700 | 11.5 | 2,910 | 21.0 | 5,660 |

*Estimated monthly discharge of Nottely River at Ranger, N. C.*

[Drainage area, 272 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 1,250 | 272 | 631 | 2.32 | 2.67 |
| February | 5,660 | 560 | 1,006 | 3.70 | 3.85 |
| March | 3,500 | 740 | 1,095 | 4.03 | 4.64 |
| April | 890 | 560 | 711 | 2.61 | 2.91 |
| May | 770 | 350 | 475 | 1.75 | 2.02 |
| June | 500 | 272 | 322 | 1.18 | 1.32 |
| July | 800 | 209 | 307 | 1.13 | 1.30 |
| August | 500 | 155 | 219 | .81 | .93 |
| September | 380 | 172 | 237 | .87 | .97 |
| October | 410 | 148 | 221 | .81 | .93 |
| November | 950 | 148 | 295 | 1.08 | 1.20 |
| December | 1,220 | 272 | 576 | 2.12 | 2.44 |
| The year | 5,660 | 148 | 850 | 1.87 | 25.18 |

## HIWASSEE RIVER AT MURPHY, N. C.

Hiwassee River rises in the northern part of Georgia and flows through the southwestern corner of North Carolina into Tennessee, where it empties into Tennessee River. The drainage basin is broken and mountainous for the most part and well covered with forest. The station is located at the highway bridge crossing the river at Murphy, N. C., one-half mile above Valley River, and was established by E. W. Myers on July 26, 1896. The length of the gage is 29.10 feet. The section is a fairly good one. The course of the stream is straight for several hundred yards above and below the bridge, and the current fairly rapid. The bottom is hard and rocky and not subject to any decided change. The observer is William Mingus, Murphy, N. C.

*Discharge measurements of Hiwassee River at Murphy, N. C.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| August 12 | B. S. Drane | 4.80 | 213 |
| August 23 | do | 4.80 | 186 |
| September 18 | do | 4.80 | 198 |
| Do | E. W. Myers | 4.80 | 216 |
| October 24 | B. S. Drane | 4.87 | 260 |
| Do | do | 4.90 | 271 |

*Daily gage height, in feet, of Hiwassee River at Murphy, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 6.95 | 7.80 | 8.50 | 6.60 | 5.70 | 5.30 | 5.20 | 4.90 | 4.75 | 5.25 | 4.90 | 5.65 |
| 2 | 6.60 | 9.10 | 7.50 | 6.50 | 5.80 | 5.30 | 5.20 | 4.90 | 4.80 | 5.15 | 4.90 | 5.50 |
| 3 | 6.15 | 7.50 | 7.05 | 6.35 | 5.70 | 5.30 | 5.15 | 5.20 | 4.80 | 5.05 | 4.90 | 6.65 |
| 4 | 6.30 | 6.90 | 6.80 | 6.30 | 5.65 | 5.25 | 5.15 | 4.95 | 5.15 | 5.00 | 4.90 | 5.95 |
| 5 | 6.15 | 6.50 | 7.15 | 6.25 | 5.70 | 5.25 | 5.15 | 4.90 | 4.95 | 5.05 | 4.90 | 5.50 |
| 6 | 6.10 | 6.35 | 6.80 | 6.15 | 5.70 | 5.20 | 5.15 | 4.85 | 4.85 | 5.10 | 5.90 | 5.65 |
| 7 | 6.00 | 6.25 | 6.55 | 6.15 | 5.60 | 5.20 | 5.30 | 4.85 | 4.80 | 5.00 | 5.20 | 5.50 |
| 8 | 5.95 | 6.15 | 6.45 | 6.65 | 5.60 | 5.55 | 5.15 | 4.85 | 4.80 | 5.00 | 5.10 | 5.45 |
| 9 | 5.90 | 6.50 | 6.75 | 6.35 | 5.60 | 5.55 | 5.10 | 4.80 | 4.80 | 5.00 | 5.00 | 5.40 |
| 10 | 5.85 | 6.00 | 6.55 | 6.25 | 5.50 | 5.55 | 5.10 | 4.80 | 5.35 | 4.95 | 5.05 | 5.35 |
| 11 | 5.85 | 5.90 | 6.50 | 6.15 | 5.50 | 5.50 | 5.10 | 4.85 | 4.95 | 5.00 | 5.00 | 5.35 |
| 12 | 5.80 | 5.90 | 6.40 | 6.10 | 5.55 | 5.50 | 5.50 | 4.80 | 4.90 | 5.45 | 5.00 | 5.30 |
| 13 | 5.75 | 5.85 | 6.65 | 6.05 | 5.55 | 5.50 | 5.40 | 4.80 | 5.05 | 5.15 | 5.00 | 5.35 |
| 14 | 5.70 | 5.80 | 6.45 | 6.00 | 5.55 | 5.45 | 5.25 | 4.80 | 5.05 | 5.45 | 5.00 | 5.25 |
| 15 | 5.70 | 5.85 | 6.40 | 6.00 | 5.50 | 5.50 | 5.30 | 4.85 | 4.90 | 5.15 | 4.95 | 5.25 |
| 16 | 5.70 | 5.90 | 6.45 | 6.00 | 5.55 | 5.50 | 5.20 | 4.80 | 4.90 | 5.10 | 4.95 | 5.75 |
| 17 | 5.65 | 5.85 | 6.90 | 5.95 | 5.50 | 5.45 | 5.15 | 4.85 | 4.85 | 5.05 | 5.00 | 6.15 |
| 18 | 5.65 | 5.75 | 6.60 | 6.00 | 5.55 | 5.40 | 5.10 | 4.80 | 4.85 | 5.00 | 5.50 | 5.90 |
| 19 | 5.90 | 5.75 | 6.45 | 5.95 | 5.50 | 5.40 | 5.10 | 4.80 | 4.95 | 4.95 | 5.15 | 5.65 |
| 20 | 5.70 | 5.80 | 6.35 | 5.90 | 5.40 | 5.40 | 5.05 | 4.80 | 5.35 | 4.95 | 5.05 | 5.50 |
| 21 | 5.65 | 6.05 | 6.30 | 5.85 | 5.40 | 5.35 | 5.05 | 4.80 | 5.05 | 4.95 | 5.05 | 5.80 |
| 22 | 5.75 | 6.25 | 6.25 | 5.80 | 5.35 | 5.40 | 5.05 | 4.75 | 5.00 | 4.95 | 5.00 | 6.30 |
| 23 | 5.65 | 6.05 | 6.20 | 5.80 | 5.45 | 5.30 | 5.05 | 4.75 | 4.95 | 4.95 | 5.05 | 5.90 |
| 24 | 5.65 | 6.00 | 6.15 | 5.75 | 5.40 | 5.30 | 5.00 | 4.75 | 4.90 | 4.95 | 5.00 | 5.75 |
| 25 | 5.60 | 6.05 | 6.10 | 5.75 | 5.50 | 5.25 | 5.00 | 4.75 | 5.45 | 4.90 | 5.50 | 5.70 |
| 26 | 5.60 | 6.05 | 6.05 | 5.75 | 5.30 | 5.50 | 4.95 | 4.75 | 5.15 | 4.90 | 6.00 | 5.60 |
| 27 | 5.65 | 6.00 | 6.10 | 5.75 | 5.30 | 5.55 | 4.90 | 4.85 | 5.35 | 4.95 | 5.70 | 5.40 |
| 28 | 5.95 | 14.15 | 6.10 | 5.75 | 5.25 | 5.45 | 4.90 | 4.95 | 5.45 | 4.95 | 5.50 | 5.45 |
| 29 | 6.05 | ..... | 10.90 | 5.70 | 5.25 | 5.30 | 4.90 | 4.90 | 5.15 | 4.90 | 5.40 | 5.40 |
| 30 | 6.10 | ..... | 7.50 | 5.90 | 5.30 | 5.25 | 4.90 | 4.85 | 5.05 | 4.90 | 5.40 | 5.75 |
| 31 | 7.20 | ..... | 6.90 | ..... | 5.35 | ..... | 4.90 | 4.90 | ..... | 4.90 | ..... | 5.50 |

*Rating table for Hiwassee River at Murphy, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 4.3 | 100 | 6.2 | 1,560 | 8.5 | 5,700 | 13.5 | 14,700 |
| 4.4 | 110 | 6.4 | 1,920 | 9.0 | 6,600 | 14.0 | 15,600 |
| 4.6 | 150 | 6.6 | 2,280 | 9.5 | 7,500 | 14.5 | 16,500 |
| 4.8 | 205 | 6.8 | 2,640 | 10.0 | 8,400 | 15.0 | 17,400 |
| 5.0 | 325 | 7.0 | 3,000 | 10.5 | 9,300 | 15.5 | 18,300 |
| 5.2 | 450 | 7.2 | 3,360 | 11.0 | 10,200 | 16.0 | 19,200 |
| 5.4 | 590 | 7.4 | 3,720 | 11.5 | 11,100 | 16.5 | 20,100 |
| 5.6 | 750 | 7.6 | 4,080 | 12.0 | 12,000 | 17.0 | 21,000 |
| 5.8 | 940 | 7.8 | 4,440 | 12.5 | 12,900 | 18.0 | 22,800 |
| 6.0 | 1,200 | 8.0 | 4,800 | 13.0 | 13,800 | 19.0 | 24,600 |

*Estimated monthly discharge of Hiwassee River at Murphy, N. C.*

[Drainage area, 410 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 3,360 | 750 | 1,203 | 2.93 | 3.38 |
| February | 15,870 | 892 | 2,259 | 5.51 | 5.74 |
| March | 10,020 | 1,290 | 2,582 | 6.30 | 7.26 |
| April | 2,370 | 845 | 1,331 | 3.25 | 3.63 |
| May | 940 | 485 | 677 | 1.65 | 1.90 |
| June | 710 | 100 | 556 | 1.36 | 1.52 |
| July | 670 | 265 | 363 | .89 | 1.03 |
| August | 450 | 190 | 232 | .57 | .66 |
| September | 555 | 190 | 336 | .82 | .91 |
| October | 485 | 265 | 347 | .85 | .98 |
| November | 1,200 | 265 | 450 | 1.10 | 1.23 |
| December | 2,370 | 520 | 834 | 2.03 | 2.34 |
| The year | 15,870 | 100 | 931 | 2.27 | 30.58 |

## LITTLE TENNESSEE RIVER AT JUDSON, N. C.

This river rises in northern Georgia, with tributaries from the mountains between North Carolina and Georgia, and flows in a northwesterly direction, emptying into Tennessee River at Lenoir, Tenn. Measurements of flow are made at Judson, N. C., below the mouth of Sawyer Branch. The area drained is mountainous and covered with forest growth. The station was established by E. W. Myers in June, 1896. It is located on the Southern Railway bridge, about one-fourth of a mile from Judson, N. C. The river is straight for several hundred yards above and below the station; the bottom rocky and very rough on the west side and sandy on the east side. The current is swift and considerably obstructed by two old piers. The section is constant, but not a good one for measurements. The observer is R. C. Sawyer, a farmer at Judson, N. C.

The following discharge measurements were made during 1902 by B. S. Drane:

August 11: Gage height, 2.50 feet; discharge, 686 second-feet.
August 22: Gage height, 2.50 feet; discharge, 471 second-feet.
October 25: Gage height, 2.62 feet; discharge, 736 second-feet.

*Daily gage height, in feet, of Little Tennessee River at Judson, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 8.41 | 6.72 | 7.29 | 4.92 | 3.24 | 3.20 | 2.91 | 2.71 | 2.51 | 3.00 | 2.61 | 3.35 |
| 2 | 6.51 | 5.38 | 5.32 | 4.84 | 4.61 | 3.41 | 2.91 | 2.71 | 2.41 | 2.91 | 2.71 | 3.32 |
| 3 | 6.34 | 4.92 | 4.96 | 4.34 | 3.22 | 3.31 | 3.00 | 2.71 | 2.41 | 2.81 | 2.61 | 4.90 |
| 4 | 5.28 | 4.92 | 4.94 | 4.31 | 3.18 | 3.10 | 2.81 | 2.61 | 2.91 | 2.71 | 2.51 | 3.15 |
| 5 | 4.49 | 4.91 | 4.81 | 4.23 | 3.10 | 3.08 | 3.81 | 2.61 | 2.71 | 2.91 | 2.61 | 3.10 |
| 6 | 4.48 | 4.86 | 4.81 | 4.21 | 4.26 | 3.05 | 2.81 | 2.51 | 2.51 | 2.91 | 4.71 | 3.74 |
| 7 | 4.48 | 4.42 | 4.78 | 4.19 | 3.92 | 3.10 | 2.81 | 2.61 | 2.51 | 2.81 | 3.41 | 3.45 |
| 8 | 4.46 | 4.50 | 5.21 | 4.19 | 3.17 | 3.31 | 2.81 | 2.51 | 2.51 | 2.71 | 3.00 | 3.41 |
| 9 | 4.52 | 4.60 | 4.19 | 4.12 | 2.94 | 3.10 | 3.00 | 2.51 | 2.81 | 2.71 | 2.91 | 3.35 |
| 10 | 4.51 | 4.50 | 4.12 | 4.90 | 2.91 | 3.05 | 3.00 | 2.61 | 2.51 | 2.61 | 2.81 | 3.26 |
| 11 | 4.43 | 4.20 | 4.13 | 4.90 | 2.93 | 3.04 | 3.10 | 2.51 | 2.71 | 2.71 | 2.81 | 3.20 |
| 12 | 4.42 | 4.20 | 4.13 | 4.60 | 2.91 | 3.03 | 3.51 | 2.51 | 2.61 | 3.41 | 2.81 | 3.35 |
| 13 | 4.39 | 4.10 | 4.10 | 4.80 | 3.61 | 3.00 | 3.31 | 2.41 | 2.61 | 3.00 | 2.81 | 3.30 |
| 14 | 4.32 | 3.98 | 4.10 | 4.70 | 3.71 | 3.20 | 2.91 | 2.51 | 3.10 | 3.10 | 2.71 | 3.25 |
| 15 | 4.28 | 3.96 | 4.12 | 4.60 | 3.61 | 3.20 | 3.91 | 2.51 | 2.71 | 2.91 | 2.71 | 3.15 |
| 16 | 4.24 | 4.21 | 5.39 | 4.30 | 3.51 | 3.20 | 2.81 | 2.71 | 2.61 | 2.81 | 2.70 | 3.25 |
| 17 | 4.22 | 4.28 | 4.72 | 4.28 | 3.51 | 3.10 | 2.71 | 2.71 | 2.51 | 2.81 | 2.76 | 4.60 |
| 18 | 3.91 | 4.27 | 4.68 | 4.92 | 3.51 | 2.91 | 2.71 | 2.51 | 2.51 | 2.71 | 2.70 | 4.00 |
| 19 | 3.92 | 4.22 | 4.22 | 4.61 | 3.41 | 3.00 | 2.81 | 2.51 | 2.91 | 2.71 | 2.70 | 3.85 |
| 20 | 3.96 | 3.93 | 4.15 | 5.20 | 3.41 | 3.01 | 3.10 | 2.41 | 3.31 | 2.71 | 2.80 | 3.71 |
| 21 | 4.51 | 3.93 | 3.96 | 4.42 | 3.41 | 3.31 | 2.91 | 2.41 | 3.00 | 2.71 | 2.80 | 3.75 |
| 22 | 3.68 | 3.91 | 3.91 | 4.19 | 3.51 | 3.20 | 2.70 | 2.51 | 2.91 | 2.61 | 2.75 | 4.70 |
| 23 | 3.62 | 3.86 | 3.82 | 4.30 | 3.41 | 3.00 | 2.71 | 2.51 | 2.71 | 2.61 | 2.86 | 4.10 |
| 24 | 3.53 | 4.17 | 3.82 | 3.96 | 3.31 | 2.91 | 2.61 | 2.61 | 2.71 | 2.61 | 2.70 | 3.95 |
| 25 | 4.21 | 4.16 | 3.68 | 3.91 | 3.31 | 2.91 | 2.61 | 2.41 | 4.10 | 2.61 | 3.55 | 3.76 |
| 26 | 4.19 | 4.19 | 3.67 | 3.68 | 3.31 | 3.10 | 2.61 | 2.51 | 3.71 | 2.71 | 4.30 | 3.65 |
| 27 | 4.16 | 5.22 | 3.54 | 3.51 | 3.21 | 3.20 | 2.71 | 2.71 | 3.31 | 2.61 | 3.35 | 3.27 |
| 28 | 5.91 | 16.19 | 4.91 | 3.10 | 3.21 | 3.00 | 2.61 | 2.61 | 3.20 | 2.71 | 3.31 | 3.25 |
| 29 | 5.84 | ..... | 9.32 | 3.10 | 3.21 | 3.10 | 2.71 | 2.61 | 3.40 | 2.61 | 3.30 | 3.50 |
| 30 | 4.36 | ..... | 6.28 | 2.98 | 3.20 | 3.00 | 2.71 | 2.51 | 3.30 | 2.61 | 3.20 | 4.00 |
| 31 | 4.33 | ..... | 5.49 | ..... | 3.20 | ..... | 2.61 | 2.61 | ..... | 2.61 | ..... | 3.51 |

*Rating table for Little Tennessee River at Judson, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.5 | 575 | 3.6 | 1,860 | 4.8 | 3,980 | 6.0 | 6,580 |
| 2.6 | 675 | 3.8 | 2,140 | 5.0 | 4,380 | 6.2 | 7,070 |
| 2.8 | 875 | 4.0 | 2,460 | 5.2 | 4,820 | 6.4 | 7,560 |
| 3.0 | 1,100 | 4.2 | 2,800 | 5.4 | 5,260 | 6.6 | 8,050 |
| 3.2 | 1,340 | 4.4 | 3,180 | 5.6 | 5,700 | 6.8 | 8,540 |
| 3.4 | 1,580 | 4.6 | 3,580 | 5.8 | 6,140 | 7.0 | 9,030 |

*Estimated monthly discharge of Little Tennessee River at Judson, N. C.*

[Drainage area, 675 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 13,800 | 1,790 | 3,827 | 5.67 | 6.54 |
| February | 50,460 | 2,220 | 5,036 | 7.46 | 7.77 |
| March | 17,550 | 1,790 | 4,079 | 6.04 | 6.96 |
| April | 4,820 | 1,100 | 3,032 | 4.49 | 5.01 |
| May | 3,580 | 975 | 1,592 | 2.36 | 2.72 |
| June | 2,140 | 975 | 1,319 | 1.95 | 2.18 |
| July | 2,300 | 675 | 1,010 | 1.50 | 1.73 |
| August | 775 | 475 | 627 | .93 | 1.07 |
| September | 2,620 | 475 | 964 | 1.43 | 1.60 |
| October | 1,580 | 675 | 846 | 1.25 | 1.44 |
| November | 3,780 | 575 | 1,128 | 1.67 | 1.86 |
| December | 4,180 | 1,220 | 1,939 | 2.87 | 3.31 |
| The year | 50,460 | 475 | 2,117 | 3.14 | 42.19 |

## TUCKASEGEE RIVER AT BRYSON, N. C.

This river rises in the southwestern part of North Carolina, at the base of Tennessee Ridge, which separates Jackson and Transylvania counties. It flows in a northwesterly direction, emptying into Little Tennessee River at Bushnell, N. C. Measurements of discharge are made at Bryson, 2 miles below the mouth of Newton Mill Creek. The drainage area is largely rough and mountainous, and covered with forest growth. The old station, described in the Eighteenth Annual Report, part 4, page 116, was on the Southern Railway bridge about 3 miles above Bryson, N. C., and just below Governor Island post-office, and was abandoned March 25, 1897, because the section was poor. A new station was established by A. P. Davis November 7, 1897, at the highway bridge in the town of Bryson, N. C. The gage is bolted to the north pier, lower side, and can be read from the bridge. The initial point of sounding is at the south end of the downstream hand rail. The channel is straight, but obstructed by the remnants of two old piers. The current is sluggish, the river bed muddy and fairly constant. The observer is H. H. Welch, a carpenter at Bryson, N. C.

The following discharge measurements were made during 1902 by B. S. Drane:

August 11: Gage height, 1.05 feet; discharge, 466 second-feet.
August 22: Gage height, 1 foot; discharge, 465 second-feet.
September 17: Gage height, 1 foot; discharge, 520 second-feet.
October 23: Gage height, 1.15 feet; discharge, 546 second-feet.

*Daily gage height, in feet, of Tuckasegee River at Bryson, N. C.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 3.30 | 3.95 | 4.90 | 3.10 | 2.20 | 1.90 | 1.50 | 1.10 | 0.95 | 1.50 | 1.10 | 1.80 |
| 2 | 3.00 | 4.10 | 4.00 | 2.90 | 2.10 | 1.60 | 1.40 | 1.05 | 0.95 | 1.30 | 1.10 | 1.60 |
| 3 | 2.80 | 3.20 | 3.50 | 2.80 | 1.90 | 1.55 | 1.35 | 1.20 | 1.35 | 1.25 | 1.10 | 2.80 |
| 4 | 2.60 | 2.90 | 3.20 | 2.70 | 1.90 | 1.50 | 1.30 | 1.10 | 1.20 | 1.30 | 1.10 | 2.20 |
| 5 | 2.40 | 2.50 | 3.10 | 2.60 | 1.90 | 1.50 | 1.40 | 1.10 | 1.10 | 1.35 | 1.20 | 2.20 |
| 6 | 2.40 | 2.50 | 3.10 | 2.50 | 1.90 | 1.45 | 1.50 | 1.40 | 1.10 | 1.30 | 2.50 | 1.90 |
| 7 | 2.30 | 2.40 | 2.90 | 2.90 | 1.90 | 1.50 | 1.40 | 1.15 | 1.00 | 1.25 | 1.50 | 1.80 |
| 8 | 2.25 | 2.30 | 3.30 | 2.70 | 1.85 | 1.50 | 1.30 | 1.10 | 1.00 | 1.20 | 1.40 | 1.70 |
| 9 | 2.20 | 2.10 | 3.00 | 2.50 | 1.80 | 1.50 | 1.60 | 1.05 | 2.70 | 1.20 | 1.30 | 1.60 |
| 10 | 2.10 | 2.00 | 2.90 | 2.40 | 1.75 | 1.40 | 1.50 | 1.05 | 1.70 | 1.10 | 1.25 | 1.60 |
| 11 | 2.05 | 1.90 | 2.80 | 2.40 | 1.75 | 1.40 | 1.40 | 1.00 | 1.20 | 1.30 | 1.20 | 1.50 |
| 12 | 2.00 | 2.00 | 2.80 | 2.35 | 1.75 | 1.35 | 1.75 | 1.00 | 1.10 | 1.30 | 1.20 | 1.50 |
| 13 | 1.90 | 1.90 | 3.20 | 2.30 | 1.75 | 1.40 | 1.40 | 1.00 | 1.50 | 1.30 | 1.20 | 1.50 |
| 14 | 2.00 | 1.40 | 2.80 | 2.25 | 1.80 | 1.40 | 1.30 | 1.00 | 1.20 | 1.75 | 1.15 | 1.50 |
| 15 | 1.90 | 2.00 | 2.70 | 2.20 | 1.75 | 1.40 | 1.40 | 1.00 | 1.10 | 1.30 | 1.15 | 4.00 |
| 16 | 1.90 | 2.00 | 5.25 | 2.20 | 1.70 | 1.60 | 1.30 | 1.20 | 1.10 | 1.30 | 1.10 | 2.10 |
| 17 | 1.80 | 1.90 | 3.65 | 2.35 | 1.75 | 1.50 | 1.25 | 1.00 | 1.00 | 1.25 | 1.20 | 2.00 |
| 18 | 1.80 | 1.80 | 3.00 | 2.20 | 1.70 | 1.40 | 1.20 | 1.00 | 1.00 | 1.20 | 1.50 | 1.90 |
| 19 | 1.80 | 1.80 | 2.90 | 2.20 | 2.00 | 1.40 | 1.30 | 1.10 | 4.00 | 1.20 | 1.30 | 1.80 |
| 20 | 1.80 | 2.00 | 2.75 | 2.20 | 1.80 | 1.40 | 1.30 | 1.00 | 2.00 | 1.20 | 1.20 | 1.70 |
| 21 | 1.90 | 2.20 | 2.70 | 2.15 | 1.80 | 1.80 | 1.25 | 1.00 | 1.80 | 1.15 | 1.20 | 3.70 |
| 22 | 1.80 | 2.15 | 2.60 | 2.10 | 1.80 | 1.45 | 1.20 | 1.00 | 1.20 | 1.10 | 1.20 | 2.30 |
| 23 | 1.75 | 2.00 | 2.50 | 2.00 | 1.90 | 1.40 | 1.20 | 1.00 | 1.20 | 1.10 | 1.15 | 2.10 |
| 24 | 1.70 | 2.00 | 2.40 | 2.00 | 1.75 | 1.35 | 1.20 | .95 | 1.40 | 1.10 | 1.15 | 1.90 |
| 25 | 1.65 | 2.30 | 2.40 | 2.00 | 2.00 | 1.30 | 1.10 | .90 | 2.10 | 1.10 | 3.45 | 1.80 |
| 26 | 1.80 | 2.10 | 2.30 | 2.00 | 1.75 | 1.60 | 1.10 | 1.10 | 1.70 | 1.10 | 2.10 | 1.70 |
| 27 | 2.40 | 3.00 | 2.30 | 1.95 | 1.70 | 1.80 | 1.10 | 1.15 | 1.50 | 1.10 | 1.80 | 1.60 |
| 28 | 2.30 | 9.90 | 4.50 | 1.90 | 1.65 | 1.50 | 1.20 | 1.10 | 1.40 | 1.10 | 1.60 | 1.80 |
| 29 | 2.40 | ..... | 6.25 | 2.10 | 1.60 | 1.50 | 1.20 | 1.10 | 1.30 | 1.10 | 1.40 | 1.80 |
| 30 | 3.20 | ..... | 3.90 | 2.10 | 1.60 | 1.70 | 1.20 | 1.10 | 1.40 | 1.10 | 1.60 | 1.80 |
| 31 | 3.80 | ..... | 3.40 | ..... | 1.60 | ..... | 1.10 | 1.10 | ..... | 1.10 | ..... | 1.60 |

*Rating table for Tuckasegee River at Bryson, N. C., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.0 | 400 | 3.2 | 4,110 | 5.4 | 10,250 | 7.6 | 22,480 |
| 1.2 | 600 | 3.4 | 4,565 | 5.6 | 11,125 | 7.8 | 23,640 |
| 1.4 | 830 | 3.6 | 5,035 | 5.8 | 12,100 | 8.0 | 24,800 |
| 1.6 | 1,080 | 3.8 | 5,515 | 6.0 | 13,200 | 8.5 | 27,700 |
| 1.8 | 1,370 | 4.0 | 6,000 | 6.2 | 14,360 | 9.0 | 30,600 |
| 2.0 | 1,700 | 4.2 | 6,510 | 6.4 | 15,520 | 9.5 | 33,500 |
| 2.2 | 2,065 | 4.4 | 7,060 | 6.6 | 16,680 | 10.0 | 36,400 |
| 2.4 | 2,450 | 4.6 | 7,640 | 6.8 | 17,840 | 10.5 | 39,300 |
| 2.6 | 2,850 | 4.8 | 8,220 | 7.0 | 19,000 | 11.0 | 42,200 |
| 2.8 | 3,260 | 5.0 | 8,800 | 7.2 | 20,160 | | |
| 3.0 | 3,675 | 5.2 | 9,475 | 7.4 | 21,320 | | |

*Estimated monthly discharge of Tuckasegee River at Bryson, N. C.*

[Drainage area, 662 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 5,515 | 1,150 | 2,173 | 3.28 | 3.78 |
| February | 35,820 | 830 | 3,547 | 5.36 | 5.58 |
| March | 14,650 | 2,255 | 4,467 | 6.75 | 7.78 |
| April | 3,890 | 1,530 | 2,341 | 3.54 | 3.95 |
| May | 2,065 | 1,080 | 1,395 | 2.11 | 2.43 |
| June | 1,530 | 710 | 962 | 1.45 | 1.62 |
| July | 1,295 | 500 | 738 | 1.11 | 1.28 |
| August | 830 | 300 | 469 | .71 | .82 |
| September | 6,000 | 350 | 1,004 | 1.52 | 1.70 |
| October | 1,295 | 500 | 636 | .96 | 1.11 |
| November | 4,682 | 500 | 929 | 1.40 | 1.56 |
| December | 6,000 | 950 | 1,723 | 2.60 | 3.00 |
| The year | 35,820 | 300 | 1,699 | 2.57 | 34.61 |

## TENNESSEE RIVER AT KNOXVILLE, TENN.

This station was originally established by the United States Weather Bureau at the old county highway bridge, which has been torn down and replaced by a new bridge. Instead of placing the gage at the new bridge, it was decided to move it down the river, in order to get below some shoals and wing dams which have been put in for boating. A temporary gage was put in at the Knoxville and Augusta Railroad bridge, a half mile below the highway bridge, and was used during the greater part of the year 1899. In the latter part of that year a new permanent gage was established, and readings from it began on November 1, 1899. The new gage is on the right bank of the river, just below the mouth of West Knoxville Bayou, and about 1,000 feet below the temporary gage at the Knoxville and Augusta Railroad bridge. The gage, which is graduated to feet and tenths, is in two sections; the first, a sloping section made of a 2 by 4 inch pine timber spiked on top of an 8 by 8 inch oak sill well bolted to piles and embedded in crushed stone, reading from −2 feet to +12 feet; the second, a vertical section of the standard Weather Bureau pattern, with a brass scale, is screwed to one of the bents of the railroad trestle across West Knoxville Bayou, about 50 feet from the bank of the river and from the sloping gage, reading from 12 to 36.5 feet. The gage is fastened to the upstream post of the bent, facing away from the river. The zero of the gage is 804.3 feet above sea level. The bench mark is a

cross in the stone on the east corner of the base to the right-bank pier of the Knoxville and Augusta Railroad bridge, and is 806.7 feet above sea level and 2.4 feet above the zero of the gage. The gage was located for the United States Weather Bureau by the United States Engineer Corps. Daily records are kept by the United States Weather Bureau and are furnished to the Geological Survey. Measurements are made at the Cherokee highway bridge 2 miles below the new gage. This bridge is a three-span iron structure and is about 80 feet above low water. The width of the river at low water is 550 feet. The section is a good one, but the current is rather sluggish at low water.

Professor Fulton, of the Tennessee University, who is Weather Bureau official here, has perfected an attachment which is connected with his office by wire and electrically records the height of water continuously in the same manner that records are made of wind, sunshine, etc.

The following discharge measurements were made during 1902:

August 13: Gage height, 0.69 foot; discharge, 4,710 second-feet.

November 18: Gage height, 0.58 foot; discharge, 4,552 second-feet.

*Daily gage height, in feet, of Tennessee River at Knoxville, Tenn.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 19.00 | 10.80 | 34.40 | 10.80 | 3.10 | 1.80 | 8.00 | 1.20 | 0.40 | 2.00 | 0.80 | 1.70 |
| 2 | 11.40 | 12.20 | 33.10 | 7.90 | 3.00 | 1.80 | 6.70 | 1.20 | .30 | 1.60 | .70 | 1.50 |
| 3 | 8.70 | 11.80 | 17.10 | 7.70 | 2.90 | 1.70 | 4.90 | 1.80 | .40 | 1.40 | .70 | 2.10 |
| 4 | 7.40 | 10.20 | 11.30 | 6.10 | 2.60 | 1.80 | 3.60 | 1.60 | .50 | 1.30 | .40 | 2.70 |
| 5 | 6.40 | 7.90 | 11.80 | 5.70 | 2.50 | 1.60 | 2.80 | 1.20 | .70 | 1.00 | .40 | 3.40 |
| 6 | 5.60 | 6.30 | 11.20 | 6.00 | 3.00 | 1.50 | 2.40 | 1.00 | .80 | .90 | .50 | 3.10 |
| 7 | 5.10 | 5.40 | 10.30 | 5.90 | 2.70 | 1.40 | 2.10 | 1.40 | .90 | .80 | .50 | 3.30 |
| 8 | 4.70 | 5.00 | 8.30 | 5.50 | 2.50 | 1.50 | 2.10 | 1.60 | .80 | 1.00 | .90 | 2.90 |
| 9 | 4.50 | 4.50 | 8.10 | 5.60 | 2.60 | 1.60 | 1.90 | 2.20 | .70 | 1.00 | 1.00 | 2.30 |
| 10 | 4.30 | 3.90 | 7.80 | 5.40 | 2.50 | 2.20 | 1.80 | 1.60 | .70 | .80 | .90 | 2.00 |
| 11 | 4.00 | 3.60 | 7.40 | 5.00 | 2.30 | 2.10 | 2.10 | 1.10 | 1.40 | .60 | .80 | 1.80 |
| 12 | 3.80 | 3.50 | 6.90 | 4.70 | 2.10 | 1.80 | 3.30 | .90 | 1.40 | .70 | .70 | 1.70 |
| 13 | 3.50 | 3.40 | 6.50 | 4.50 | 2.00 | 1.60 | 3.60 | .80 | 1.20 | .80 | .60 | 1.60 |
| 14 | 3.20 | 3.20 | 6.10 | 4.30 | 2.00 | 1.40 | 2.50 | .60 | .90 | 1.60 | .50 | 1.50 |
| 15 | 3.00 | 3.10 | 5.80 | 4.10 | 2.20 | 1.60 | 2.40 | .60 | .80 | 1.70 | .50 | 1.50 |
| 16 | 3.00 | 3.00 | 6.00 | 4.00 | 2.20 | 1.70 | 2.00 | .80 | .80 | 1.50 | .50 | 1.70 |
| 17 | 2.90 | 2.90 | 9.30 | 3.90 | 2.30 | 1.80 | 2.10 | 1.70 | .80 | 1.30 | .40 | 2.00 |
| 18 | 2.90 | 2.90 | 10.60 | 3.90 | 2.10 | 3.30 | 1.60 | 1.80 | .70 | 1.00 | .50 | 2.70 |
| 19 | 2.90 | 2.80 | 8.70 | 3.90 | 2.00 | 3.60 | 1.40 | 1.80 | .50 | .90 | .80 | 3.10 |
| 20 | 2.80 | 2.60 | 7.00 | 3.80 | 2.30 | 3.40 | 1.30 | .70 | .80 | .70 | 1.10 | 2.60 |
| 21 | 3.00 | 2.80 | 6.10 | 3.80 | 3.00 | 2.40 | 1.20 | .60 | 1.80 | .60 | 1.10 | 2.60 |
| 22 | 3.60 | 4.00 | 5.60 | 3.90 | 2.90 | 2.20 | 1.20 | .70 | .50 | .60 | 1.00 | 2.80 |
| 23 | 3.80 | 4.70 | 5.10 | 3.70 | 3.10 | 2.40 | 1.20 | .80 | 1.10 | .50 | .90 | 2.80 |
| 24 | 3.40 | 4.60 | 4.80 | 3.50 | 2.80 | 2.00 | 1.00 | 1.00 | .90 | .30 | .80 | 2.90 |
| 25 | 3.10 | 4.20 | 4.50 | 3.30 | 2.60 | 1.70 | .90 | .80 | 1.30 | .30 | 1.40 | 2.50 |
| 26 | 3.00 | 5.70 | 4.20 | 3.20 | 2.40 | 1.50 | .80 | .60 | 1.10 | .30 | 2.00 | 2.00 |
| 27 | 3.90 | 9.00 | 4.00 | 3.00 | 3.30 | 1.90 | .80 | .50 | 1.90 | .30 | 2.60 | 1.90 |
| 28 | 8.30 | 14.80 | 3.90 | 2.80 | 3.30 | 5.60 | .80 | .40 | 1.80 | .30 | 2.80 | 1.70 |
| 29 | 9.30 | ..... | 10.00 | 2.80 | 2.80 | 9.80 | .90 | .40 | 1.60 | .40 | 2.30 | 1.50 |
| 30 | 8.90 | ..... | 18.50 | 2.90 | 2.30 | 8.60 | .90 | .40 | 1.20 | .60 | 1.90 | 1.40 |
| 31 | 9.60 | ..... | 15.80 | ..... | 2.00 | ..... | 1.20 | .40 | ..... | .80 | ..... | 1.70 |

*Rating table for Tennessee River at Knoxville, Tenn., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.0 | 3,500 | 3.8 | 15,398 | 7.6 | 32,790 | 16.5 | 74,175 |
| .2 | 3,900 | 4.0 | 16,242 | 7.8 | 33,720 | 17.0 | 76,500 |
| .4 | 4,250 | 4.2 | 17,102 | 8.0 | 34,650 | 17.5 | 78,825 |
| .6 | 4,590 | 4.4 | 17,978 | 8.5 | 36,975 | 18.0 | 81,150 |
| .8 | 5,050 | 4.6 | 18,870 | 9.0 | 39,300 | 18.5 | 83,475 |
| 1.0 | 5,600 | 4.8 | 19,778 | 9.5 | 41,625 | 19.0 | 85,800 |
| 1.2 | 6,170 | 5.0 | 20,700 | 10.0 | 43,950 | 19.5 | 88,125 |
| 1.4 | 6,760 | 5.2 | 21,630 | 10.5 | 46,275 | 20.0 | 90,450 |
| 1.6 | 7,370 | 5.4 | 22,560 | 11.0 | 48,600 | 21.0 | 95,100 |
| 1.8 | 8,000 | 5.6 | 23,490 | 11.5 | 50,925 | 22.0 | 99,750 |
| 2.0 | 8,650 | 5.8 | 24,420 | 12.0 | 53,250 | 23.0 | 104,400 |
| 2.2 | 9,320 | 6.0 | 25,350 | 12.5 | 55,575 | 24.0 | 109,050 |
| 2.4 | 10,010 | 6.2 | 26,280 | 13.0 | 57,900 | 25.0 | 113,700 |
| 2.6 | 10,720 | 6.4 | 27,210 | 13.5 | 60,225 | 26.0 | 118,350 |
| 2.8 | 11,450 | 6.6 | 28,140 | 14.0 | 62,550 | 27.0 | 123,000 |
| 3.0 | 12,200 | 6.8 | 29,070 | 14.5 | 64,875 | 28.0 | 127,650 |
| 3.2 | 12,970 | 7.0 | 30,000 | 15.0 | 67,200 | 29.0 | 132,300 |
| 3.4 | 13,760 | 7.2 | 30,930 | 15.5 | 69,525 | 30.0 | 136,950 |
| 3.6 | 14,570 | 7.4 | 31,860 | 16.0 | 71,850 | 31.0 | 141,600 |

*Estimated monthly discharge of Tennessee River at Knoxville, Tenn.*

[Drainage area, 8,990 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 85,800 | 11,450 | 23,144 | 2.57 | 2.96 |
| February | 66,270 | 10,720 | 24,500 | 2.73 | 2.84 |
| March | 157,410 | 15,818 | 43,999 | 4.89 | 5.64 |
| April | 47,670 | 11,450 | 19,652 | 2.19 | 2.44 |
| May | 13,362 | 8,650 | 10,620 | 1.18 | 1.36 |
| June | 43,020 | 6,760 | 10,952 | 1.22 | 1.36 |
| July | 34,650 | 5,050 | 10,023 | 1.11 | 1.28 |
| August | 9,320 | 4,250 | 5,818 | .65 | .75 |
| September | 8,322 | 4,100 | 5,569 | .62 | .69 |
| October | 8,650 | 4,100 | 5,425 | .60 | .69 |
| November | 11,450 | 4,250 | 5,763 | .64 | .71 |
| December | 13,760 | 6,760 | 9,500 | 1.06 | 1.22 |
| The year | 157,410 | 4,100 | 14,580 | 1.62 | 21.94 |

### FRENCH BROAD RIVER AT OLDTOWN, NEAR NEWPORT, TENN.

This was originally one of the temporary stations established in connection with the general hydrographic study of the southern Appalachian region.

The original gage put in at this station was carried away with the old bridge by flood early in the spring of 1902. The present gage was put in on the new bridge October 27, 1902. A 12-foot scale, subdivided into feet and tenths, is marked with tacks on the downstream guard rail on the second span from the southwest end. The zero of the gage is directly opposite the center of the first intermediate post, second span from the southwest end. From the zero of the gage to the outer rim of the pulley is 2.80 feet. The length of the wire, from the end of the weight to the pointer, is 30.38 feet. When the gage reads 1 foot the water surface is 25.60 feet below the top of the hexagonal nut on the center bolt in the lower chord of the bridge below (and slightly downstream from) the zero of the gage.

The following discharge measurements were made during 1902 by B. S. Drane:

September 20: Gage height, 3.54 feet; discharge, 4,581 second-feet.
October 27: Gage height, 1.49 feet; discharge, 1,128 second-feet.
November 11: Gage height, 1.57 feet; discharge, 1,299 second-feet.
December 9: Gage height, 2.05 feet; discharge, 2,459 second-feet.

*Daily gage height, in feet, of French Broad River at Oldtown, Tenn.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | 1.40 | 2.10 | 12 | 1.40 | 1.90 | 23 | 1.60 | 2.50 |
| 2 | 1.40 | 2.20 | 13 | 1.50 | 1.90 | 24 | 1.60 | 2.60 |
| 3 | 1.40 | 2.30 | 14 | 1.40 | 1.90 | 25 | 2.00 | 2.40 |
| 4 | 1.40 | 3.20 | 15 | 1.40 | 1.90 | 26 | 2.20 | 2.20 |
| 5 | 1.40 | 2.80 | 16 | 1.50 | 2.00 | 27 | 2.10 | 2.00 |
| 6 | 1.60 | 2.60 | 17 | 1.60 | 3.00 | 28 | 1.90 | 2.10 |
| 7 | 1.80 | 2.40 | 18 | 1.60 | 2.90 | 29 | 1.90 | 2.00 |
| 8 | 2.00 | 2.30 | 19 | 1.90 | 2.30 | 30 | 2.00 | 1.90 |
| 9 | 1.20 | 2.20 | 20 | 1.80 | 2.20 | 31 | ..... | 2.00 |
| 10 | 1.30 | 2.10 | 21 | 1.70 | 2.10 | | | |
| 11 | 1.30 | 2.00 | 22 | 1.60 | 2.20 | | | |

### PIGEON RIVER AT NEWPORT, TENN.

This station was established September 4, 1900, on the wagon bridge at the upper end of the town of Newport, about 100 yards above the railroad bridge. The course of the river is straight for several hundred yards above and for about 50 yards below the bridge. The current at extreme low water is very sluggish. At even the lowest gage heights the water is very deep. The bottom is smooth, being of rock, in many places overlain with mud. The 15-foot mark of the rod, or the end, is abutted firmly against the east side of the first strut from

the west end of the bridge on the downstream side. The distance between the zero of the rod and the outer rim of the pulley wheel is 0.95 foot, and from the end of the weight to the pointer on the wire the distance is 32.89 feet. When the gage reading is 1 foot, the water level is 27.42 feet below the top surface of the lower chord directly beneath the zero of the gage rod. The rod is of hard pine, well painted, and divided into feet and tenths. The drainage area is 655 square miles. The observer is H. M. Boyer, proprietor of a livery stable at Newport. The records at this station have been incomplete, as the gage has been damaged a number of times by high water and by malicious persons. It was finally reestablished on September 19, 1902, all the measurements for the setting of the gage, etc., being the same as before. Gage heights were not taken until December 14, 1902.

### NOLICHUCKY RIVER NEAR CHUCKY VALLEY, TENN.

This station was established September 6, 1900, to aid in the general investigation of the hydrographic conditions of the southern Appalachian region made during the summer and autumn of 1900, and was located on the highway bridge about 1 mile above Chucky Valley post-office.

The wire gage was suspended from the upstream side of the bridge, and the stage of the water surface was referred to a horizontal gage fastened to the guard rail of the bridge. The initial point for sounding was the end of the guard rail at the left end of the bridge, on the downstream side.

The section presented at this point was very favorable for the making of accurate measurements of discharge, as the course of the river was straight for a long distance above and below the station, the bed of the stream was very smooth, the current velocity neither excessive nor too small, and the banks high and not subject to overflow.

This station was maintained until the great flood of May 1901, swept away the bridge, which has not since been replaced.

*Discharge measurements of Nolichucky River near Chucky Valley, Tenn.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| September 5 | E. W. Myers | 2.00 | 302 |
| September 20 | L. V. Branch | 2.18 | 442 |
| October 15 | do | 2.00 | 378 |
| November 10 | do | 2.90 | 919 |
| 1901. | | | |
| March 31 | R. E. Shuford | 5.18 | 5,356 |
| April 14 | E. W. Myers | 4.45 | 3,022 |

*Daily gage height, in feet, of Nolichucky River near Chucky Valley, Tenn.*

| Day. | Sept. | Oct. | Nov. | Dec. | Day | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | 1900. | | | | |
| 1 | ..... | 1.80 | 2.50 | 3.10 | 17 | 3.10 | 2.00 | 2.50 | 2.70 |
| 2 | ..... | 1.90 | 2.60 | 3.20 | 18 | 2.60 | 1.90 | 2.50 | 2.70 |
| 3 | ..... | 1.90 | 3.00 | 3.00 | 19 | 2.30 | 2.00 | 2.40 | 2.60 |
| 4 | ..... | 2.00 | 5.20 | 4.80 | 20 | 2.10 | 1.90 | 2.40 | 2.60 |
| 5 | 2.00 | 3.30 | 4.00 | 3.30 | 21 | 2.00 | 1.90 | 2.30 | 2.90 |
| 6 | 2.00 | 3.20 | 3.50 | 3.50 | 22 | 2.00 | 1.90 | 2.50 | 2.80 |
| 7 | 2.00 | 2.50 | 3.20 | 3.40 | 23 | 2.20 | 9.30 | 2.50 | 2.90 |
| 8 | 2.00 | 2.30 | 2.50 | 3.30 | 24 | 2.20 | 5.20 | 2.50 | 3.00 |
| 9 | 1.80 | 2.30 | 3.00 | 3.30 | 25 | 2.10 | 3.90 | 2.70 | 3.00 |
| 10 | 1.80 | 2.20 | 2.90 | 3.20 | 26 | 2.10 | 3.30 | 6.50 | 3.20 |
| 11 | 1.80 | 2.10 | 2.80 | 3.10 | 27 | 2.10 | 3.10 | 4.50 | 3.10 |
| 12 | 1.80 | 2.10 | 2.80 | 3.00 | 28 | 2.00 | 2.90 | 3.40 | 3.00 |
| 13 | 1.80 | 2.10 | 2.70 | 3.00 | 29 | 2.00 | 2.80 | 3.40 | 2.90 |
| 14 | 2.60 | 2.00 | 2.70 | 2.90 | 30 | 1.80 | 2.70 | 3.20 | 3.00 |
| 15 | 2.30 | 2.00 | 2.60 | 2.90 | 31 | ..... | 2.60 | ..... | 3.20 |
| 16 | 4.70 | 2.00 | 2.50 | 2.80 | | | | | |

| Day. | Jan. | Feb. | Mar. | Apr. | May. | Day. | Jan. | Feb. | Mar. | Apr. | May. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | 1901. | | | | | |
| 1 | 3.20 | 3.20 | 3.10 | 4.10 | 4.30 | 17 | 3.70 | 3.30 | 3.30 | 3.20 | 3.30 |
| 2 | 3.30 | 3.00 | 2.80 | 6.80 | 4.10 | 18 | 3.50 | 3.40 | 3.20 | 3.10 | 3.30 |
| 3 | 3.50 | 3.30 | 2.80 | 8.60 | 4.10 | 19 | 3.20 | 3.20 | 3.10 | 3.20 | 3.40 |
| 4 | 3.30 | 3.20 | 2.80 | 6.40 | 4.80 | 20 | 3.30 | 3.30 | 3.30 | 4.60 | 3.40 |
| 5 | 3.10 | 3.30 | 3.30 | 5.30 | 4.00 | 21 | 3.40 | 3.30 | 3.30 | 3.40 | 3.50 |
| 6 | 3.00 | 3.30 | 3.20 | 4.90 | 3.80 | 22 | 3.20 | 3.30 | 3.40 | 3.30 | ..... |
| 7 | 3.00 | 3.40 | 2.90 | 4.70 | 3.60 | 23 | 3.50 | 3.40 | 3.40 | 3.30 | ..... |
| 8 | 3.20 | 3.40 | 3.00 | 4.60 | 3.60 | 24 | 3.30 | 3.20 | 3.20 | 3.40 | ..... |
| 9 | 3.00 | 4.00 | 3.30 | 4.40 | 4.00 | 25 | 3.30 | 3.40 | 3.30 | 3.80 | ..... |
| 10 | 2.90 | 4.20 | 3.30 | 4.20 | 3.80 | 26 | 3.20 | 3.30 | 8.00 | 4.40 | ..... |
| 11 | 3.00 | 3.90 | 4.70 | 4.00 | 3.80 | 27 | 3.20 | 3.20 | 5.30 | 4.50 | ..... |
| 12 | 3.60 | 3.80 | 3.80 | 3.80 | 3.70 | 28 | 3.30 | 3.20 | 5.30 | 4.40 | ..... |
| 13 | 5.20 | 3.60 | 3.50 | 3.00 | 3.60 | 29 | 3.30 | ..... | 4.50 | 4.50 | ..... |
| 14 | 4.30 | 3.40 | 3.30 | 3.20 | 3.50 | 30 | 3.20 | ..... | 4.60 | 4.40 | ..... |
| 15 | 4.00 | 3.30 | 3.30 | 3.10 | 3.40 | 31 | 3.30 | ..... | 4.40 | ..... | ..... |
| 16 | 3.90 | 3.40 | 3.40 | 3.20 | 3.40 | | | | | | |

*Rating table for Nolichucky River near Chucky Valley, Tenn., for 1900 and 1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.8 | 270 | 4.4 | 2,925 | 7.0 | 12,650 | 9.6 | 23,050 |
| 1.9 | 305 | 4.5 | 3,150 | 7.1 | 13,050 | 9.7 | 23,450 |
| 2.0 | 340 | 4.6 | 3,400 | 7.2 | 13,450 | 9.8 | 23,850 |
| 2.1 | 390 | 4.7 | 3,675 | 7.3 | 13,850 | 9.9 | 24,250 |
| 2.2 | 440 | 4.8 | 3,950 | 7.4 | 14,250 | 10.0 | 24,650 |
| 2.3 | 500 | 4.9 | 4,300 | 7.5 | 14,650 | 10.1 | 25,050 |
| 2.4 | 560 | 5.0 | 4,650 | 7.6 | 15,050 | 10.2 | 25,450 |
| 2.5 | 625 | 5.1 | 5,050 | 7.7 | 15,450 | 10.3 | 25,850 |
| 2.6 | 695 | 5.2 | 5,450 | 7.8 | 15,850 | 10.4 | 26,250 |
| 2.7 | 765 | 5.3 | 5,850 | 7.9 | 16,250 | 10.5 | 26,650 |
| 2.8 | 840 | 5.4 | 6,250 | 8.0 | 16,650 | 10.6 | 27,050 |
| 2.9 | 920 | 5.5 | 6,650 | 8.1 | 17,050 | 10.7 | 27,450 |
| 3.0 | 1,000 | 5.6 | 7,050 | 8.2 | 17,450 | 10.8 | 27,850 |
| 3.1 | 1,085 | 5.7 | 7,450 | 8.3 | 17,850 | 10.9 | 28,250 |
| 3.2 | 1,175 | 5.8 | 7,850 | 8.4 | 18,250 | 11.0 | 28,650 |
| 3.3 | 1,275 | 5.9 | 8,250 | 8.5 | 18,650 | 11.1 | 29,050 |
| 3.4 | 1,385 | 6.0 | 8,650 | 8.6 | 19,050 | 11.2 | 29,450 |
| 3.5 | 1,505 | 6.1 | 9,050 | 8.7 | 19,450 | 11.3 | 29,850 |
| 3.6 | 1,630 | 6.2 | 9,450 | 8.8 | 19,850 | 11.4 | 30,250 |
| 3.7 | 1,770 | 6.3 | 9,850 | 8.9 | 20,250 | 11.5 | 30,650 |
| 3.8 | 1,910 | 6.4 | 10,250 | 9.0 | 20,650 | 11.6 | 31,050 |
| 3.9 | 2,060 | 6.5 | 10,650 | 9.1 | 21,050 | 11.7 | 31,450 |
| 4.0 | 2,210 | 6.6 | 11,050 | 9.2 | 21,450 | 11.8 | 31,850 |
| 4.1 | 2,370 | 6.7 | 11,450 | 9.3 | 21,850 | 11.9 | 32,250 |
| 4.2 | 2,540 | 6.8 | 11,850 | 9.4 | 22,250 | 12.0 | 32,650 |
| 4.3 | 2,725 | 6.9 | 12,250 | 9.5 | 22,650 | | |

*Estimated monthly discharge of Nolichucky River near Chucky Valley, Tenn.*

[Drainage area, 817 square miles.]

| Month. | Discharge in second-feet. | | | Total in acre-feet. | Run-off. | | Rainfall. |
|---|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | | Second-feet per square mile. | Depth in inches. | Inches. |
| 1900. | | | | | | | |
| September [a] | ..... | ..... | 536 | 27,642 | 0.656 | 0.63 | 3.08 |
| October | 21,850 | 270 | 1,444 | 88,788 | 1.767 | 2.04 | 5.33 |
| November | 10,650 | 500 | 1,433 | 85,270 | 1.754 | 1.96 | 3.89 |
| December | 3,950 | 695 | 1,173 | 72,125 | 1.435 | 1.65 | 3.40 |
| 1901. | | | | | | | |
| January | 5,450 | 920 | 1,490 | 91,617 | 1.823 | 2.09 | 3.84 |
| February | 2,540 | 1,000 | 1,413 | 78,474 | 1.729 | 1.81 | 2.03 |
| March | 16,650 | 840 | 2,280 | 140,192 | 2.790 | 3.22 | 4.37 |
| April | 19,050 | 1,000 | 3,457 | 205,706 | 4.231 | 4.75 | 5.12 |
| May [b] | ..... | ..... | 1,868 | 77,807 | 2.286 | 1.79 | 6.92 |

[a] 26 days.

[b] May 1 to 21. Does not include great May flood, which washed bridge and gage away.

Note on rainfall for May, 1901: This does not contain any record from station in mountains of North Carolina for this month, where the rainfall was very great from May 18 to 23, causing greatest floods ever known in most of the rivers draining the region.

## HOLSTON RIVER (SOUTH FORK) AT BLUFF CITY, TENN.

This station was originally established by the United States Weather Bureau at the highway bridge at Bluff City. Readings were begun July 17, 1900, by the United States Geological survey, in connection with the general hydrographic investigation of the southern Appalachian region. The gage is a 4 by 8 inch timber, bolted to the downstream side of the stone pier. The initial point for soundings is on the north end of the bridge, downstream side. The channel is straight for about 500 feet above and below the bridge, and the current is swift. The north bank is high, but the south bank is subject to overflow at the bridge. The bed is rocky and constant in section. O. V. Cox is the observer.

The following discharge measurements were made during 1902 by B. S. Drane:

October 28: Gage height, 0.45 foot; discharge, 460 second-feet.
November 12: Gage height, 0.35 foot; discharge, 355 second-feet.
December 10: Gage height, 1.10 feet; discharge, 789 second-feet.

*Daily gage height, in feet, of Holston River (South Fork) at Bluff City, Tenn.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 4.50 | 5.40 | 8.20 | 3.10 | 1.30 | 0.70 | 4.10 | 1.10 | 0.40 | 1.00 | 0.30 | 1.20 |
| 2 | 3.40 | 4.60 | 6.70 | 2.60 | 1.20 | .70 | 3.20 | 1.10 | .30 | .60 | .30 | 1.00 |
| 3 | 3.30 | 3.70 | 6.50 | 2.30 | 1.10 | .60 | 2.10 | 1.10 | .30 | .40 | .40 | .90 |
| 4 | 3.20 | 3.80 | 5.40 | 2.40 | 1.10 | .50 | 2.10 | 1.10 | .40 | .50 | .40 | 1.70 |
| 5 | 3.00 | 3.70 | 4.70 | 3.30 | 1.10 | .50 | 1.60 | 1.00 | .50 | .70 | .40 | 2.20 |
| 6 | 2.80 | 2.80 | 4.50 | 3.00 | 1.00 | .50 | 1.60 | 4.00 | .50 | .60 | .40 | 2.70 |
| 7 | 2.70 | 2.60 | 4.10 | 2.80 | 1.00 | .40 | 1.20 | 3.10 | .60 | .50 | .30 | 1.70 |
| 8 | 2.60 | 2.00 | 3.40 | 2.60 | 1.00 | 1.00 | 1.40 | 2.80 | .50 | .40 | .30 | 1.30 |
| 9 | 2.40 | 1.80 | 3.30 | 2.40 | .90 | 1.40 | 1.50 | 1.30 | .30 | .30 | .30 | 1.20 |
| 10 | 2.00 | 1.80 | 3.30 | 2.50 | .90 | 1.00 | 1.70 | 1.00 | .40 | .20 | .30 | 1.10 |
| 11 | 1.20 | 1.70 | 3.20 | 2.40 | .90 | .60 | 1.40 | 1.30 | .40 | .20 | .30 | 1.00 |
| 12 | 1.20 | 1.70 | 3.10 | 2.40 | .90 | .60 | 1.30 | 1.00 | .40 | .70 | .30 | .90 |
| 13 | 1.10 | 1.60 | 3.10 | 2.30 | .90 | 1.00 | 1.20 | 1.00 | .40 | .70 | .30 | 1.00 |
| 14 | 1.60 | 1.60 | 3.10 | 2.20 | .90 | 1.50 | 1.60 | 1.00 | .30 | .60 | .30 | .90 |
| 15 | 1.50 | 1.70 | 2.80 | 2.00 | .90 | 1.20 | .90 | .90 | .30 | .60 | .30 | .90 |
| 16 | 1.30 | 1.60 | 3.40 | 1.80 | .90 | 1.10 | .80 | .80 | .30 | .60 | .30 | 1.30 |
| 17 | 1.30 | 1.50 | 3.40 | 1.60 | .90 | 2.00 | .80 | .80 | .20 | .50 | .30 | 1.70 |
| 18 | 1.30 | 1.50 | 3.10 | 1.40 | .90 | 1.50 | .70 | .70 | .20 | .40 | .40 | 1.60 |
| 19 | 1.20 | 1.40 | 2.80 | 1.40 | .90 | 1.20 | .70 | .90 | .20 | .40 | .40 | 1.30 |
| 20 | 1.70 | 1.40 | 2.70 | 1.40 | .90 | 1.10 | .70 | .90 | .40 | .30 | .50 | 1.30 |
| 21 | 1.60 | 2.00 | 2.30 | 1.90 | 1.00 | 1.00 | .90 | 1.00 | .30 | .20 | .40 | 1.20 |
| 22 | 1.50 | 2.00 | 2.00 | 1.80 | .90 | .90 | .80 | .90 | .20 | .20 | .40 | 1.10 |
| 23 | 1.70 | 1.80 | 2.80 | 1.70 | .80 | .80 | .70 | .80 | .20 | .10 | .50 | 1.00 |
| 24 | 1.80 | 2.00 | 2.70 | 1.60 | .80 | .70 | .70 | .70 | .10 | .10 | .50 | .90 |
| 25 | 1.70 | 2.60 | 2.00 | 1.50 | 1.10 | .60 | .70 | .70 | .20 | .10 | .70 | .90 |
| 26 | 1.80 | 3.10 | 1.80 | 1.40 | 1.10 | 1.20 | .70 | .60 | .70 | .10 | 1.60 | .80 |
| 27 | 3.60 | 4.40 | 1.80 | 1.30 | 1.10 | 5.55 | .70 | .60 | .40 | .50 | 1.60 | .70 |
| 28 | 3.40 | 11.45 | 2.00 | 1.30 | .90 | 8.00 | .80 | .50 | .40 | .40 | 1.60 | .80 |
| 29 | 4.40 | ..... | 6.00 | 1.20 | .90 | 4.40 | .90 | .40 | .40 | .40 | 1.40 | .90 |
| 30 | 4.80 | ..... | 5.00 | 1.40 | .80 | 4.20 | 1.80 | .40 | .60 | .30 | 1.30 | 1.10 |
| 31 | 5.40 | ..... | 3.80 | ..... | .80 | ..... | 1.20 | .40 | ..... | .30 | ..... | 1.00 |

*Rating table for Holston River (South Fork) at Bluff City, Tenn., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.1 | 293 | 2.2 | 1,890 | 4.4 | 4,430 | 7.5 | 16,400 |
| .2 | 310 | 2.4 | 2,110 | 4.6 | 4,795 | 8.0 | 18,500 |
| .4 | 346 | 2.6 | 2,330 | 4.8 | 5,245 | 9.0 | 22,700 |
| .6 | 444 | 2.8 | 2,550 | 5.0 | 5,900 | 10.0 | 26,900 |
| .8 | 576 | 3.0 | 2,770 | 5.2 | 6,740 | 11.0 | 31,100 |
| 1.0 | 730 | 3.2 | 2,990 | 5.4 | 7,580 | 12.0 | 35,300 |
| 1.2 | 896 | 3.4 | 3,210 | 5.6 | 8,420 | 13.0 | 39,500 |
| 1.4 | 1,070 | 3.6 | 3,430 | 5.8 | 9,260 | 14.0 | 43,700 |
| 1.6 | 1,255 | 3.8 | 3,650 | 6.0 | 10,100 | | |
| 1.8 | 1,456 | 4.0 | 3,870 | 6.5 | 12,200 | | |
| 2.0 | 1,670 | 4.2 | 4,130 | 7.0 | 14,300 | | |

*Estimated monthly discharge of Holston River (South Fork) at Bluff City, Tenn.*

[Drainage area, 828 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| January | 7,580 | 813 | 2,256 | 2.72 | 3.14 |
| February | 32,990 | 1,070 | 3,356 | 4.05 | 4.22 |
| March | 19,340 | 1,456 | 4,459 | 5.39 | 6.21 |
| April | 3,100 | 896 | 1,730 | 2.09 | 2.33 |
| May | 983 | 576 | 702 | .85 | .98 |
| June | 18,500 | 346 | 1,788 | 2.16 | 2.41 |
| July | 4,000 | 510 | 1,692 | 2.04 | 2.35 |
| August | 3,870 | 346 | 874 | 1.06 | 1.22 |
| September | 510 | 293 | 349 | .42 | .47 |
| October | 730 | 293 | 383 | .46 | .53 |
| November | 1,255 | 328 | 485 | .59 | .66 |
| December | 2,440 | 510 | 922 | 1.11 | 1.28 |
| The year | 32,990 | 293 | 1,583 | 1.91 | 25.80 |

WATAUGA RIVER AT BUTLER, TENN.

This station was established on August 14, 1900, in connection with the general hydrographic investigation of the southern Appalachian area.

The gage rod was a vertical scale graduated to feet and tenths and securely spiked and braced to an overhanging tree on the right bank of the stream about 100 yards below the highway bridge, from which the gagings were made and on which was the bench mark to which the gage was referred.

The section at this station was favorable for making accurate measurements of discharge, as the bed of the stream was of smooth, hard sand, the course of the river straight for some distance above and below the station, and the current velocities sufficient and well distributed in the section, while the banks were high and not subject to overflow except during extraordinary freshets.

The initial point for soundings was at the end of the hand rail on the left bank of the stream and on the downstream side of the bridge.

This station was maintained up to the end of 1901, though the bridge from which gagings were made was swept away in the great flood of May, 1901, and no gagings were possible after that date.

*Discharge measurements of Watauga River at Butler, Tenn.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| July 30 | E. W. Myers | 1.37 | 434 |
| August 7 | L. V. Branch | .90 | 214 |
| August 17 | do | .84 | 166 |
| October 6 | E. W. Myers | 1.12 | 238 |
| November 7 | L. V. Branch | 2.20 | 591 |
| December 28 | E. W. Myers | 1.40 | 311 |
| 1901. | | | |
| January 17 | E. W. Myers | 2.10 | 574 |
| April 12 | do | 2.55 | 849 |

*Daily gage height, in feet, of Watauga River at Butler, Tenn.*

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900. | | | | | | 1900. | | | | | |
| 1 | | 0.90 | 0.90 | 5.60 | 2.00 | 17 | | 4.50 | 0.70 | 1.50 | 1.50 |
| 2 | | .90 | .90 | 5.00 | 2.40 | 18 | 0.90 | 4.00 | .70 | 1.50 | 1.50 |
| 3 | | .90 | .90 | 2.30 | 2.40 | 19 | .80 | 3.20 | .70 | 1.40 | 1.50 |
| 4 | | .90 | .90 | 2.10 | 5.00 | 20 | .80 | 2.70 | .70 | 1.40 | 1.50 |
| 5 | | .90 | .90 | 2.50 | 4.00 | 21 | 1.10 | 1.10 | .70 | 1.40 | 1.50 |
| 6 | | .90 | .90 | 2.30 | 3.50 | 22 | 1.60 | 1.00 | .70 | 1.40 | 1.50 |
| 7 | | .80 | .90 | 2.00 | 3.00 | 23 | 1.30 | 1.10 | 15.00 | 1.40 | 1.50 |
| 8 | | .80 | .90 | 2.00 | 2.50 | 24 | 1.20 | .90 | 9.00 | 1.40 | 1.50 |
| 9 | | .80 | .90 | 1.90 | 2.10 | 25 | .90 | .90 | 4.50 | 1.40 | 1.50 |
| 10 | | .80 | .90 | 1.90 | 1.90 | 26 | .90 | .90 | 2.50 | 5.40 | 1.50 |
| 11 | | .80 | .90 | 1.90 | 1.50 | 27 | .90 | .90 | 2.00 | 4.00 | 1.50 |
| 12 | | .80 | .80 | 1.80 | 1.50 | 28 | .90 | .90 | 4.50 | 3.00 | 1.50 |
| 13 | | .80 | .80 | 1.60 | 1.50 | 29 | .80 | .90 | 4.00 | 3.00 | 1.50 |
| 14 | 1.30 | 1.70 | .90 | 1.50 | 1.50 | 30 | 1.90 | .90 | 4.00 | 2.40 | 1.50 |
| 15 | .80 | 1.70 | .80 | 1.50 | 1.50 | 31 | 1.40 | | 3.20 | | 1.50 |
| 16 | .70 | 3.10 | .70 | 1.50 | 1.50 | | | | | | |

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | 2.00 | 1.60 | 1.50 | 3.00 | 3.00 | 3.00 | 6.40 | 2.00 | 3.50 | 2.80 | 2.60 | 2.60 |
| 2 | 2.00 | 1.60 | 1.50 | 8.00 | 3.00 | 3.00 | 4.10 | 2.00 | 3.10 | 2.80 | 2.60 | 2.60 |
| 3 | 2.00 | 1.60 | 1.50 | 7.00 | 3.00 | 3.00 | 3.50 | 2.00 | 2.70 | 2.80 | 2.60 | 2.60 |
| 4 | 1.80 | 2.80 | 1.50 | 6.30 | 3.00 | 3.00 | 2.80 | 2.00 | 2.70 | 2.80 | 3.50 | 2.60 |
| 5 | 1.60 | 2.00 | 1.50 | 5.00 | 3.00 | 3.00 | 2.50 | 2.00 | 2.70 | 2.80 | 3.10 | 2.60 |
| 6 | 1.50 | 2.00 | 1.50 | 4.50 | 3.00 | 3.00 | 2.50 | 8.00 | 2.70 | 2.80 | 3.00 | 2.60 |
| 7 | 1.50 | 1.80 | 1.70 | 3.40 | 3.60 | 3.00 | 2.50 | 5.10 | 2.70 | 2.70 | 2.80 | 2.60 |
| 8 | 1.50 | 1.60 | 2.00 | 3.00 | 4.60 | 11.00 | 2.30 | 3.40 | 2.70 | 2.70 | 2.80 | 2.60 |
| 9 | 1.50 | 3.50 | 2.00 | 2.50 | 3.50 | 6.30 | 2.00 | 2.80 | 2.70 | 2.60 | 2.80 | 2.60 |
| 10 | 1.90 | 3.00 | 2.00 | 2.50 | 3.20 | 4.50 | 2.00 | 2.50 | 2.70 | 2.60 | 2.80 | 4.70 |
| 11 | 2.00 | 2.80 | 4.00 | 2.50 | | 4.50 | 2.00 | 3.50 | 2.70 | 2.60 | 2.80 | 3.60 |
| 12 | 7.00 | 2.80 | 3.00 | 2.50 | 2.80 | 3.60 | 2.00 | 7.60 | 3.00 | 2.60 | 2.80 | 3.10 |

*Daily gage height, in feet, of Watauga River at Butler, Tenn.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 13 | 5.00 | 2.40 | 2.00 | 2.50 | 2.80 | 3.40 | 2.00 | 5.30 | 3.00 | 4.10 | 2.80 | 3.00 |
| 14 | 4.30 | 2.00 | 2.00 | 2.50 | 2.60 | 3.00 | 2.00 | 4.50 | 2.70 | 4.00 | 2.80 | 9.50 |
| 15 | 3.60 | 2.00 | 2.00 | 2.50 | 2.60 | 3.00 | 2.00 | 4.70 | 2.70 | 3.60 | 2.80 | 8.00 |
| 16 | 3.00 | 2.00 | 2.00 | 2.50 | 2.60 | 3.00 | 2.00 | 6.70 | 4.50 | 3.60 | 2.80 | 6.00 |
| 17 | 2.60 | 2.00 | 2.00 | 2.50 | 2.60 | 2.50 | 2.00 | 6.70 | 3.60 | 3.20 | 2.80 | 4.50 |
| 18 | 2.60 | 1.80 | 2.00 | 2.50 | 2.60 | 2.50 | 2.00 | 5.90 | 3.10 | 3.20 | 2.80 | 3.60 |
| 19 | 2.60 | 1.60 | 1.80 | 2.50 | 2.80 | 2.50 | 2.00 | 4.60 | 3.00 | 3.20 | 2.80 | 3.00 |
| 20 | 2.10 | 1.00 | 1.60 | 12.00 | 3.00 | 2.50 | 2.00 | 4.00 | 3.00 | 3.20 | 2.80 | 3.00 |
| 21 | 2.00 | .80 | 1.60 | 5.20 | 16.27 | 2.50 | 2.00 | 6.90 | 3.00 | 3.20 | 2.80 | 3.00 |
| 22 | 1.80 | .80 | 1.60 | 4.50 | 11.00 | 2.50 | 2.00 | 5.80 | 3.00 | 3.20 | 2.80 | 3.00 |
| 23 | 1.60 | .60 | 1.60 | 4.50 | 5.00 | 2.50 | 2.00 | 4.00 | 3.00 | 2.90 | 2.80 | 3.00 |
| 24 | 1.60 | .60 | 1.80 | 4.50 | 4.60 | 2.50 | 2.00 | 3.50 | 3.80 | 2.90 | 2.60 | 6.00 |
| 25 | 1.60 | .80 | 2.00 | 3.70 | 4.50 | 2.50 | 2.00 | 3.50 | 3.50 | 2.90 | 2.60 | 4.00 |
| 26 | 1.60 | 1.00 | 7.00 | 3.70 | 3.60 | 3.20 | 2.00 | 3.50 | 3.00 | 2.90 | 2.60 | 3.00 |
| 27 | 1.60 | 1.50 | 6.00 | 3.70 | 3.40 | 8.70 | 2.00 | 3.50 | 3.00 | 2.60 | 2.60 | 3.00 |
| 28 | 1.60 | 1.50 | 4.80 | 3.00 | 3.40 | 8.90 | 2.00 | 3.50 | 3.00 | 2.60 | 2.60 | 3.00 |
| 29 | 1.60 | ..... | 3.50 | 3.00 | 3.40 | 3.80 | 2.00 | 3.50 | 3.00 | 2.60 | 2.60 | ..... |
| 30 | 1.60 | ..... | 3.00 | 3.00 | 3.40 | 2.60 | 2.00 | 3.50 | 2.80 | 2.60 | 2.60 | ..... |
| 31 | 1.60 | ..... | 3.00 | ..... | 3.00 | ..... | 2.00 | 3.50 | ..... | 2.60 | ..... | ..... |

*Rating table for Watauga River at Butler, Tenn., for 1900 and 1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.6 | 120 | 2.3 | 665 | 4.0 | 2,010 | 5.7 | 3,370 |
| .7 | 135 | 2.4 | 735 | 4.1 | 2,090 | 5.8 | 3,450 |
| .8 | 157 | 2.5 | 810 | 4.2 | 2,170 | 5.9 | 3,530 |
| .9 | 180 | 2.6 | 890 | 4.3 | 2,250 | 6.0 | 3,610 |
| 1.0 | 205 | 2.7 | 970 | 4.4 | 2,330 | 6.1 | 3,690 |
| 1.1 | 230 | 2.8 | 1,050 | 4.5 | 2,410 | 6.2 | 3,770 |
| 1.2 | 255 | 2.9 | 1,130 | 4.6 | 2,490 | 6.3 | 3,850 |
| 1.3 | 283 | 3.0 | 1,210 | 4.7 | 2,570 | 6.4 | 3,930 |
| 1.4 | 311 | 3.1 | 1,290 | 4.8 | 2,650 | 6.5 | 4,010 |
| 1.5 | 341 | 3.2 | 1,370 | 4.9 | 2,730 | 6.6 | 4,090 |
| 1.6 | 373 | 3.3 | 1,450 | 5.0 | 2,810 | 6.7 | 4,170 |
| 1.7 | 405 | 3.4 | 1,530 | 5.1 | 2,890 | 6.8 | 4,250 |
| 1.8 | 440 | 3.5 | 1,610 | 5.2 | 2,970 | 6.9 | 4,330 |
| 1.9 | 476 | 3.6 | 1,690 | 5.3 | 3,050 | 7.0 | 4,410 |
| 2.0 | 515 | 3.7 | 1,770 | 5.4 | 3,130 | | |
| 2.1 | 562 | 3.8 | 1,850 | 5.5 | 3,210 | | |
| 2.2 | 610 | 3.9 | 1,930 | 5.6 | 3,290 | | |

*Estimated monthly discharge of Watauga River at Butler, Tenn.*

[Drainage area, 261 square miles.]

| Month. | Discharge in second-feet. | | | Total in acre-feet. | Run-off. | |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | | Second-feet per square mile. | Depth in inches. |
| 1900. | | | | | | |
| August [a] | | | 228 | 7,688 | 0.874 | 0.25 |
| September | 2,410 | 157 | 432 | 25,705 | 1.655 | 1.85 |
| October | 10,810 | 135 | 1,030 | 63,332 | 3.946 | 4.55 |
| November | 3,290 | 311 | 808 | 48,079 | 3.097 | 3.46 |
| December | 2,810 | 341 | 601 | 36,953 | 2.302 | 2.65 |
| 1901. | | | | | | |
| January | 4,410 | 341 | 794 | 48,820 | 3.042 | 3.52 |
| February | 1,610 | 120 | 512 | 28,435 | 1.962 | 2.04 |
| March | 4,410 | 341 | 900 | 55,339 | 3.448 | 3.97 |
| April | 8,410 | 810 | 1,970 | 117,223 | 7.548 | 8.42 |
| May | 11,850 | 890 | 1,971 | 121,192 | 7.551 | 8.71 |
| June | 7,610 | 810 | 1,821 | 108,357 | 6.977 | 7.78 |
| July | 3,930 | 515 | 762 | 46,853 | 2.920 | 3.37 |
| August | 5,210 | 515 | 2,182 | 134,166 | 8.360 | 9.63 |
| September | 2,410 | 970 | 1,226 | 75,332 | 4.697 | 5.24 |
| October | 2,090 | 890 | 1,176 | 72,309 | 4.505 | 5.20 |
| November | 1,610 | 890 | 969 | 57,659 | 3.712 | 4.14 |
| December [b] | | | 1,762 | 97,801 | 6.751 | 8.93 |
| The year | 11,850 | 120 | 1,337 | 963,486 | 5.123 | 70.95 |

[a] 17 days. [b] 28 days.

ROAN CREEK AT BUTLER, TENN.

The station on this stream was established on August 8, 1900, and the gage rod was spiked and braced to a tree on the left bank of the stream a short distance below Cole & Scott's gristmill, about one-half mile above the mouth of the creek, at which point the gagings were made from the highway bridge. The initial point for soundings at this station was at the end of the hand rail over the right bank and on the upstream side of the bridge. The left bank was low and subject to overflow, and the bed was of sand and mud.

The bridge on which this station was located was washed away at the same time as the one across the Watauga, but was later replaced by a temporary structure, from which a gaging was made near the end of 1901.

This station was discontinued at the end of 1901.

*Discharge measurements of Roan Creek at Butler, Tenn.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1900. | | *Feet.* | *Second-feet.* |
| July 30 | E. W. Myers | 1.47 | 137 |
| August 7 | do | 1.02 | 65 |
| August 17 | do | .85 | 58 |
| October 6 | do | .86 | 52 |
| November 7 | do | 1.50 | 171 |
| December 28 | do | 1.20 | 82 |
| 1901. | | | |
| January 17 | do | 1.72 | 279 |
| April 12 | do | 1.70 | 286 |
| October 25 | do | .95 | 118 |

*Daily gage height, in feet, of Roan Creek at Butler, Tenn.*

| Day. | Aug. | Sept. | Oct. | Day. | Aug. | Sept. | Oct. |
|---|---|---|---|---|---|---|---|
| 1900. | | | | 1900. | | | |
| 1 | ..... | 0.95 | 1.00 | 17 | 0.84 | 1.30 | 0.80 |
| 2 | ..... | 1.00 | .85 | 18 | .85 | 1.05 | .80 |
| 3 | ..... | .83 | .85 | 19 | .80 | 1.00 | .80 |
| 4 | ..... | .88 | .85 | 20 | .82 | .93 | .81 |
| 5 | ..... | .83 | .80 | 21 | 1.05 | .92 | .78 |
| 6 | ..... | .81 | .86 | 22 | 1.71 | .95 | .80 |
| 7 | ..... | .80 | .80 | 23 | 1.27 | 1.20 | 4.80 |
| 8 | 0.90 | .76 | .83 | 24 | 1.00 | 1.25 | ..... |
| 9 | .72 | .80 | .89 | 25 | .90 | 1.05 | ..... |
| 10 | .82 | .75 | .88 | 26 | .90 | .95 | ..... |
| 11 | .78 | .75 | .83 | 27 | .84 | .98 | ..... |
| 12 | .78 | .73 | .87 | 28 | .86 | .91 | ..... |
| 13 | .85 | .75 | .90 | 29 | .91 | .95 | ..... |
| 14 | 1.20 | 1.00 | .85 | 30 | 1.32 | 1.30 | ..... |
| 15 | .93 | 1.65 | .88 | 31 | 1.05 | ..... | ..... |
| 16 | .86 | 2.50 | .82 | | | | |

| Day. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | |
| 1 | 1.60 | 1.20 | 1.90 | 1.80 | ..... | ..... | ..... | 6.60 | 1.50 | 0.80 |
| 2 | 1.50 | 1.20 | 3.30 | 1.90 | ..... | ..... | ..... | 4.10 | 1.50 | .85 |
| 3 | 1.60 | 1.20 | 6.25 | 1.80 | ..... | ..... | ..... | 3.00 | 1.50 | .90 |
| 4 | 1.60 | 1.20 | ..... | 1.70 | ..... | ..... | ..... | 2.20 | 1.40 | .90 |
| 5 | 1.80 | 1.30 | ..... | 1.70 | ..... | ..... | 2.80 | 1.90 | 1.40 | .80 |
| 6 | 1.90 | 1.30 | ..... | 1.50 | ..... | ..... | 3.90 | 1.60 | 1.20 | .80 |
| 7 | 2.20 | 1.40 | ..... | 1.40 | ..... | ..... | 3.30 | 1.60 | 1.10 | .80 |
| 8 | 2.00 | 1.30 | ..... | 1.40 | ..... | ..... | 3.00 | 1.60 | 1.10 | .80 |
| 9 | 1.80 | 1.20 | ..... | 1.60 | ..... | ..... | 1.80 | 1.60 | 1.10 | .75 |
| 10 | 1.80 | 1.20 | ..... | 1.60 | ..... | ..... | 1.50 | 1.50 | 1.00 | .80 |
| 11 | 1.40 | 1.30 | ..... | 1.60 | ..... | ..... | 2.00 | 1.40 | 1.00 | .80 |
| 12 | 1.60 | 1.25 | 1.20 | 1.60 | ..... | ..... | 3.05 | 1.45 | 1.20 | .80 |

*Daily gage height, in feet, of Roan Creek at Butler, Tenn.*—Continued.

| Day. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | |
| 13 | 1.60 | 1.30 | 1.60 | 1.90 | ..... | ..... | 5.00 | 1.35 | 1.90 | 0.90 |
| 14 | 1.60 | 1.40 | 1.60 | 1.80 | ..... | ..... | 4.50 | 1.30 | 1.70 | .90 |
| 15 | 1.50 | 1.70 | 1.60 | 1.80 | ..... | ..... | 4.00 | 1.30 | 1.40 | .95 |
| 16 | 1.40 | 1.50 | 1.50 | 1.70 | ..... | ..... | 4.00 | 1.30 | 1.40 | .90 |
| 17 | 1.40 | 1.50 | 1.50 | 1.60 | ..... | ..... | 3.40 | 1.60 | 1.20 | .90 |
| 18 | 1.40 | 1.30 | 1.45 | 1.40 | ..... | ..... | 3.00 | 1.50 | 1.10 | .90 |
| 19 | 1.40 | 1.30 | 1.40 | 1.90 | ..... | ..... | 2.60 | 1.30 | 1.10 | .80 |
| 20 | 1.30 | 1.30 | 6.45 | 7.60 | ..... | ..... | 4.45 | 1.30 | 1.10 | .80 |
| 21 | 1.30 | 1.30 | 3.60 | ..... | ..... | ..... | 4.40 | 1.20 | 1.00 | .80 |
| 22 | 1.30 | 1.30 | 3.00 | ..... | ..... | ..... | 3.00 | 1.20 | 1.00 | .80 |
| 23 | 1.30 | 1.40 | 2.80 | ..... | ..... | ..... | 2.60 | 1.15 | 1.00 | 1.00 |
| 24 | 1.40 | 1.30 | 2.50 | ..... | ..... | ..... | 2.50 | 1.10 | 1.00 | ..... |
| 25 | 1.45 | 1.30 | 3.20 | ..... | ..... | ..... | 1.80 | 1.10 | .95 | ..... |
| 26 | 1.30 | 3.35 | 3.30 | ..... | ..... | ..... | 2.20 | 1.00 | .90 | ..... |
| 27 | 1.30 | 3.30 | 2.60 | ..... | ..... | ..... | 2.80 | 1.00 | .80 | ..... |
| 28 | 1.25 | 3.00 | 2.30 | ..... | ..... | ..... | 2.40 | 1.00 | .80 | ..... |
| 29 | ..... | 2.80 | 2.00 | ..... | ..... | ..... | 2.00 | 1.80 | .85 | ..... |
| 30 | ..... | 2.40 | 1.80 | ..... | ..... | ..... | 2.00 | 1.60 | .80 | ..... |
| 31 | ..... | 2.10 | ..... | ..... | ..... | ..... | 2.00 | ..... | .80 | ..... |

*Rating table for Roan Creek at Butler, Tenn., for 1900 and 1901.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.6 | 35 | 2.3 | 720 | 4.0 | 1,995 | 5.7 | 3,270 |
| .7 | 42 | 2.4 | 795 | 4.1 | 2,070 | 5.8 | 3,345 |
| .8 | 50 | 2.5 | 870 | 4.2 | 2,145 | 5.9 | 3,420 |
| .9 | 61 | 2.6 | 945 | 4.3 | 2,220 | 6.0 | 3,495 |
| 1.0 | 73 | 2.7 | 1,020 | 4.4 | 2,295 | 6.1 | 3,570 |
| 1.1 | 87 | 2.8 | 1,095 | 4.5 | 2,370 | 6.2 | 3,645 |
| 1.2 | 102 | 2.9 | 1,170 | 4.6 | 2,445 | 6.3 | 3,720 |
| 1.3 | 120 | 3.0 | 1,245 | 4.7 | 2,520 | 6.4 | 3,795 |
| 1.4 | 143 | 3.1 | 1,320 | 4.8 | 2,595 | 6.5 | 3,870 |
| 1.5 | 170 | 3.2 | 1,395 | 4.9 | 2,670 | 6.6 | 3,945 |
| 1.6 | 210 | 3.3 | 1,470 | 5.0 | 2,745 | 6.7 | 4,020 |
| 1.7 | 270 | 3.4 | 1,545 | 5.1 | 2,820 | 6.8 | 4,095 |
| 1.8 | 345 | 3.5 | 1,620 | 5.2 | 2,895 | 6.9 | 4,170 |
| 1.9 | 420 | 3.6 | 1,695 | 5.3 | 2,970 | 7.0 | 4,245 |
| 2.0 | 495 | 3.7 | 1,770 | 5.4 | 3,045 | | |
| 2.1 | 570 | 3.8 | 1,845 | 5.5 | 3,120 | | |
| 2.2 | 645 | 3.9 | 1,920 | 5.6 | 3,195 | | |

*Estimated monthly discharge of Roan Creek at Butler, Tenn.*

[Drainage area, 164 square miles.]

| Month. | Discharge in second-feet. | | | Total in acre-feet. | Run-off. | |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | | Second-feet per square mile. | Depth in inches. |
| 1900. | | | | | | |
| August [a] | | | 74 | 3,522 | 0.45 | 0.40 |
| September | 870 | 46 | 101 | 6,009 | .677 | .75 |
| October [b] | | | 165 | 7,527 | 1.010 | .86 |
| 1901. | | | | | | |
| February | 645 | 111 | 216 | 11,996 | 1.323 | 1.38 |
| March | 1,507 | 102 | 319 | 19,614 | 1.945 | 2.25 |
| April [c] | | | 957 | 41,760 | 5.835 | 7.62 |
| May [d] | | | 490 | 19,348 | 3.000 | 2.23 |
| August [e] | | | 1,219 | 65,282 | 7.433 | 7.46 |
| September | 3,945 | 73 | 400 | 23,802 | 2.439 | 2.72 |
| October | 420 | 50 | 111 | 6,825 | .677 | .78 |
| November [f] | | | 55 | 2,509 | .335 | .28 |

[a] 24 days.
[b] 23 days.
[c] 22 days.
[d] May 1–20. Does not include May flood, which washed gage away.
[e] 27 days.
[f] November 1–23.

## MISCELLANEOUS MEASUREMENTS IN TENNESSEE RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in the Tennessee drainage basin in 1902 by B. M. Hall and his assistants:

| Date. | Stream. | Locality. | Discharge. |
|---|---|---|---|
| Mar. 11 | Rock Creek | Lula Lake, near Flintstone, Ga., Walker County. | 47 |
| July 12 | Coal Creek | Southern Rwy. bridge, Coal Creek, Tenn. | 6 |
| 24 | Clinch River | 2 miles below Clinton, Tenn. (gage height 3.7 feet). | 1,238 |

## YAZOO RIVER DRAINAGE BASIN.

Yazoo River rises in the northwestern part of Mississippi. It flows south just west of the central portion of the State and enters the Mississippi River just above Vicksburg. The United States Geological Survey is maintaining a station on this river at Yazoo City under the direction of B. M. Hall.

YAZOO RIVER AT YAZOO CITY, MISS.

A gage has been maintained at this point by the Engineer Corps of the Army. It was replaced in 1901 by a new gage rod in three sections, marked with brass figures and brass tacks, the sections being placed as follows: The lowest, marked from −3 to +4.5 feet, is attached to the protecting work of the bridge; the middle section, marked from 4.5 to 18.5 feet, is attached to the piling that protects the bridge pier; the uppermost section, continuing the graduation up to 32.3 feet, is on a post under the approach to the bridge. The highest known water occurred in 1882, reaching a gage height of 36.5 feet; the lowest occurred on October 15 to 17 and 20 to 22, 1896, with a gage height of −2.8 feet. The danger line is at 25 feet. A bench mark was established on the top of the upstream cylinder of the second pier from the left bank, at a distance of 85 feet from the initial point for soundings, which is on the downstream end of iron bridge on the left bank. The elevation of the mark is 35.85 feet above the zero of the gage. Other important bench marks in Yazoo City are the following: P. B. M. 12, Yazoo City, is a copper bolt in stone under ground, surmounted by an iron pipe and cap, in the north corner of the county court-house yard. It is 44.1 feet above the zero of the gage and 116.2 feet above mean sea level. P. B. M. 13, Yazoo City, is a copper bolt in stone under ground, surmounted by an iron pipe and cap, in the north corner of the public school yard, near Washington and Main streets. It is 29.2 feet above the zero of the gage, and 101.3 feet above mean sea level. Discharge measurements are made by the United States Geological Survey from the city toll bridge, one-half mile northwest from the Illinois Central station. The observer is P. C. Battaille. Daily gage heights are furnished by the Weather Bureau.

The following discharge measurements were made during 1902:

July 12: Gage height, 3.40 feet; discharge, 2,887 second-feet.
July 14: Gage height, 4.40 feet; discharge, 3,672 second-feet.
September 24: Gage height, −1.0 foot; discharge, 2,108 second-feet.
September 25: Gage height, −1.0 foot; discharge, 2,048 second-feet.

*Daily gage height, in feet, of Yazoo River at Yazoo City, Miss.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 11.40 | 11.30 | 16.70 | 23.90 | 25.30 | 2.30 | 0.10 | 3.20 | −0.70 | −1.00 | −2.10 | 4.90 |
| 2 | 11.50 | 12.40 | 16.60 | 23.80 | 25.00 | 1.90 | .20 | 3.00 | − .80 | − .90 | −2.10 | 5.30 |
| 3 | 11.40 | 12.80 | 16.60 | 23.80 | 24.70 | 1.80 | .20 | 3.00 | − .50 | − .80 | −2.10 | 5.80 |
| 4 | 11.00 | 13.20 | 16.60 | 23.80 | 24.40 | 1.60 | .00 | 3.20 | − .50 | .00 | −2.10 | 5.90 |
| 5 | 10.90 | 13.40 | 16.90 | 23.80 | 24.10 | 1.50 | .00 | 3.60 | − .50 | .60 | −2.10 | 6.00 |
| 6 | 10.80 | 13.70 | 16.90 | 23.80 | 23.70 | 1.50 | −.10 | 4.00 | − .30 | 1.00 | −2.10 | 6.30 |
| 7 | 10.50 | 13.90 | 16.80 | 25.10 | 23.30 | 1.70 | −.20 | 4.40 | .00 | 1.30 | −2.10 | 6.50 |
| 8 | 10.30 | 14.10 | 16.80 | 25.10 | 22.90 | 2.00 | .00 | 4.50 | .20 | 1.50 | −2.10 | 6.90 |
| 9 | 10.00 | 14.30 | 16.80 | 25.00 | 22.40 | 2.20 | .70 | 4.70 | .30 | 1.50 | −2.10 | 7.00 |
| 10 | 9.70 | 14.60 | 16.70 | 25.00 | 21.80 | 2.40 | 1.50 | 4.70 | .00 | 1.20 | −2.10 | 7.20 |
| 11 | 9.30 | 14.90 | 16.70 | 25.10 | 20.90 | 2.50 | 2.40 | 4.70 | − .20 | .90 | −2.10 | 7.30 |
| 12 | 8.90 | 15.20 | 16.90 | 25.30 | 20.10 | 2.40 | 3.40 | 4.70 | − .50 | .70 | −2.10 | 7.40 |
| 13 | 8.40 | 15.50 | 17.40 | 25.50 | 19.20 | 2.10 | 4.00 | 4.60 | − .70 | .50 | −2.10 | 7.40 |
| 14 | 7.90 | 15.80 | 17.30 | 25.60 | 18.00 | 1.80 | 4.50 | 4.60 | −1.10 | .50 | −2.10 | 7.50 |
| 15 | 7.30 | 16.00 | 17.30 | 25.80 | 16.90 | 1.50 | 4.90 | 4.50 | −1.20 | .50 | −2.10 | 7.50 |
| 16 | 6.50 | 16.30 | 17.90 | 26.00 | 15.50 | 1.20 | 5.00 | 4.50 | −1.30 | .20 | −2.10 | 9.80 |
| 17 | 5.70 | 16.40 | 17.80 | 26.20 | 14.20 | .90 | 5.00 | 4.40 | −1.40 | − .20 | −2.10 | 9.80 |
| 18 | 4.90 | 16.40 | 17.70 | 26.30 | 13.00 | .50 | 4.70 | 4.40 | −1.50 | − .50 | −2.10 | 10.20 |
| 19 | 4.20 | 16.40 | 17.70 | 26.40 | 11.90 | .40 | 4.40 | 4.30 | −1.50 | −1.00 | −2.10 | 10.90 |
| 20 | 3.50 | 16.30 | 17.80 | 26.50 | 10.80 | .30 | 4.00 | 4.20 | −1.50 | −1.20 | −2.10 | 11.50 |
| 21 | 3.20 | 16.20 | 18.00 | 26.60 | 9.70 | .00 | 3.90 | 4.00 | −1.50 | −1.30 | −2.10 | 12.00 |
| 22 | 3.50 | 16.10 | 18.10 | 26.60 | 8.50 | −.10 | 3.50 | 3.80 | −1.50 | −1.50 | −2.10 | 12.70 |
| 23 | 3.00 | 16.00 | 18.10 | 26.50 | 7.70 | −.20 | 3.40 | 3.30 | −1.50 | −1.60 | −2.10 | 13.20 |
| 24 | 3.50 | 16.00 | 19.00 | 26.50 | 6.70 | −.30 | 3.00 | 2.60 | −1.10 | −1.60 | −2.10 | 13.80 |
| 25 | 4.00 | 16.20 | 19.00 | 26.50 | 5.80 | −.40 | 3.00 | 1.90 | −1.10 | −1.70 | −1.10 | 14.30 |
| 26 | 4.70 | 16.10 | 18.90 | 26.40 | 5.00 | −.40 | 2.90 | 1.30 | −1.10 | −1.70 | .20 | 14.80 |
| 27 | 5.40 | 16.20 | 21.00 | 26.20 | 4.40 | −.40 | 2.90 | .50 | −1.00 | −1.70 | .80 | 15.20 |
| 28 | 6.40 | 16.60 | 24.80 | 26.00 | 3.90 | −.40 | 2.90 | −.10 | −1.00 | −1.80 | 1.50 | 15.40 |
| 29 | 7.40 | ..... | 24.80 | 25.80 | 3.30 | −.20 | 2.80 | −.10 | −1.00 | −2.00 | 3.00 | 15.80 |
| 30 | 9.40 | ..... | 24.30 | 25.60 | 3.00 | .00 | 2.70 | −.30 | −1.00 | −2.10 | 4.40 | 16.00 |
| 31 | 10.30 | ..... | 24.00 | ..... | 2.50 | ..... | 2.60 | −.60 | ..... | −2.10 | ..... | 16.20 |

*Rating table for Yazoo River at Yazoo City, Miss., for 1902.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| −2.0 | 1,830 | 1.0 | 2,620 | 4.0 | 3,870 | 11.5 | 10,500 |
| −1.8 | 1,870 | 1.2 | 2,690 | 4.5 | 4,145 | 12.0 | 11,000 |
| −1.6 | 1,915 | 1.4 | 2,760 | 5.0 | 4,440 | 12.5 | 11,500 |
| −1.4 | 1,965 | 1.6 | 2,830 | 5.5 | 4,790 | 13.0 | 12,000 |
| −1.2 | 2,015 | 1.8 | 2,900 | 6.0 | 5,150 | 13.5 | 12,500 |
| −1.0 | 2,065 | 2.0 | 2,970 | 6.5 | 5,550 | 14.0 | 13,000 |
| − .8 | 2,115 | 2.2 | 3,050 | 7.0 | 6,000 | 14.5 | 13,500 |
| − .6 | 2,165 | 2.4 | 3,130 | 7.5 | 6,500 | 15.0 | 14,000 |
| − .4 | 2,215 | 2.6 | 3,210 | 8.0 | 7,000 | 15.5 | 14,500 |
| − .2 | 2,265 | 2.8 | 3,300 | 8.5 | 7,500 | 16.0 | 15,000 |
| .0 | 2,320 | 3.0 | 3,390 | 9.0 | 8,000 | 16.5 | 15,500 |
| .2 | 2,380 | 3.2 | 3,480 | 9.5 | 8,500 | 17.0 | 16,000 |
| .4 | 2,440 | 3.4 | 3,570 | 10.0 | 9,000 | 17.5 | 16,500 |
| .6 | 2,500 | 3.6 | 3,660 | 10.5 | 9,500 | 18.0 | 17,000 |
| .8 | 2,560 | 3.8 | 3,760 | 11.0 | 10,000 | | |

*Estimated monthly discharge of Yazoo River at Yazoo City, Miss.*

[Drainage area, 8,580 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| January | 17,300 | 10,800 | 14,829 | 1.73 | 1.99 |
| February | 17,200 | 15,200 | 16,443 | 1.92 | 2.00 |
| March | 15,600 | 10,800 | 13,377 | 1.56 | 1.80 |
| April | 15,600 | 11,800 | 14,043 | 1.64 | 1.83 |
| May | 15,600 | 8,200 | 13,094 | 1.53 | 1.76 |
| June | 8,000 | 2,350 | 4,478 | .52 | .58 |
| July | 2,440 | 1,965 | 2,181 | .25 | .29 |
| August | 8,100 | 1,965 | 3,805 | .44 | .51 |
| September | 8,100 | 2,620 | 5,456 | .64 | .71 |
| October | 6,400 | 1,965 | 3,327 | .39 | .45 |
| November | 2,500 | 1,870 | 2,046 | .24 | .27 |
| December | 10,600 | 2,115 | 5,978 | .70 | .81 |
| The year | 17,300 | 1,965 | 8,255 | .96 | 13.00 |
| 1902. | | | | | |
| January | 10,500 | 3,390 | 8,493 | 0.99 | 1.14 |
| February | 15,600 | 10,300 | 14,082 | 1.64 | 1.71 |
| March | 23,800 | 15,600 | 17,448 | 2.03 | 2.34 |
| April | 25,600 | 22,800 | 24,477 | 2.85 | 3.18 |
| May | 24,300 | 3,170 | 14,004 | 1.63 | 1.88 |
| June | 3,170 | 2,215 | 2,651 | .31 | .35 |
| July | 4,440 | 2,265 | 3,281 | .38 | .44 |
| August | 4,260 | 2,165 | 3,578 | .42 | .48 |
| September | 2,410 | 1,940 | 2,104 | .25 | .28 |
| October | 2,795 | 1,810 | 2,223 | .26 | .30 |
| November | 4,090 | 1,810 | 2,023 | .24 | .27 |
| December | 15,200 | 4,380 | 9,065 | 1.06 | 1.22 |
| The year | 25,600 | 1,810 | 8,619 | 1.00 | 13.59 |

## GREAT LAKES DRAINAGE BASIN.

Owing to the irregularity in the general outline of the Great Lakes, the drainage areas in this section have not been arranged in regular geographical order. The general plan of arrangement is from east to west, although the report is properly divided by States, viz, Ohio, Michigan, and Wisconsin.

### MAUMEE RIVER DRAINAGE BASIN.

Maumee River is formed by the junction of St. Joseph and St. Marys rivers near Fort Wayne, Ind., and flows in a northeasterly direction through Ohio, emptying into Lake Erie at Toledo. The southern part of the basin is flat, the northern part gently rolling and hilly in places. Formerly the hilly section was covered with timber; but all the best has been cut, leaving a section of scrub timber, with occassional farms cleared and cultivated. At the station the bed of the stream is rocky and the current sluggish, the fall being only 1.1 feet per mile on an average. Two dams have been built on the Maumee—one at Defiance, to supply water for the Ohio State canals, and one at Grand Rapids, for furnishing water power. Blanchard and Ottawa rivers unite a short distance below Ottawa and form Auglaize River, which empties into the Maumee at Defiance, Ohio. The following gaging stations were maintained in this drainage basin during 1902 by the United States Geological Survey, under the direction of Benjamin H. Flynn; on the Maumee River at Waterville; on Blanchard River at Ottawa; on Ottawa River at Lima.

The data collected at these stations during 1902 are given on the following pages.

#### MAUMEE RIVER AT WATERVILLE, OHIO.

A station was established on this river by H. A. Pressey and B. H. Flynn, November 19, 1898. It is located at the highway bridge near Waterville, the gagings being made on the downstream side of the bridge. Zero of gage is on the left bank, marked by a nail in the guard rail. The wire gage is referred to a bench mark cut in the upstream side of the abutment on the left bank of the river. The elevation is 25.2 feet above gage datum. This is the lowest place on the river at which gagings can be made without being affected by backwater from the lake. The observer is J. E. Harper, station agent at Waterville, Ohio. No measurements were made at this station during 1902, and gage heights were taken only for a part of January.

BLANCHARD RIVER AT OTTAWA, OHIO.

This station was established November 22, 1902, by Benjamin H. Flynn. It is located at the Cincinnati, Hamilton and Dayton Railroad bridge in the town of Ottawa, Ohio. The upper portion of the gage is inclined and graduated, so as to read directly to feet and tenths. The lower portion of the gage is vertical and graduated to feet and tenths. It is spiked to a stake driven into the ground. The initial point of sounding is on the right bank of the river. The river is straight for 200 feet above and 500 feet below the station. The right bank is high and does not overflow. The left bank is low but seldom overflows, as the water is confined by the railroad. The bed of the stream is firm gravel, with mud along the banks. The current is sluggish. The bench mark is the upper of two parallel marks cut in the east end of the south main pier of the bridge; elevation, 14.0 feet above the zero of the gage. The observer is C. W. Ewing, who reads the gage twice daily.

The following discharge measurements were made during 1902:

November 22: Gage height, 2.65 feet; discharge, 332 second-feet.
December 23: Gage height, 9.80 feet; discharge, 1,845 second-feet.

*Daily gage height, in feet, of Blanchard River at Ottawa, Ohio.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | 2.93 | 12 | | 3.12 | 23 | 1.20 | 9.72 |
| 2 | | 2.88 | 13 | | 4.90 | 24 | .85 | 7.68 |
| 3 | | 4.85 | 14 | | 4.70 | 25 | .78 | 5.25 |
| 4 | | 7.68 | 15 | | 4.38 | 26 | .45 | 3.10 |
| 5 | | 7.60 | 16 | | 7.85 | 27 | .42 | 2.38 |
| 6 | | 5.90 | 17 | | 11.82 | 28 | .45 | 2.60 |
| 7 | | 3.25 | 18 | | 9.72 | 29 | .55 | 2.60 |
| 8 | | 2.65 | 19 | | 7.50 | 30 | 2.10 | 2.50 |
| 9 | | 2.80 | 20 | | 6.05 | 31 | | 2.50 |
| 10 | | 2.80 | 21 | | 8.65 | | | |
| 11 | | 2.80 | 22 | 2.65 | 10.60 | | | |

OTTAWA RIVER NEAR LIMA, OHIO.

This station was established November 21, 1902, by Benjamin H. Flynn. It is located on the highway bridge, 2½ miles east of Lima, Ohio. The gage is a plain staff graduated to feet and tenths. It is spiked to the face of the abutment, and is read daily by Edward King. Discharge measurements are made by wading. The channel is straight for about 250 feet above and 500 feet below the station. The banks are both high, and overflow only in times of extreme floods. The bed of the stream is rocky. The bench mark is a cut in the downstream face of the left abutment; elevation, 8.0 feet above the zero of the gage.

During 1902 the following discharge measurements were made:

November 21: Gage height, 2.65 feet; discharge, 56 second-feet.
December 22: Gage height, 3.60 feet; discharge, 320 second-feet.

*Daily gage height, in feet, of Ottawa River at Lima, Ohio.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | 2.65 | 12 | | 2.90 | 23 | 2.50 | 3.45 |
| 2 | | 2.55 | 13 | | 3.00 | 24 | 2.45 | 3.50 |
| 3 | | 3.60 | 14 | | 2.90 | 25 | 2.40 | 3.30 |
| 4 | | 3.40 | 15 | | 3.50 | 26 | 2.35 | 3.15 |
| 5 | | 3.05 | 16 | | 4.60 | 27 | 2.35 | 2.95 |
| 6 | | 2.75 | 17 | | 4.10 | 28 | 2.30 | 2.85 |
| 7 | | 2.70 | 18 | | 3.80 | 29 | 2.35 | 2.75 |
| 8 | | 2.60 | 19 | | 3.30 | 30 | 2.60 | 2.75 |
| 9 | | 2.55 | 20 | | 3.00 | 31 | | 2.75 |
| 10 | | 2.55 | 21 | 2.65 | 3.00 | | | |
| 11 | | 2.70 | 22 | 2.60 | 3.60 | | | |

## HYDROGRAPHIC FEATURES OF MICHIGAN.

With the exception of a small area in the region of the Lac Vieux Desert, on the Wisconsin-Michigan boundary, the entire drainage of the State of Michigan is tributary to the Great Lakes system. The State contains slightly over one-third of the aggregate drainage tributary to the Lakes north of Lake Erie. The climate of both peninsulas, surrounded as they are by these great water bodies, is undoubtedly tempered and modified by the influence of the Great Lakes, which produces certain insular characteristics.

*Land and water surface of Michigan in the several Great Lake basins, in square miles.*[a]

| Lake. | Total land drained. | Land in Michigan. | Total water area. | Water in Michigan. |
|---|---|---|---|---|
| Superior | 48,600 | 7,860 | 31,800 | 16,653 |
| Michigan | 45,700 | 28,500 | 22,400 | 12,922 |
| Huron | 52,100 | 16,700 | 23,200 | 9,925 |
| St. Clair | 6,320 | 2,160 | 495 | 460 |
| Erie | 24,480 | 2,290 | 10,000 | |

[a] U. S. Deep Waterways Commission, 1896, and U. S. Land Survey, 1900.

The streams of the State are of commercial importance for purposes of agriculture, public water supply, water power, lumbering, and navigation. The natural drainage has been, however, generally unfavorable to agriculture, the enormous natural marsh and swamp areas rendering much of the best land unfit for cultivation in its natural state. Out of the total of 57,530 square miles of land surface there

were, in 1901, 15,422 square miles of improved farm lands; that is, an average throughout the State of 26 per cent of the total area was under cultivation. In the southern four tiers of counties of the Lower Peninsula the percentage of the total area now tillable is very much greater, the ratio gradually decreasing to the north of Saginaw Bay and becoming almost nil for a large portion of the Upper Peninsula. In the southern four tiers of counties a large portion of the land now under cultivation lies in basins which have been artificially drained. This drainage comprises: (1) The cutting of artificial channels to draw off the surplus ground waters into the streams; (2) dredging, cleaning, and removing beaver dams and other obstructions from natural stream tributaries and water courses, thereby lowering their water level and with this the water horizon in the adjoining land.

The flat topography, the original forest-covered condition, and the sluggish character of the streams have all been conducive to the silting up of channels and their obstruction by logs and drift, and they have also rendered easy the flooding of large tracts and the formation of beaver meadows before settlement began. Hundreds of miles of drainage channels have been cut or cleared in many of the southern counties within the past fifty years. The result has been an extremely important change in the hydrography of the State. The effect of thus drawing off more rapidly the surface waters and surplus ground water has undoubtedly been to increase the maximum and to decrease the minimum flow. Whether or not a gradual decrease in the total annual yield of the streams has taken place can not be stated. It is possible that the total run-off of many basins has actually increased, because of the smaller water surface exposed to evaporation and the greater facility with which the water reaches the streams. The value of the streams for water power has probably been greatly diminished.

The settlers of this region were largely from the Eastern States. Comparing these streams with those of the northeastern Appalachian region, it is observed that they are relatively constant in flow, in spite of the detrimental influence of drainage. The streams are comparatively few and yield small annual run-off, on account of the relatively low rainfall and the high evaporation induced by the flat, sandy soil and the cultural conditions. Storage reservoirs in the Lower Peninsula are, with few exceptions, unfeasible.

The interests of agriculture and navigation have always been considered paramount to those of water power. No mill acts have been passed and no legislative efforts have been made to encourage the utilization of the power of the streams[a]. Inland rivers are to-day of little importance to navigation. A lock system on St. Joseph River was abandoned many years ago. Saginaw, Kalamazoo, Muskegon,

[a] A law passed in 1887 granting to waterpower companies the power of eminent domain, enabling them to condemn land for flowage, has been declared unconstitutional by the Supreme Court.

Manistee, and Thunder Bay rivers, Grand River below Grand Rapids, and other rivers are utilized as harbors and for navigation near their outlets. Cheboygan River and a system of lakes, extending nearly across the northwestern Lower Peninsula from Cheboygan to Petoskey, form a navigation route still extensively utilized, about 20.000 passengers being carried during the summer season each year.

Probably the most important use made of the streams has been in connection with lumbering operations. The following table shows the extent of log rafting on a few of the more important rivers:

*Amount of timber floated on Michigan streams.*

| Stream. | Average number of feet of logs now scaled per year.[a] |
|---|---|
| Manistee River | 75,000,000 |
| Cheboygan River | 35,000,000 |
| Menominee River | 250,000,000 |
| Escanaba River | 55,000,000 |
| Au Sable River | [b]55,000,000 |
| Manistique River | 60,000,000 |

[a] Amount ten to twenty years ago much greater. Amount now rapidly decreasing in most cases.
[b] Includes logs brought by rail.

For purposes of water supply the streams are of less importance than in many States. Their fall is, as a rule, so slight that gravity supplies can not be obtained. Owing to the superficial topography of the Pleistocene deposits, the great depth of drift, and the topography of the rock horizons underneath, excellent and abundant artesian water can be obtained in most sections of the State, and especially in the lake coast region, where the larger towns are located. The Great Lakes themselves also afford water of suitable quality for public use when required.

*Public water supply systems in Michigan.*[a]

| Source. | Number. | System. | Number. |
|---|---|---|---|
| Artesian and shallow wells | 80 | Pumping | 155 |
| Streams, rivers | 42 | Gravity | 4 |
| Great Lakes | 31 | Total | 159 |
| Springs | 6 | | |

[a] Manual of American Waterworks, M. N. Baker, 1897.

In behalf of navigation a statute has been enacted and embodied in the State highway laws requiring a franchise to be obtained from the

county board of supervisors before the erection of a dam can be undertaken on any public stream. Inquiries have been received from those interested in water-power projects as to the proper method of procedure. A copy of the law is given below:

LAW OF DAM CONSTRUCTION ON MICHIGAN STREAMS.[a]

§ 2495. Sec. 22. Whenever any person or persons or any incorporation shall wish to construct a dam across any such stream as is mentioned in the preceding section, such person or persons or incorporation shall present to the board of supervisors, or file with their clerk, to be presented to them at their next meeting, a petition praying for leave to construct such dam, and setting forth the purpose, location, height, and description of such dam, and whether it is proposed to construct a lock or chute or apron, and of what description, for the passage of boats, vessels, rafts, or timber; and before the same shall be heard and determined by such board it shall be made to appear to the board that notice of such application, signed by the petitioners, and stating substantially the contents of such petition, has been published in some newspaper printed in each county through which such streams run, if there be a newspaper published in such county, and also in one newspaper, at least three weeks previous to the hearing of such application, published in the city of Detroit; and on such hearing any person or persons shall be heard in favor of and in opposition to the prayer of the petition; and such board may adjourn such hearing to any other time or place, and they may grant or refuse the prayer of such petition. And the determination shall be entered at length upon the record of said board. And if such board shall allow the said dam to be constructed, the petitioner shall be at liberty to construct the same by complying fully with the terms and conditions set forth in their petition; and after having obtained such right and constructed such dam, such petitioners, their heirs, successors, or assigns, may, if such dam be destroyed or decayed, construct a new dam, subject to all the same terms and conditions, on the same site, without again applying to such board: *Provided*, That nothing in this act contained shall be construed as giving to such board of supervisors any power to grant the right to any person or persons or corporation to flow or in any manner to take or injure the lands of any person or persons by or in consequence of constructing such dam.

The petition under this section must set forth in detail the whole plan of the proposed dam and the capacity and character of any chute or passage to be constructed therein; so that by means of the notice all persons interested may be informed, in advance of the hearing, of the precise nature of the project, and be enabled to judge of the nature and extent of the obstruction. Nor can the resolution of the board supply details and facts required to be set forth in the petition as a basis for their power to act. (Powers *v.* Irish, 23 Mich., 429.)

[a] From Laws and Supreme Court Decisions Relating to Highways and Bridges, published by secretary of state of Michigan, 1900, p. 157.

WATER POWER IN USE IN MICHIGAN, 1900.

The water power has been most extensively used for flour milling and lumbering purposes. The total horsepower of water wheels installed, as reported by the United States Census of 1900, is given below:

*Water power in use in Michigan, 1900.*

| Industry. | Horsepower. | Industry | Horsepower. |
|---|---|---|---|
| Brick and tile | 20 | Paper | 11,627 |
| Hosiery and knit goods | 257 | Silk and silk goods | 200 |
| Chemicals | 1,000 | Agricultural implements | 152 |
| Explosives | 150 | Shipbuilding | 65 |
| Lumber and sawmill and lumber products | 6,746 | Iron and steel | 150 |
| Flour and grist mills | 19,866 | Printing and publishing | 52 |
| Carriages and wagons | 60 | Total | 40,345 |

Lake Superior affords a most valuable water power resource at Sault Ste. Marie.

HYDROGRAPHIC FEATURES OF THE UPPER PENINSULA.

The hydrography of the Upper Peninsula differs from that of the Lower Peninsula in the greater extent of forest and untilled lands, the absence of artificial drainage, the precipitous watersheds with a large per cent of rock outcrop, and the rapid fall of the streams. Little water power has been developed. Since the advent of successful electric transmission, attention has been devoted to the utilization of the natural power resources for general mining purposes and for air compression for mine supply. Use has been made of many streams to supply the launders of copper stamp mills. One of these mills often requires as much water for ore washing and transport as would be needed for the municipal supply of a large city.

DEAD RIVER DRAINAGE BASIN.

Dead River lies in Marquette County, Upper Peninsula, Michigan, and flows into Lake Superior. The drainage basin is rugged, precipitous, and for the most part timber covered. The soil is sandy and is underlain with rock, which forms the bed of the stream throughout its lower course. The only storage reservoir of importance is Silver Lake, with an area of 1,600 acres, and capable of draft to a depth of 10 feet. This and one other lumbermans' dam on the stream are controlled by the South Arm Lumber Company. The lower basin is narrow. The greater portion of the drainage area lies above The Hoist,

about 14 miles from the mouth of the river. The fall in the lower reaches of the stream is very rapid. The aggregate descent is stated to be 850 feet in a distance of 10 miles. The most notable pitches, beginning at the mouth of the stream, are as follows:

Lake Superior Powder Company, near Marquette, about 20 feet fall.

The Valley Flour Mill, 18 feet fall, 4 miles from mouth.

Marquette electric-light plant utilizes 85 feet fall, but has a total fall of 112 feet, 6 feet fall above the present dam and 18 feet below the tailrace remaining undeveloped; rated capacity of turbines, 1,000 horsepower. The electric current generated is transmitted to Marquette, a city of 10,000 population, situated on the shore of Lake Superior, 6 miles distant.

From 2 to 5 miles above Forestville are rapids aggregating two available falls of 100 feet each, owned by J. M. Longyear, of Marquette.

At The Hoist, about 8 miles north from Negaunee and Ishpeming, is a fall of 110 feet, owned by the Oliver Iron Mining Company.

The drainage area has been estimated from a map of the Cleveland-Cliffs Iron Company, as follows:

*Drainage areas, Dead River.*

| Location. | Square miles. | Increment. |
|---|---|---|
| Above The Hoist | 126.3 | ..... |
| Above Forestville | 141.9 | 15.6 |
| Above mouth | 165.5 | 23.6 |

The mean annual precipitation in the vicinity of Marquette is stated to be 32 inches.

Dead River is not a large stream, but owing to its great fall, its well-sustained flow, and its location near important mining centers, it attains unusual economic importance.

### DEAD RIVER AT THE HOIST, NEAR NEGAUNEE, MICH.

July 10, 1902, a gaging record was started at The Hoist under the direction of Frank Drake, chief engineer of the Oliver Iron Mining Company, Duluth, Minn. A suitable cross section was selected and a cableway of 91 feet span was erected across the stream about 700 feet south of the lumbermen's dam. The gaging station is located in the northeast portion of T. 48 N., R. 27 W. The stage of the stream is observed daily and current-meter discharge measurements are made from time to time. The hydrographic work has been done by C. G. Mason, E. M., acting in cooperation with the United States Geological Survey. The bed of the stream is rock and the velocity of the current relatively high. These features, together with the location just below a dam, tend to keep the gaging section open during winter.

*Discharge measurements of Dead River at The Hoist, near Negaunee, Mich.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| July 11 | C. G. Mason | 10.70 | 140 |
| July 20 | do | 10.60 | 105 |
| September 26 | do | 10.60 | 105 |
| October 2 | do | 10.55 | 88 |
| October 6 | do | 10.50 | 86 |
| October 31 | Savicki and Mason | 10.80 | 176 |
| November 20 | C. G. Mason | 11.05 | 234 |

*Daily gage height, in feet, of Dead River at The Hoist, near Negaunee, Mich.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|
| 1902. | | | | | | |
| 1 | ..... | 10.60 | 10.70 | 10.55 | 10.80 | 10.60 |
| 2 | ..... | 10.60 | 10.70 | 10.55 | 10.85 | 10.55 |
| 3 | ..... | 10.60 | 10.75 | 10.55 | 10.95 | 10.90 |
| 4 | ..... | 10.60 | 10.80 | 10.55 | 10.80 | 10.80 |
| 5 | ..... | 10.65 | 10.75 | 10.50 | 10.80 | 10.75 |
| 6 | ..... | 10.65 | 10.75 | 10.50 | 10.75 | 10.80 |
| 7 | ..... | 10.60 | 10.70 | 10.50 | 10.70 | 10.85 |
| 8 | ..... | 10.55 | 10.70 | 10.55 | 10.65 | 10.70 |
| 9 | ..... | 10.60 | 10.70 | 10.55 | 10.70 | 10.65 |
| 10 | 10.75 | 10.55 | 10.65 | 10.55 | 10.65 | 10.60 |
| 11 | 10.70 | 10.55 | 10.65 | 10.55 | 10.65 | 10.60 |
| 12 | 10.65 | 10.55 | 10.65 | 10.60 | 11.20 | 10.55 |
| 13 | 10.65 | 10.55 | 10.65 | 10.65 | 11.25 | 10.55 |
| 14 | 10.60 | 10.55 | 10.60 | 10.70 | 11.55 | 10.50 |
| 15 | 10.60 | 10.55 | 10.60 | 10.80 | 11.05 | 10.50 |
| 16 | 10.60 | 10.55 | 10.60 | 10.70 | 10.80 | 10.55 |
| 17 | 10.65 | 10.60 | 10.65 | 10.55 | 11.05 | 10.55 |
| 18 | 10.60 | 10.60 | 10.65 | 10.60 | 10.85 | 10.50 |
| 19 | 10.55 | 10.75 | 10.60 | 10.55 | 10.85 | 10.50 |
| 20 | 10.60 | 10.75 | 10.60 | 10.55 | 11.05 | 10.50 |
| 21 | 10.60 | 10.70 | 10.65 | 10.60 | 10.70 | 10.45 |
| 22 | 10.60 | 10.70 | 10.65 | 10.75 | 10.70 | 10.45 |
| 23 | 10.60 | 10.65 | 10.70 | 10.85 | 10.75 | 10.50 |
| 24 | 10.65 | 10.65 | 10.60 | 11.40 | 10.70 | 10.80 |
| 25 | 10.65 | 10.65 | 10.60 | 11.45 | 10.65 | 10.90 |
| 26 | 10.75 | 10.60 | 10.60 | 11.40 | 10.60 | 10.70 |
| 27 | 10.70 | 10.60 | 10.60 | 11.10 | 10.60 | 10.65 |
| 28 | 10.65 | 10.60 | 10.55 | 11.05 | 10.60 | 10.50 |
| 29 | 10.60 | 10.65 | 10.55 | 10.90 | 10.55 | 10.50 |
| 30 | 10.60 | 10.65 | 10.55 | 10.80 | 10.60 | 10.45 |
| 31 | 10.60 | 10.75 | ..... | 10.80 | ..... | 10.45 |

## CARP RIVER DRAINAGE BASIN.

Carp River, situated in Marquette County, Upper Peninsula, Michigan, drains a diversified area of sand and rock, mostly wooded, and with little cultivated land. The percentage of swamp area is probably

less than for most streams of this locality. There are, however, a number of lakes in the region of the headwaters, aggregating perhaps 3 square miles of water surface. From Teal Lake is pumped the water supply of Negaunee, the stated average consumption being 1.25 second-feet per day. From Lake Sally is drawn by gravity the supply of Ishpeming, the average daily consumption being stated at 1.4 second-feet.

The stream enters Lake Superior at Carp River furnace, 1 mile south of Marquette. A series of rapids occurs in the stream a short distance above its mouth, where a large fall can be developed.

### CARP RIVER NEAR MARQUETTE, MICH.

A weir was erected 500 feet above the mouth of the stream by the Cleveland-Cliffs Iron Company, and the daily gage record was started July 5, 1902. The gage readings have been furnished by Noah Gray, superintendent of the furnace. The weir has a level crest 10.04 feet in length, with two end contractions. The water flows over a sharp edge or crest lip, but falls on a nearly horizontal apron at a slightly lower level on the downstream side. In order to calculate the discharge of the nappe as modified by the apron, the weir formula of Bazin, using coefficients from experiment series No. 142, has been used. During high stages of the stream, the water also flows over the flashboards forming the wings of the weir. The gage is attached vertically to a framework 16 feet upstream, and the same distance to the left of the weir crest.

The following discharge measurements were made at the highway bridge at the mouth of the stream:

*Discharge measurements of Carp River near Marquette, Mich.*

| Date. | Gage height. | Discharge by current meter. | Calculated discharge over weir. |
|---|---|---|---|
| 1902. | *Feet.* | *Second-feet.* | *Second-feet.* |
| September 8 | 1.59 | 68.0 | 68.1 |
| October 30 | 1.71 | 78.9 | 75.7 |

The gage datum is referred to the east rail of the Duluth, South Shore and Atlantic Railroad at the tramroad crossing.

| | Feet. |
|---|---|
| Elevation of bench mark | 100.00 |
| Crest of weir | 96.28 |
| Zero of gage | 96.28 |

The drainage area above Eagle Mills is 60 square miles; above the mouth, at Marquette, it is 86 square miles.

*Mean daily discharge, in second-feet, of Carp River at Marquette, Mich.*

[Drainage area, 86 square miles.]

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|
| 1902. | | | | | | |
| 1 | ..... | 47 | 52 | 38 | 61 | 56 |
| 2 | ..... | 47 | 50 | 38 | 61 | 54 |
| 3 | ..... | 42 | 50 | 39 | 61 | 52 |
| 4 | ..... | 40 | 52 | 39 | 61 | 52 |
| 5 | ..... | 38 | 56 | 38 | 59 | 50 |
| 6 | 132 | 39 | 66 | 38 | 56 | 47 |
| 7 | 160 | 39 | 71 | 39 | 52 | 47 |
| 8 | 173 | 38 | 61 | 38 | 52 | 45 |
| 9 | 173 | 38 | 60 | 36 | 47 | 44 |
| 10 | 160 | 37 | 56 | 35 | 52 | 42 |
| 11 | 107 | 36 | 52 | 34 | 71 | 42 |
| 12 | 80 | 34 | 47 | 34 | 104 | 41 |
| 13 | 59 | 34 | 42 | 44 | 218 | 41 |
| 14 | 54 | 34 | 40 | 54 | 178 | 41 |
| 15 | 52 | 34 | 40 | 47 | 169 | 41 |
| 16 | 50 | 34 | 40 | 47 | 178 | 41 |
| 17 | 47 | 34 | 38 | 52 | 178 | 40 |
| 18 | 47 | 34 | 38 | 53 | 173 | 40 |
| 19 | 42 | 51 | 38 | 54 | 173 | 40 |
| 20 | 42 | 47 | 38 | 50 | 169 | 38 |
| 21 | 40 | 47 | 38 | 51 | 151 | (a) |
| 22 | 39 | 45 | 38 | 50 | 143 | ..... |
| 23 | 38 | 42 | 39 | 52 | 135 | ..... |
| 24 | 47 | 40 | 38 | 79 | 110 | ..... |
| 25 | 82 | 38 | 38 | 82 | 87 | ..... |
| 26 | 80 | 34 | 38 | 79 | 77 | ..... |
| 27 | 69 | 34 | 38 | 78 | 71 | ..... |
| 28 | 61 | 32 | 37 | 77 | 71 | ..... |
| 29 | 54 | 30 | 37 | 75 | 66 | ..... |
| 30 | 54 | 32 | 37 | 69 | 61 | ..... |
| 31 | 49 | 47 | ..... | ..... | ..... | ..... |
| Mean | 76 | 39 | 45 | 51 | 105 | 45 |

(a) No record December 21 to 31.

*Estimated monthly discharge of Carp River at Marquette, Mich.*

[Drainage area, 86 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1902. | | | | | |
| July | 173 | 38 | 76 | 0.89 | 1.03 |
| August | 51 | 30 | 39 | .46 | .53 |
| September | 71 | 37 | 45 | .53 | .59 |
| October | 82 | 34 | 51 | .60 | .69 |
| November | 218 | 47 | 105 | 1.23 | 1.37 |
| December | 56 | 38 | 45 | .53 | .61 |

## MENOMINEE RIVER DRAINAGE BASIN.

Menominee River forms the dividing line between Wisconsin and the Upper Peninsula of Michigan. It is formed by the junction of Brule River and Michigamme River in T. 41 N., R. 30 W. It flows thence in a general southeasterly direction, entering Lake Michigan in Green Bay at Marinette. Its total drainage area is approximately 4,000 square miles, of which 1,450 square miles lie in Wisconsin and 2,250 square miles in Michigan.

The headwaters of Brule River are in a region in northern Wisconsin interspersed with almost innumerable small lakes; but few of these are tributary to the Menominee River. The larger portion of the drainage comes from an elevated plateau, extending from the headwaters of Michigamme River, at an elevation of about 1,750 feet and at a distance of 12 miles from Keweenaw Bay, Lake Superior. This upland slopes gradually to the southeast. The river is, however, frequently interrupted in its southeasterly course by encountering barriers of rock strata, along which it flows, either to the north or to the south, until an outlet is reached. In its upper reaches the river flows over metamorphic base rock of granite, gneiss, and schist. Below the mouth of Pike River it crosses Potsdam sandstone for about 10 miles and thence flows across magnesian and Trenton limestone for about 28 miles to its mouth.

The main tributaries, beginning at the head, are Bois Brule or Burnt Woods River, called by the Indians the Wisacode, which in turn receives the Iron and the Paint or Mequacumecum River. Iron River is elsewhere described in connection with gagings of that stream. Paint River is formed by the junction of Net and Hemlock rivers at an elevation of 1,400 feet, and has a fall of about 7 feet per mile in its lower course. The basin of this stream, like that of the adjoining Michigamme River, contains a large percentage of swamp area. The topography is rough, though not mountainous. There are numerous small lakes and undrained hollows. Water power is developed at Crystal Falls for municipal lighting purposes, a fall of 18 feet being utilized to drive turbines of 350-horsepower capacity.

Michigamme River, the next large tributary from the Michigan side, has a total fall of about 500 feet. The region about its headwaters contains numerous lake areas. The largest of these is Lake Michigamme, which receives drainage from a tributary area of 140 square miles, and has a water surface of 6.5 square miles. In sec. 9, T. 41 N., R. 31 W., occurs a precipitous fall. Other tributaries from the north are Sturgeon and Little Cedar rivers. The main tributaries from Wisconsin are Pine, Pemebonwon, Pike, and Wausaukee rivers. The drainage basin is largely timber covered. Pine and spruce predominate, though hard woods are also found. The average annual precipitation over the drainage area is stated to be 35 inches. Owing

to the rapid fall of the streams, sites for extensive storage reservoirs are rare. The river makes a total descent, from its nominal head at the junction of Brule and Michigamme rivers to its mouth, of about 700 feet. This fall is chiefly concentrated in numerous rapids, usually in pairs, the more important of which are described below. The fall which could be obtained by the construction of dams will usually be greater than the natural descent, as stated. In some cases, a considerable length of rapids could thus be concentrated into a single head. Between the nominal head of the river and the entrance of Pine River, a distance of 14 miles, the drainage area increases from 1,796 to 1,833 square miles. In this region occur the Bad Water Rapids, Twin Falls, and Pine River Falls. Bad Water Rapids, 7 miles below the head of the river, give a direct descent of 5 feet over a granite or schist ledge, the stream being 100 feet wide. This fall is situated 3 miles upstream from the Chicago and Northwestern Railroad. Twin Falls, 3 to 4 miles farther downstream, consist of two drops of 12 feet each, located in sec. 12, T. 40 N., R. 31 W., Michigan, near the Chicago and Northwestern Railroad, at an elevation of 1,100 feet above tide. Pine River Falls comprise a series of rapids, both above and below the mouth of Pine River, of possibly 20 feet total fall.

In the stretch of 18 miles from a point just below Pine River to the influx of Sturgeon River, the drainage area increases from 2,419 to 2,538 square miles. The total fall is about 225 feet. This section includes Upper or Big Quinnesec Falls, Lower or Little Quinnesec Falls, and Sand Portage Rapids. Both Upper and Lower Quinnesec Falls are developed. The Upper or Big Quinnesec Falls, with a head of 40 feet, affords power to compress air for the supply of mines at Iron Mountain, 2 miles distant. The river at the falls is 1,000 feet above tide, and passes over a greenstone ledge in a very narrow gorge, broadening out below and forming a stretch of slack water, with a fall of but 1.25 feet in 4 miles to Little Quinnesec Falls. Big Quinnesec Falls are in sec. 6, T. 38 N., R. 20 E., Wisconsin.

Little Quinnesec Falls, situated in sec. 15, T. 39 N., R. 30 W., Michigan, formerly partially developed under 25 feet head for wood pulp grinding, were redeveloped in 1898 by the Kimberly & Clark Company, for wood pulp and paper manufacturing. A head of 64 feet is obtained, and turbines of 5,800 horsepower have been installed.

Sand Portage Rapids afford a total fall of 30 to 40 feet, extending over sand shoals of 6 miles, but mainly concentrated in a narrow section in T. 39 N., R. 30 W., Michigan.

From below the mouth of Sturgeon River to a point just below Pemebonwon River, a distance of 10 miles, the drainage area increases from 2,934 square miles to 2,993 square miles. In this stretch occur Sturgeon Falls, one-half mile below the mouth of Sturgeon River, in sec. 22, T. 38 N., R. 21 E., Wisconsin. They have high rock ledge banks, with two pitches aggregating perhaps 12 feet fall.

From below Pemebonwon River to a point just below Pike River, a distance of 18 miles, the drainage area increases from 3,156 square miles to 3,279 square miles. The Pemena, Chalk Hill, and White rapids occur in this region. Pemena Falls, in sec. 21, T. 37 N., R. 28 E., Wisconsin, about one-half mile below Pemebonwon, are stated to afford a total fall of 60 feet in a distance of 2 miles, with one precipitous descent of 10 feet over metamorphic slaty schist. Eight miles farther downstream are Chalk Hill Rapids, stated to afford 8 feet fall in one-fourth mile, over slate rock. Four miles above Pike River occur White Rapids, affording a descent of about 20 feet in 3 miles, over gravel and bowlders.

From below the inflow of Pike River to a point just below Little Cedar River, a distance of 22 miles, the drainage increases from 3,566 to 3,792 square miles. Opposite the mouth of Little Cedar River Grand Rapids are formed by a descent over a hard Trenton limestone, underlain by softer strata. They have a total fall stated at 25 feet in a length of 3 miles.

From below Little Cedar River to the mouth of the stream, 22 miles, the drainage increases from 3,941 to 4,113 square miles. This section contains Twin Island Rapids, 16 miles above the mouth of the river, stated to afford 10 feet fall in three-fourths mile, formerly utilized by a sawmill. In crossing the Trenton limestone between Twin Islands and the mouth the river forms a series of rapids. The uppermost, Chappees Rift, has an undeveloped fall of about 10 feet. Of the remaining fall in the stream, 19 feet are taken up by three dams of the M. and M. Paper Company and the Menominee River Boom Company, the uppermost situated 1 mile above Marinette. The three have heads available, beginning at the uppermost, of 7, 5, and 7 feet, respectively. The power is utilized for lumber and paper manufacture.[a]

The following table gives the drainage area of Menominee River at various points. The drainage areas of Brule, Paint, Michigamme, and Sturgeon rivers are given separately. The figures from James L. Greenleaf's report, cited above, have been used in part.

*Menominee River drainage areas.*

| | Square miles. | Increment. |
|---|---|---|
| BRULE RIVER. | | |
| Brule River above Iron River | 170 | |
| Iron River above mouth | 94.7 | |
| Brule River, including Iron River | 264.7 | |
| Brule River above Paint River | 305 | 40.3 |

[a] The above description of Menominee River Rapids is largely from data furnished by G. W. Hanley, of the Menominee River Boom Company, and from the report of James L. Greenleaf, C. E., on Water Power of the Northwest, Tenth United States Census, vol. 17, pp. 69–81.

*Menominee River drainage areas*—Continued.

| | Square miles. | Increment. |
|---|---|---|
| PAINT RIVER. | | |
| Net River above West Branch Paint River | 234.4 | ..... |
| West Branch Paint River above Net River | 287.9 | ..... |
| West Branch Paint River and Net River at junction | 522.3 | ..... |
| Paint River, including Hemlock River | 560.4 | 38.1 |
| Paint River at Crystal Falls | 678.5 | 118.1 |
| Paint River at mouth | 738.5 | 60 |
| Brule River at junction with Michigamme River | 1,044 | ..... |
| MICHIGAMME RIVER. | | |
| Michigamme River above outlet of Lake Michigamme | 234.1 | ..... |
| Michigamme River above Mitchikan River | 374.7 | 140.6 |
| Mitchikan River | 179.1 | ..... |
| Michigamme River, including Mitchikan River | 553.8 | ..... |
| Michigamme River above junction with West Branch | 559.7 | 5.9 |
| West Branch Michigamme River | 80.3 | ..... |
| Michigamme River, including West Branch | 640 | ..... |
| Michigamme River at Mansfield mine | 664.7 | 24.7 |
| Michigamme River at mouth | 723.7 | 59 |
| MENOMINEE RIVER. | | |
| Menominee River at junction of Brule and Michigamme rivers | 1,769 | ..... |
| Menominee River above junction with Pine River | 1,833 | ..... |
| Pine River | 586 | ..... |
| Menominee River, including Pine River | 2,419 | ..... |
| Menominee River above Sturgeon River | 2,538 | ..... |
| Sturgeon River, East Branch | 117 | ..... |
| Sturgeon River, West Branch | 89 | ..... |
| Sturgeon River at junction of both branches | 206 | ..... |
| Sturgeon River at mouth | 396 | 190 |
| Menominee, including Sturgeon River | 2,934 | ..... |
| Menominee above junction with Pemebonwon River | 2,993 | 59 |
| Pemebonwon River, Wisconsin | 163 | ..... |
| Menominee, including Pemebonwon River | 3,156 | ..... |
| Menominee River above Pike River | 3,274 | 118 |
| Pike River, Wisconsin | 292 | ..... |
| Menominee River, including Pike River | 3,566 | ..... |
| Menominee River above Little Cedar River | 3,792 | 226 |
| Little Cedar River | 149 | ..... |
| Menominee River, including Little Cedar River | 3,941 | ..... |
| Menominee River at mouth | 4,113 | 172 |

In addition to its value for water power, air compressing, and water supply to the adjacent mines, Menominee River is of great importance as a lumbering stream. Numerous dams have been constructed, usually of spar or timber-crib design, for flooding logs, thus taking up the fall of many of the rapids described above. A list of the dams in Menominee Basin is given below:

*Lumbermen's dams on Menominee River and its branches*

| Description. | River. | State. | Section. | Township.[a] | Range. |
|---|---|---|---|---|---|
| Dam No. 1 | Menominee | Michigan | 4 | 31 | 27 |
| Dam No. 2 | do | do | 4 | 31 | 27 |
| Dam No. 3 | do | do | 4 | 31 | 27 |
| Pemene Falls | do | Wisconsin | 21 | 37 | 28 |
| Pemene Dam | do | do | 24 | 37 | 21 |
| Shakie Lake Dam | do | Michigan | 24 | 35 | 29 |
| Dam No. 1 | Michigamme | do | 7 | 43 | 31 |
| Do | Brule | do | 32 | 41 | 33 |
| Dam No. 2 | do | do | 21 | 42 | 34 |
| Dam No. 3 | do | do | 18 | 42 | 36 |
| Dam No. 1 | Paint | do | 14 | 42 | 32 |
| Dam No. 2 | do | do | 11 | 44 | 34 |
| Dam No. 1 | Pine | do | 28 | 39 | 18 |
| Dam No. 2 | do | do | 11 | 39 | 15 |
| Dam No. 3 | do | do | 15 | 39 | 14 |
| Dam No. 4 | do | do | 36 | 40 | 13 |
| Dam No. 1 | Pike | Wisconsin | 8 | 35 | 21 |
| Dam No. 2 | do | do | 16 | 35 | 20 |
| Dam No. 1 | North Branch of Pike River. | do | 20 | 36 | 20 |
| Dam No. 2 | do | do | 6 | 36 | 19 |
| Do | South Branch of North Branch of Pike River. | do | 29 | 37 | 18 |
| Dam No. 1 | South Branch of Pike River. | do | 19 | 35 | 20 |
| Dam No. 2 | do | do | 32 | 36 | 19 |
| Dam No. 3 | do | do | 35 | 36 | 18 |
| Dam No. 4 | do | do | 17 | 36 | 18 |

[a] Land-survey townships are numbered northerly from the principal parallel; and ranges in Michigan are numbered westerly and in Wisconsin easterly from the principal meridian of the respective States.

The first dam constructed on the stream was built for a gristmill in 1832. The lumbering interests soon outweighed the value of the water power, and little progress has been made in power development

until recently. The accompanying table, furnished by the Menominee River Boom Company, shows the total number of logs or feet of lumber rafted on Menominee River since the organization of the Menominee River Manufacturing Company in 1866.

*Logs and lumber scaled on Menominee River from 1868 to 1901, inclusive.*

| Year. | Number of logs. | Feet B. M. | Year. | Number of logs. | Feet B. M. |
|---|---|---|---|---|---|
| 1868 | | 62,809,804 | 1886 | 2,141,293 | 387,489,272 |
| 1869 | | 85,744,573 | 1887 | 2,517,445 | 462,280,890 |
| 1870 | | 197,300,150 | 1888 | 2,681,218 | 513,703,492 |
| 1871 | | 117,342,697 | 1889 | 4,245,763 | 642,137,318 |
| 1872 | | 142,993,976 | 1890 | 2,904,436 | 433,876,844 |
| 1873 | | 122,101,228 | 1891 | 3,276,591 | 430,590,085 |
| 1874 | | 114,310,556 | 1892 | 4,416,767 | 560,938,627 |
| 1875 | | 112,026,280 | 1893 | 4,168,187 | 490,896,814 |
| 1876 | | 148,510,313 | 1894 | 3,360,746 | 345,675,068 |
| 1877 | | 137,120,601 | 1895 | 3,616,275 | 374,643,625 |
| 1878 | 817,395 | 137,086,041 | 1896 | 3,101,463 | 337,987,807 |
| 1879 | 1,095,885 | 181,197,529 | 1897 | 2,259,119 | 232,677,937 |
| 1880 | 1,258,771 | 240,660,524 | 1898 | 3,262,216 | 291,229,121 |
| 1881 | 1,470,689 | 265,187,163 | 1899 | 3,090,699 | 268,234,278 |
| 1882 | 1,920,788 | 344,674,448 | 1900 | 3,156,027 | 249,351,247 |
| 1883 | 2,083,333 | 333,285,369 | 1901 | 3,066,167 | 247,130,515 |
| 1884 | 2,286,639 | 377,738,266 | Total | 64,196,217 | 9,724,539,384 |
| 1885 | 1,998,305 | 335,606,926 | | | |

MENOMINEE RIVER AT LOWER QUINNESEC FALLS, WISCONSIN.

The following tables, giving mean daily discharge and run-off of Menominee River at Lower Quinnesec Falls during a portion of the years 1898 and 1899, have been furnished by the Kimberly & Clark Company, of Niagara, Wis. The discharge was determined by Joseph H. Wallace, C. E., by means of float measurements at various stages, taken in a measuring course about one-fourth mile above Lower Quinnesec Falls. These measurements were made May 11 to June 15, 1898, and comparative observations of the stream stage were taken. Beginning May 23, 1898, a series of gage readings were taken each day at 7 a. m., 1 p. m., and 6 p. m., from which the daily discharge here given has been deduced. During the period in which the records were kept the flow of the stream was modified to some extent by the opening and closing of lumbermen's dams above.

*Mean daily discharge, in second-feet, of Menominee River at Lower Quinnesec Falls, Wisconsin.*

| Day. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. |
|---|---|---|---|---|---|---|---|---|
| 1898. | | | | | | | | |
| 1 | ..... | ..... | 3,253 | 2,740 | 794 | ..... | 3,278 | 3,575 |
| 2 | ..... | ..... | 2,257 | 2,458 | 498 | ..... | 2,080 | ..... |
| 3 | ..... | ..... | 1,640 | ..... | 2,797 | ..... | 1,947 | 3,601 |
| 4 | ..... | ..... | 1,692 | ..... | 1,122 | ..... | 2,211 | 3,285 |
| 5 | ..... | ..... | ..... | 2,321 | 753 | 2,633 | 3,251 | 3,502 |
| 6 | ..... | ..... | 2,269 | 1,611 | 1,184 | 797 | ..... | ..... |
| 7 | ..... | ..... | 3,176 | 1,926 | ..... | 1,360 | 3,066 | 3,556 |
| 8 | ..... | ..... | ..... | ..... | ..... | 2,282 | 3,341 | 3,382 |
| 9 | ..... | ..... | 3,235 | 1,491 | ..... | 1,317 | ..... | ..... |
| 10 | ..... | ..... | 3,309 | ..... | ..... | 2,824 | 3,092 | 3,277 |
| 11 | ..... | ..... | 3,616 | 655 | ..... | ..... | 3,870 | 2,703 |
| 12 | ..... | ..... | 3,468 | 771 | ..... | 3,263 | 3,913 | 2,289 |
| 13 | ..... | ..... | ..... | 676 | ..... | 3,099 | 2,931 | ..... |
| 14 | ..... | ..... | 3,403 | 952 | ..... | 2,791 | 2,977 | 1,528 |
| 15 | ..... | ..... | 2,674 | 1,097 | 2,263 | 2,697 | 3,060 | 1,523 |
| 16 | ..... | ..... | 2,471 | ..... | 1,159 | 3,334 | ..... | 1,484 |
| 17 | ..... | ..... | 2,555 | ..... | 790 | 3,114 | 3,284 | 1,656 |
| 18 | ..... | ..... | 2,032 | 811 | 1,277 | ..... | ..... | 2,419 |
| 19 | ..... | ..... | ..... | 877 | 949 | 3,544 | ..... | 2,799 |
| 20 | ..... | ..... | 0 | 1,657 | ..... | 3,349 | 3,381 | ..... |
| 21 | ..... | ..... | ..... | 1,522 | ..... | 2,668 | 3,348 | 2,891 |
| 22 | ..... | ..... | 1,731 | 1,853 | 3,269 | 2,785 | 3,510 | 3,000 |
| 23 | ..... | ..... | 1,551 | 1,466 | 4,493 | 2,704 | ..... | 3,253 |
| 24 | ..... | ..... | 1,696 | ..... | 4,968 | ..... | 3,543 | 2,843 |
| 25 | ..... | ..... | 1,447 | 2,044 | 4,660 | ..... | ..... | ..... |
| 26 | ..... | 3,802 | ..... | 1,308 | 4,726 | 2,583 | ..... | ..... |
| 27 | ..... | 2,887 | 1,955 | 420 | 3,097 | 2,626 | 3,278 | ..... |
| 28 | ..... | 2,443 | ..... | 1,656 | ..... | 2,296 | 3,160 | ..... |
| 29 | ..... | ..... | 2,315 | 1,363 | ..... | 2,108 | 3,201 | ..... |
| 30 | ..... | 2,755 | 2,263 | ..... | ..... | 2,290 | ..... | ..... |
| 31 | ..... | 3,543 | ..... | ..... | ..... | ..... | 5,735 | ..... |
| Mean | ..... | 3.086 | 2,459 | 1,439 | 2,282 | 2,566 | 3,248 | 2,766 |
| 1899. | | | | | | | | |
| 1 | ..... | ..... | 3,421 | 2,120 | 1,420 | ..... | ..... | ..... |
| 2 | ..... | ..... | 3,768 | 1,988 | 1,408 | ..... | ..... | ..... |
| 3 | ..... | ..... | 3,517 | 1,790 | 1,413 | ..... | ..... | ..... |
| 4 | ..... | ..... | 3,922 | ..... | 1,789 | ..... | ..... | ..... |
| 5 | ..... | ..... | 4,347 | 2,377 | 1,722 | ..... | ..... | ..... |
| 6 | ..... | ..... | 4,266 | 2,083 | 1,686 | ..... | ..... | ..... |
| 7 | ..... | ..... | 4,265 | 2,006 | ..... | ..... | ..... | ..... |
| 8 | ..... | ..... | 4,374 | 1,896 | ..... | ..... | ..... | ..... |
| 9 | ..... | ..... | 4,624 | ..... | ..... | ..... | ..... | ..... |
| 10 | ..... | ..... | 4,127 | ..... | ..... | ..... | ..... | ..... |
| 11 | 3,744 | ..... | 3,974 | 2,198 | ..... | ..... | ..... | ..... |
| 12 | 3,470 | ..... | 3,495 | 2,197 | ..... | ..... | ..... | ..... |
| 13 | 3,083 | ..... | 3,420 | 1,989 | ..... | ..... | ..... | ..... |
| 14 | 3,982 | ..... | 3,253 | 1,897 | ..... | ..... | ..... | ..... |
| 15 | 4,384 | 3,744 | 4,027 | 1,790 | ..... | ..... | ..... | ..... |
| 16 | ..... | 4,256 | 4,159 | 2,083 | ..... | ..... | ..... | ..... |
| 17 | ..... | ..... | 3,160 | 2,341 | ..... | ..... | ..... | ..... |
| 18 | ..... | ..... | 3,543 | 804 | ..... | ..... | ..... | ..... |
| 19 | 4,642 | ..... | 3,543 | 2,257 | ..... | ..... | ..... | ..... |

*Mean daily discharge, in second-feet, of Menominee River at Lower Quinnesec Falls, Wisconsin*—Continued.

| Day. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. |
|---|---|---|---|---|---|---|---|---|
| 1899. | | | | | | | | |
| 20 | | | 4,027 | 2,521 | | | | |
| 21 | | | 3,373 | 1,518 | | | | |
| 22 | | | 2,541 | 1,487 | | | | |
| 23 | | | 3,543 | 1,277 | | | | |
| 24 | 4,321 | | 3,494 | 1,433 | | | | |
| 25 | 4,463 | 4,485 | 2,711 | 1,593 | | | | |
| 26 | | 4,349 | 2,438 | 1,593 | | | | |
| 27 | | 4,402 | 2,297 | 1,380 | | | | |
| 28 | | 4,027 | 2,521 | 1,534 | | | | |
| 29 | | 3,847 | 2,121 | 1,587 | | | | |
| 30 | | 3,920 | 2,017 | 1,645 | | | | |
| 31 | | 4,078 | | 1,574 | | | | |
| Year | 4,011 | 4,112 | 3,476 | 1,819 | 1,573 | | | |

*Estimated monthly discharge of Menominee River at Lower Quinnesec Falls, Wis.*

[Drainage area 2,432 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1898. | | | | | |
| May | 3,802 | 2,443 | 3,086 | 1.26 | 1.45 |
| June | 3,616 | 1,447 | 2,459 | 1.01 | 1.13 |
| July | 2,740 | 655 | 1,439 | .59 | .68 |
| August | 4,968 | 498 | 2,282 | .94 | 1.08 |
| September | 3,544 | 797 | 2,566 | 1.05 | 1.17 |
| October | 5,735 | 1,947 | 3,248 | 1.34 | 1.54 |
| November | 3,601 | 1,484 | 2,766 | 1.14 | 1.27 |
| 1899. | | | | | |
| April | 4,642 | 3,083 | 4,011 | 1.65 | 1.84 |
| May | 4,485 | 3,744 | 4,112 | 1.69 | 1.95 |
| June | 4,624 | 2,017 | 3,476 | 1.43 | 1.60 |
| July | 2,521 | 804 | 1,819 | .75 | .86 |
| August | 1,789 | 1,408 | 1,573 | .65 | .75 |

## MENOMINEE RIVER NEAR IRON MOUNTAIN, MICH.

A gaging station was established at the Homestead highway bridge, 2½ miles south of Iron Mountain, September 4, 1902. The gage is a vertical scale graduated to feet and tenths and attached to the

upstream side of the right-hand bridge abutment. The bridge has a single span of 220 feet. The bed is of earth, and the channel is straight for some distance both above and below the bridge. The gage is referred to the top of the 12-inch timber bridge seat on the right-hand abutment over the gage, the elevation of which is assumed to be 100 feet, the gage datum being elevation 77.32 feet. The gage readings are taken at 8 a. m. and 6 p. m. each day by Theodore Moll. The stream freezes across underneath the bridge, and special winter discharge measurements are required to determine the flow.

The drainage area above the gaging station is approximately 2,415 square miles.

During 1902 the following discharge measurements were made by R. E. Horton and W. V. Savicki:

September 4: Gage height, 1.90 feet; discharge, 1,322 second-feet.
November 4: Gage height, 2.67 feet; discharge, 1,584 second-feet.

A measurement of low-water discharge of Crystal Lake outlet, near Iron Mountain, September 4, 1902, showed a discharge of 2.25 second-feet or 0.45 second-foot per square mile from a flat sand area of 5 square miles,[a] containing 0.1 square mile lake surface.

*Mean daily gage height, in feet, of Menominee River near Iron Mountain, Mich.*

| Day. | Sept. | Oct. | Nov. | Dec. | Day. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | 1902. | | | | |
| 1 | ..... | 1.67 | 2.52 | 1.60 | 17 | 1.40 | 1.65 | 6.45 | 2.55 |
| 2 | ..... | 1.53 | 2.80 | 2.22 | 18 | 1.45 | 1.92 | 5.65 | 2.70 |
| 3 | ..... | 1.55 | 2.95 | 2.80 | 19 | 1.35 | 1.60 | 5.35 | 2.63 |
| 4 | 1.90 | 1.45 | 2.72 | 2.25 | 20 | 1.35 | 1.65 | 5.00 | 2.75 |
| 5 | 1.60 | 1.55 | 2.85 | 1.85 | 21 | 1.20 | 1.57 | 4.47 | 2.75 |
| 6 | 2.00 | 1.58 | 2.95 | 1.95 | 22 | 1.45 | 1.65 | 4.45 | 2.57 |
| 7 | 2.25 | 1.60 | 2.50 | 2.25 | 23 | 1.52 | 1.67 | 3.90 | 2.40 |
| 8 | 2.35 | 1.67 | 2.60 | 2.70 | 24 | 1.48 | 2.42 | 3.92 | 2.32 |
| 9 | 2.05 | 1.77 | 2.50 | 3.45 | 25 | 1.47 | 2.80 | 3.45 | 2.35 |
| 10 | 1.92 | 1.30 | 2.40 | 3.35 | 26 | 1.40 | 3.22 | 3.30 | 2.20 |
| 11 | 1.87 | 1.50 | 2.45 | 3.60 | 27 | 1.40 | 2.95 | 3.00 | 2.10 |
| 12 | 1.95 | 1.55 | 3.27 | 3.35 | 28 | 1.35 | 3.57 | 2.62 | 2.00 |
| 13 | 1.65 | 2.85 | 4.85 | 3.05 | 29 | 1.38 | 3.07 | 2.55 | 2.15 |
| 14 | 1.53 | 2.95 | 6.07 | 2.90 | 30 | 1.55 | 2.83 | 2.62 | 2.20 |
| 15 | 1.45 | 2.47 | 6.88 | 2.85 | 31 | ..... | 2.75 | ..... | 2.10 |
| 16 | 1.40 | 1.82 | 6.57 | 2.90 | | | | | |

## IRON RIVER DRAINAGE BASIN.

Iron River, a tributary of the Menominee system through Brule River, drains the southwest portion of Iron County, Upper Peninsula, Mich. The drainage basin is rugged; the soil is sandy and largely covered with second-growth and small timber. There are two lum-

[a] Probably including some mine pumpage.

bermen's dams, one at Iron River, about 7 miles from the mouth, and the second 7 miles farther upstream. The elevation of the stream at its confluence with Brule River is 1,400 feet and at the second dam, 14 miles upstream, 1,500 feet. The river flows through a flat valley averaging about ½ mile in width, flanked by hills 100 feet or more in height. The basin contains numerous tributary lakes, as well as a number of undrained hollows and ponds. The approximate areas of the principal lakes above Riverton Mine are given below. The aggregate water surface is 3.6 square miles.

*Pond and drainage areas, Iron River Basin.*

| Ponds and areas. | Square miles. | Ponds and areas | Square miles. |
|---|---|---|---|
| Pickerel Lake | 0.80 | Other lakes and ponds | 0.50 |
| Stanley Lake | .47 | Drainage area above Riverton Mine | 74.6 |
| Iron Lake | .65 | Drainage area above mouth | 94.7 |
| Sunset Lake | .77 | | |
| Ice Lake | .40 | | |

## IRON RIVER AT RIVERTON MINE, MICHIGAN.

A gage was erected at the mine bridge at Riverton mine, and readings were taken, as a rule, daily by the engineers of the mine, from November 9, 1900, to July 23, 1901, inclusive. The record was again started March 1, 1902, and readings have since been taken once each day. Two readings daily were taken during March, 1902, and at times of high water. The present gage is attached vertically to a braced cedar post at the left end and the upstream side of the mine bridge. The elevation of the zero of the gage previous to October 3, 1902, was 90.95 feet; on and after October 3, 1902, it was 85 feet.

All gage readings have been converted into elevations above mine datum. The bridge from which measurements are made has a span of 30 feet between abutments. The stream does not freeze over at the gaging station. The Iron River dam for ponding logs is located 1 mile upstream from the gage. Irregular draft from the pond causes fluctuations in stage below at times; otherwise the flow is regular. The Riverton mine is situated almost directly underneath the river channel. Pumpage from the mine, which, when observed September 5, 1902, was at the rate of 1.7 second-feet, enters the stream a short distance above the gage. The record is kept under the direction of Frank Drake, chief engineer of the Oliver Iron Mining Company. The assistant engineers at Iron River mine cooperate with the United States Geological Survey in making discharge measurements.

During 1902 the following discharge measurements were made by R. E. Horton and W. V. Savicki:

September 5: Gage height, 85.95 feet; discharge, 45 second-feet.[a]
September 5: Gage height, 86.64 feet; discharge, 102 second-feet.

In 1899 a series of observations were made to determine the flow and slope from the waterworks footbridge 2,959 feet upstream to the mine bridge, which, in connection with the current-meter measurements since made, will enable the discharge to be determined. The stream in the intervening section has a uniform width and depth with earth and cobble bed. Elevations are referred to the mine datum.

*Slope of Iron River near Riverton mine, Michigan.*

| Date. | Time. | Elevation of water at upper bridge. | Elevation of water at lower bridge. | Fall. |
|---|---|---|---|---|
| 1899. | | *Feet.* | *Feet.* | *Feet.* |
| July 13 | 8.15 a. m | 93.88 | 85.24 | 8.64 |
| July 13 | 10.00 a. m | 93.88 | 83.24 | 8.64 |
| July 13 | 11.55 a. m | 93.72 | 85.05 | 8.67 |
| July 14 | 8.00 a. m | 93.55 | 84.69 | 8.86 |
| July 14 | 1.30 p. m | 93.69 | 84.91 | 8.78 |
| July 15 | 8.35 a. m | 93.50 | 84.69 | 8.81 |
| July 21 | 1.45 p. m | 93.90 | 85.25 | 8.65 |
| July 23 | 7.00 p. m | 94.80 | 86.80 | 8.00 |
| August 11 | 9.00 a. m | 93.59 | 84.71 | 8.88 |
| August 11 | 11.45 a. m | 93.60 | 84.70 | 8.90 |

*Mean daily gage height, in feet, of Iron River at Riverton mine, Michigan.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1900. | | | 1900. | | | 1900. | | |
| 1 | ..... | 86.13 | 12 | 86.40 | 86.25 | 23 | 86.24 | ..... |
| 2 | ..... | ..... | 13 | 86.38 | 86.27 | 24 | 86.25 | 86.33 |
| 3 | ..... | 86.48 | 14 | 86.25 | 86.27 | 25 | ..... | ..... |
| 4 | ..... | 86.38 | 15 | 86.31 | 86.27 | 26 | 86.28 | 86.18 |
| 5 | ..... | 86.30 | 16 | 86.35 | ..... | 27 | 86.25 | 86.24 |
| 6 | ..... | 86.28 | 17 | 86.29 | 86.25 | 28 | 86.07 | 86.23 |
| 7 | ..... | 86.25 | 18 | ..... | 86.22 | 29 | ..... | 86.25 |
| 8 | ..... | 86.18 | 19 | 86.30 | 86.21 | 30 | 86.10 | ..... |
| 9 | 86.07 | ..... | 20 | 86.29 | 86.21 | 31 | ..... | 86.18 |
| 10 | 81.44 | 86.28 | 21 | 86.35 | 86.20 | | | |
| 11 | ..... | 86.25 | 22 | 86.47 | 86.28 | | | |

[a] Stream raised by opening of storage dam above.

*Mean daily gage height, in feet, of Iron River at Riverton mine, Michigan*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | 86.18 | 86.18 | 86.03 | 86.20 | 87.03 | 86.14 | 86.15 | ..... | ..... | ..... | ..... | ..... |
| 2 | 86.23 | 86.18 | 86.05 | 86.18 | 87.00 | ..... | 86.01 | ..... | ..... | ..... | ..... | ..... |
| 3 | 86.18 | ..... | 86.00 | 86.20 | 86.85 | 86.25 | 86.18 | ..... | ..... | ..... | ..... | ..... |
| 4 | 86.20 | 86.18 | ..... | 86.47 | 86.75 | 86.23 | 87.25 | ..... | ..... | ..... | ..... | ..... |
| 5 | 86.20 | 86.23 | 86.07 | 86.50 | ..... | 86.15 | 87.85 | ..... | ..... | ..... | ..... | ..... |
| 6 | ..... | 86.18 | 86.10 | 86.35 | 86.65 | 86.64 | 87.55 | ..... | ..... | ..... | ..... | ..... |
| 7 | 86.22 | 86.14 | 86.08 | ..... | 86.59 | 86.20 | ..... | ..... | ..... | ..... | ..... | ..... |
| 8 | 86.20 | 86.10 | 86.05 | 86.63 | 86.50 | 86.15 | 87.25 | ..... | ..... | ..... | ..... | ..... |
| 9 | 86.19 | 86.09 | 86.08 | 86.75 | 86.50 | ..... | 87.13 | ..... | ..... | ..... | ..... | ..... |
| 10 | ..... | ..... | ..... | 86.90 | 86.50 | 86.42 | 86.65 | ..... | ..... | ..... | ..... | ..... |
| 11 | 86.23 | 86.11 | 86.00 | 87.18 | 86.50 | 86.20 | 86.70 | ..... | ..... | ..... | ..... | ..... |
| 12 | 86.19 | 86.30 | 86.23 | 87.20 | ..... | 86.15 | 86.60 | ..... | ..... | ..... | ..... | ..... |
| 13 | ..... | 86.11 | 86.05 | 87.28 | 86.69 | 86.55 | 86.50 | ..... | ..... | ..... | ..... | ..... |
| 14 | 86.19 | 86.10 | 86.05 | ..... | 86.45 | 86.79 | ..... | ..... | ..... | ..... | ..... | ..... |
| 15 | 86.19 | 86.07 | 86.28 | 87.33 | 86.53 | 86.35 | 86.35 | ..... | ..... | ..... | ..... | ..... |
| 16 | 86.17 | 86.08 | 86.13 | 87.48 | 86.60 | ..... | 86.23 | ..... | ..... | ..... | ..... | ..... |
| 17 | 86.15 | ..... | ..... | 88.25 | 86.55 | 86.25 | 86.33 | ..... | ..... | ..... | ..... | ..... |
| 18 | 86.20 | 86.10 | 86.05 | 88.00 | 86.48 | 86.10 | 86.25 | ..... | ..... | ..... | ..... | ..... |
| 19 | 86.33 | 86.13 | 86.00 | 87.70 | ..... | 85.92 | 86.25 | ..... | ..... | ..... | ..... | ..... |
| 20 | ..... | 86.18 | 86.95 | 87.50 | 86.40 | 86.20 | 86.25 | ..... | ..... | ..... | ..... | ..... |
| 21 | 86.20 | 86.19 | ..... | ..... | 86.35 | 86.20 | ..... | ..... | ..... | ..... | ..... | ..... |
| 22 | 86.15 | 86.09 | 86.08 | 87.10 | 86.40 | 86.60 | 86.60 | ..... | ..... | ..... | ..... | ..... |
| 23 | 86.15 | 86.08 | 86.05 | 87.13 | 86.45 | ..... | 86.40 | ..... | ..... | ..... | ..... | ..... |
| 24 | 86.15 | ..... | ..... | 87.10 | 86.71 | 86.25 | ..... | ..... | ..... | ..... | ..... | ..... |
| 25 | 86.15 | 86.08 | 86.18 | 87.08 | 86.40 | 86.30 | ..... | ..... | ..... | ..... | ..... | ..... |
| 26 | 86.15 | 86.09 | 86.85 | 87.03 | ..... | 86.29 | ..... | ..... | ..... | ..... | ..... | ..... |
| 27 | ..... | 86.03 | ..... | 86.95 | 86.30 | 86.43 | ..... | ..... | ..... | ..... | ..... | ..... |
| 28 | 86.15 | 86.15 | 86.20 | ..... | 86.48 | 86.18 | ..... | ..... | ..... | ..... | ..... | ..... |
| 29 | 86.15 | ..... | 86.18 | 86.85 | 86.20 | 86.18 | ..... | ..... | ..... | ..... | ..... | ..... |
| 30 | 86.12 | ..... | 86.18 | 87.00 | 86.18 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 31 | 86.12 | ..... | ..... | ..... | 86.15 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1902. | | | | | | | | | | | | |
| 1 | ..... | ..... | 86.15 | 86.50 | 86.95 | 86.00 | 86.15 | 86.05 | 86.05 | 86.05 | 86.15 | 87.95 |
| 2 | ..... | ..... | 86.00 | 86.42 | 87.00 | 86.85 | 86.20 | 86.08 | 86.10 | 86.05 | 86.20 | 86.40 |
| 3 | ..... | ..... | 86.12 | 86.35 | 87.00 | 87.20 | 86.30 | 86.00 | 86.85 | 86.05 | 86.15 | 86.40 |
| 4 | ..... | ..... | 85.93 | 86.35 | 86.90 | 86.75 | ..... | 85.80 | 85.90 | 86.05 | 86.15 | 86.35 |
| 5 | ..... | ..... | 86.16 | 86.35 | 86.80 | 86.55 | 86.30 | 85.80 | 85.85 | 86.05 | 86.15 | 86.33 |
| 6 | ..... | ..... | 86.12 | 86.30 | 87.00 | 86.40 | ..... | 85.95 | 86.00 | 86.08 | 86.12 | 86.33 |
| 7 | ..... | ..... | 86.14 | 86.35 | 87.10 | 86.30 | 86.15 | 86.20 | 85.95 | 86.05 | 86.08 | 86.33 |
| 8 | ..... | ..... | 86.13 | 86.27 | 87.00 | 86.30 | 86.10 | 86.20 | 85.95 | 86.10 | 86.08 | 86.33 |
| 9 | ..... | ..... | 86.15 | 86.27 | 86.90 | 86.72 | 86.10 | 86.00 | 86.10 | 86.08 | 86.05 | 86.33 |
| 10 | ..... | ..... | 86.20 | 86.30 | 86.80 | 86.45 | 85.95 | 85.90 | 86.05 | 86.05 | 86.15 | 86.33 |
| 11 | ..... | ..... | 86.57 | 86.30 | 86.60 | 86.45 | 85.95 | 85.90 | 85.90 | 86.09 | 86.20 | 86.30 |
| 12 | ..... | ..... | 86.41 | 86.40 | 86.60 | 86.40 | ..... | 85.85 | 86.10 | 86.08 | 86.35 | 86.30 |
| 13 | ..... | ..... | 86.30 | 86.30 | 86.60 | 86.45 | 85.85 | 85.90 | 86.05 | 86.10 | 87.18 | 86.30 |
| 14 | ..... | ..... | 86.33 | 86.25 | 86.50 | 86.42 | 85.90 | 85.85 | 86.00 | 86.10 | 87.27 | 86.30 |
| 15 | ..... | ..... | 86.43 | 86.30 | 86.50 | 86.30 | 86.00 | 86.20 | 85.85 | 86.05 | 87.05 | 86.30 |
| 16 | ..... | ..... | 86.30 | 86.20 | 86.50 | 86.22 | 86.10 | 86.10 | 87.55 | 86.05 | 86.40 | 86.30 |
| 17 | ..... | ..... | 86.25 | 86.25 | 86.45 | 86.25 | 86.00 | 86.00 | 87.00 | 86.10 | 86.35 | 86.30 |
| 18 | ..... | ..... | 86.23 | 86.30 | 86.35 | 86.22 | 86.00 | 85.90 | 85.85 | 86.09 | 86.33 | 86.30 |
| 19 | ..... | ..... | 86.28 | 86.25 | 86.30 | 86.22 | 86.00 | 85.95 | 85.50 | 86.08 | 86.33 | 86.30 |
| 20 | ..... | ..... | 86.25 | 86.20 | 86.33 | 86.20 | 86.10 | 86.00 | 85.80 | 86.08 | 86.33 | 86.32 |
| 21 | ..... | ..... | 86.25 | 86.22 | 86.40 | 86.25 | 86.20 | 86.20 | ..... | 86.08 | 86.33 | 86.32 |

*Mean daily gage height, in feet, of Iron River at Riverton mine, Michigan*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 22 | ..... | ..... | 86.28 | 86.25 | 86.40 | 86.22 | 86.45 | 85.90 | 86.80 | 86.08 | 86.33 | 86.32 |
| 23 | ..... | ..... | ..... | 86.45 | 86.35 | 86.20 | 86.10 | 85.95 | 86.55 | 86.09 | 86.33 | 86.32 |
| 24 | ..... | ..... | 86.50 | 86.40 | 86.35 | 86.25 | 86.10 | 85.85 | 85.80 | 86.80 | 86.33 | 86.32 |
| 25 | ..... | ..... | 86.55 | 86.30 | ..... | 86.30 | 86.10 | 85.95 | 86.00 | 86.25 | 86.33 | 86.32 |
| 26 | ..... | ..... | 86.69 | 87.25 | 86.10 | 86.52 | 86.00 | 86.00 | 86.00 | 86.25 | 86.33 | 86.32 |
| 27 | ..... | ..... | 86.63 | 87.55 | 86.10 | 86.20 | 86.00 | 85.90 | 86.05 | 86.25 | 86.33 | 86.32 |
| 28 | ..... | ..... | 86.68 | 87.50 | 86.00 | 86.20 | 85.95 | 85.90 | ..... | 86.20 | 86.33 | 86.30 |
| 29 | ..... | ..... | 86.68 | 87.35 | 86.00 | ..... | 85.95 | 86.10 | 86.05 | 86.20 | 86.33 | 86.30 |
| 30 | ..... | ..... | 86.62 | 86.13 | 86.12 | 86.15 | 86.10 | 86.90 | 86.05 | 86.20 | 86.33 | 86.30 |
| 31 | ..... | ..... | 86.55 | ..... | 86.05 | ..... | 86.05 | 86.70 | ..... | 86.20 | ..... | 86.35 |

## ST. JOSEPH RIVER DRAINAGE BASIN.

St. Joseph River rises at Bunday Hills, in northern Hillsdale County, Mich., flows southwesterly into Indiana, turns northward at South Bend, recrosses the State line near Bertrand, and debouches into Lake Michigan at St Joseph. The total area drained is approximately 4,586 square miles, of which 2,916 square miles are in Michigan and 1,670 square miles in Indiana. The drainage basin contains more than 400 small lakes, varying in surface area from an eighth of a square mile to 6 square miles. Of these, approximately 100 are in Indiana and 300 in Michigan. No storage is developed on the stream.

The drainage basin lies in a completely glaciated region, and is overlain with diversified drift deposits. The current of the river from South Bend to its mouth was formerly reversed, and this valley formed an outlet for the waters of Lake Michigan, which turned to the southwest, through Kankakee River, at South Bend, and thus reached the Mississippi through Illinois River.

The basin of St. Joseph River in Michigan contains relatively little marsh land not artificially drained and relatively little uncleared land. About a third of the lakes are, however, without outlets. The proportion of undrained lakes in Indiana is smaller, and the swamp lands are much more extensive.

Elkhart River, one of the principal Indiana tributaries of the St. Joseph, drains an area of about 500 square miles which contains large lakes and extended swamp areas, with the principal fall occurring in the passage of the stream from marsh to marsh.

### ST. JOSEPH RIVER AT BUCHANAN, MICH.

A gaging station was established on St. Joseph River at the dam of the Buchanan Electric Light and Power Company, 1 mile below the village of Buchanan, April 1, 1901. The dam is of frame timber of the Beardsley type, 10 feet high, and rests on earth foundation, leakage

being prevented by means of triple sheet piling at the downstream toe. The upstream face of the dam has a slope of approximately 2.4 horizontal to 1 vertical. The downstream side is also faced with a sloping apron, the two slopes meeting at the crest at an angle of 90°. The dam is level and 392.5 feet in length. The crest gage is attached to piling 45 feet upstream from the crest, and is read at 7.30 a. m. and 5.30 p. m. each day by Charles E. Babcock.

The discharge over the dam has been calculated by the weir formula, using coefficients derived from experiments at Cornell University on a weir of the same form of cross section.

At the right-hand side of the stream is situated the Buchanan electric-light plant, containing three special 48-inch New American turbines, 1895 model. These are controlled by a single Woodward governor, and a record is kept of the number of hours per day the wheels are run and the average opening of the speed gate.

On the left-hand side of the dam are two 35-inch Leffel turbines in separate vertical cylinder cases connected to a single governor; from them power is transmitted to adjacent mills by manila rope. A record is also kept of the daily operation of these turbines by Charles E. Kissenger. The average working head on the water wheels is 11.25 feet. A small amount of leakage through the dam existed in 1901, which has not been estimated.

The record at Buchanan is kept through the cooperation of Hugh H. Hosford, superintendent of the electric light and power plant. The accompanying tables show the estimated daily discharge and monthly run-off at the dam. August 21, 1902, a discharge measurement of St. Joseph River at Niles, 4 miles above Buchanan, showed the flow to be 2,217 second-feet, or 0.613 second-feet per square mile from the tributary drainage area of 3,616 square miles.

*Mean daily discharge, in second-feet, of St. Joseph River at Buchanan, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | | | | 7,476 | 3,913 | 2,693 | 1,943 | 1,449 | 1,383 | 1,670 | 2,648 | 2,548 |
| 2 | | | | 7,212 | 3,693 | 2,476 | 1,943 | 1,453 | 1,817 | 1,670 | 2,712 | 3,017 |
| 3 | | | | 6,532 | 3,414 | 2,432 | 1,812 | 1,456 | 1,588 | 1,670 | 2,478 | 3,891 |
| 4 | | | | 6,196 | 3,285 | 2,430 | 1,745 | 1,248 | 1,588 | 1,670 | 2,785 | 2,766 |
| 5 | | | | 6,099 | 3,066 | 2,384 | 2,060 | 1,328 | 1,769 | 1,664 | 2,839 | 2,782 |
| 6 | | | | 5,860 | 3,081 | 2,308 | 2,191 | 1,335 | 1,817 | 1,442 | 2,839 | 2,766 |
| 7 | | | | 5,409 | 3,293 | 2,188 | 1,980 | 1,335 | 1,709 | 1,740 | 2,712 | 2,639 |
| 8 | | | | 5,528 | 3,429 | 2,064 | 2,122 | 1,456 | 1,748 | 1,861 | 2,775 | 2,471 |
| 9 | | | | 5,444 | 3,361 | 1,980 | 2,499 | 1,342 | 1,769 | 1,922 | 2,844 | 2,687 |
| 10 | | | | 5,343 | 3,344 | 2,064 | 1,878 | 1,335 | 1,896 | 1,984 | 2,478 | 2,954 |
| 11 | | | | 5,201 | 3,358 | 2,060 | 1,936 | 1,037 | 1,834 | 2,046 | 2,585 | 3,018 |
| 12 | | | | 4,875 | 3,263 | 2,067 | 1,812 | 1,169 | 1,834 | 2,040 | 2,839 | 2,742 |
| 13 | | | | 4,658 | 3,350 | 2,060 | 1,812 | 1,122 | 1,834 | 2,301 | 2,966 | 2,869 |
| 14 | | | | 4,393 | 3,146 | 2,064 | 1,730 | 1,028 | 1,834 | 3,929 | 2,966 | 2,757 |
| 15 | | | | 4,295 | 3,017 | 1,936 | 1,941 | 1,276 | 1,380 | 4,505 | 2,966 | 4,333 |

*Mean daily discharge, in second-feet, of St. Joseph River at Buchanan, Mich.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 16 | ..... | ..... | ..... | 4,216 | 2,883 | 1,729 | 1,876 | 1,127 | 1,471 | 4,577 | 2,966 | 3,888 |
| 17 | ..... | ..... | ..... | 4,148 | 2,570 | 1,751 | 1,753 | 1,127 | 1,652 | 4,289 | 2,106 | 3,477 |
| 18 | ..... | ..... | ..... | 4,442 | 2,566 | 2,126 | 1,635 | 1,138 | 1,896 | 3,997 | 2,966 | 3,205 |
| 19 | ..... | ..... | ..... | 4,419 | 2,490 | 2,002 | 1,629 | 1,826 | 1,821 | 3,927 | 2,839 | 2,933 |
| 20 | ..... | ..... | ..... | 4,439 | 2,643 | 1,936 | 1,624 | 1,826 | 1,883 | 3,740 | 2,966 | 2,933 |
| 21 | ..... | ..... | ..... | 4,461 | 2,763 | 1,881 | 1,613 | 1,826 | 1,821 | 3,853 | 2,966 | 3,137 |
| 22 | ..... | ..... | ..... | 4,583 | 2,573 | 1,936 | 1,693 | 1,598 | 1,743 | 3,991 | 2,902 | 3,205 |
| 23 | ..... | ..... | ..... | 4,726 | 2,490 | 1,725 | 1,630 | 1,700 | 2,154 | 3,447 | 2,839 | 3,328 |
| 24 | ..... | ..... | ..... | 4,888 | 2,566 | 1,755 | 1,570 | 1,765 | 2,160 | 3,173 | 2,490 | 2,619 |
| 25 | ..... | ..... | ..... | 4,888 | 2,700 | 1,816 | 1,390 | 1,377 | 1,912 | 3,109 | 2,753 | 3,880 |
| 26 | ..... | ..... | ..... | 4,875 | 2,617 | 1,816 | 1,390 | 2,074 | 1,918 | 2,959 | 3,017 | 3,952 |
| 27 | ..... | ..... | ..... | 4,733 | 2,827 | 1,940 | 1,511 | 2,012 | 1,912 | 2,946 | 3,144 | 3,924 |
| 28 | ..... | ..... | ..... | 4,317 | 2,820 | 2,184 | 1,102 | 2,074 | 1,851 | 2,702 | 2,890 | 4,024 |
| 29 | ..... | ..... | ..... | 4,288 | 2,814 | 2,058 | 1,330 | 2,081 | 1,790 | 2,705 | 2,636 | 3,593 |
| 30 | ..... | ..... | ..... | 4,273 | 2,617 | 1,856 | 1,572 | 1,954 | 1,428 | 2,701 | 2,636 | 3,816 |
| 31 | ..... | ..... | ..... | ..... | 2,750 | ..... | 1,574 | 1,830 | ..... | 2,708 | ..... | 3,667 |
| Mean | ..... | ..... | ..... | 5,074 | 2,990 | 2,057 | 1,750 | 1,507 | 1,774 | 2,804 | 2,785 | 3,220 |
| 1902. | | | | | | | | | | | | |
| 1 | 3,260 | 2,174 | 4,411 | 4,961 | 2,933 | 5,940 | 5,772 | 3,409 | 1,665 | 4,045 | 2,425 | 3,205 |
| 2 | 3,137 | 2,161 | 6,192 | 4,961 | 2,937 | 5,785 | 6,024 | 3,205 | 1,740 | 4,045 | 2,539 | 3,273 |
| 3 | 3,069 | 2,302 | 6,293 | 4,801 | 2,679 | 5,281 | 5,940 | 3,192 | 1,802 | 4,045 | 2,679 | 3,341 |
| 4 | 3,001 | 2,429 | 5,537 | 4,645 | 2,412 | 4,645 | 5,856 | 3,001 | 1,678 | 3,901 | 2,806 | 3,341 |
| 5 | 2,920 | 2,429 | 4,961 | 4,489 | 3,208 | 4,189 | 5,688 | 2,806 | 1,557 | 3,888 | 2,933 | 3,205 |
| 6 | 2,933 | 2,495 | 4,649 | 4,476 | 3,072 | 3,685 | 5,604 | 2,679 | 1,436 | 4,045 | 3,069 | 3,192 |
| 7 | 2,069 | 2,556 | 4,415 | 4,411 | 3,904 | 3,205 | 5,449 | 2,679 | 1,544 | 4,045 | 3,205 | 3,192 |
| 8 | 2,933 | 2,679 | 4,333 | 4,337 | 4,336 | 3,192 | 5,197 | 2,615 | 1,678 | 3,901 | 3,205 | 3,341 |
| 9 | 2,933 | 2,793 | 4,320 | 4,193 | 4,336 | 3,757 | 4,957 | 2,552 | 1,802 | 3,757 | 2,920 | 3,341 |
| 10 | 2,933 | 2,810 | 4,195 | 4,049 | 4,333 | 3,685 | 4,801 | 2,488 | 1,926 | 3,757 | 3,001 | 3,341 |
| 11 | 2,806 | 2,810 | 4,339 | 3,689 | 3,744 | 2,205 | 4,489 | 2,425 | 1,926 | 3,757 | 3,205 | 3,341 |
| 12 | 2,793 | 2,746 | 5,372 | 3,477 | 3,977 | 3,069 | 4,333 | 2,425 | 2,040 | 3,600 | 3,205 | 3,477 |
| 13 | 2,933 | 2,683 | 6,545 | 3,464 | 3,689 | 3,069 | 4,176 | 2,425 | 2,174 | 3,477 | 3,341 | 3,477 |
| 14 | 2,933 | 2,683 | 6,545 | 3,413 | 3,409 | 3,205 | 4,045 | 2,361 | 2,161 | 3,409 | 3,341 | 3,464 |
| 15 | 2,933 | 2,488 | 6,457 | 3,345 | 3,209 | 3,396 | 3,757 | 2,298 | 2,174 | 3,273 | 3,341 | 3,545 |
| 16 | 2,933 | 2,412 | 6,276 | 3,141 | 3,209 | 3,757 | 3,477 | 2,174 | 2,174 | 3,205 | 3,464 | 3,613 |
| 17 | 2,933 | 2,302 | 6,205 | 2,937 | 3,205 | 3,685 | 3,477 | 2,161 | 2,298 | 3,205 | 3,477 | 3,613 |
| 18 | 2,806 | 2,302 | 6,037 | 2,810 | 2,666 | 3,409 | 3,202 | 2,174 | 2,298 | 3,205 | 3,477 | 3,613 |
| 19 | 2,412 | 2,178 | 5,785 | 2,806 | 3,209 | 3,341 | 3,613 | 2,174 | 2,298 | 3,192 | 3,341 | 3,829 |
| 20 | 2,298 | 2,178 | 5,537 | 2,729 | 3,073 | 3,205 | 4,032 | 2,174 | 2,298 | 3,056 | 3,205 | 4,117 |
| 21 | 2,425 | 2,178 | 5,173 | 2,683 | 2,937 | 3,273 | 4,333 | 2,174 | 2,161 | 3,069 | 3,205 | 4,476 |
| 22 | 2,425 | 2,050 | 4,957 | 2,683 | 2,937 | 3,464 | 4,333 | 2,174 | 2,298 | 3,069 | 3,205 | 5,113 |
| 23 | 2,552 | 2,161 | 4,944 | 2,683 | 2,810 | 3,341 | 4,045 | 2,174 | 2,425 | 2,933 | 3,464 | 6,289 |
| 24 | 2,556 | 2,240 | 4,805 | 2,683 | 2,933 | 3,273 | 4,045 | 2,037 | 2,615 | 2,933 | 3,341 | 5,869 |
| 25 | 2,552 | 2,492 | 4,805 | 2,746 | 4,032 | 3,137 | 3,757 | 2,174 | 2,742 | 2,806 | 3,137 | 5,268 |
| 26 | 2,475 | 2,621 | 4,649 | 2,933 | 5,369 | 3,001 | 3,613 | 2,174 | 3,137 | 1,665 | 3,001 | 4,723 |
| 27 | 2,429 | 3,347 | 4,649 | 2,927 | 6,125 | 2,933 | 3,192 | 2,050 | 2,933 | 2,679 | 2,920 | 4,645 |
| 28 | 2,365 | 1,808 | 4,571 | 3,209 | 6,377 | 3,001 | 3,477 | 1,988 | 3,260 | 2,552 | 3,069 | 4,710 |
| 29 | 2,240 | ..... | 4,489 | 3,205 | 6,293 | 3,260 | 3,477 | 1,864 | 3,829 | 2,552 | 3,069 | 4,723 |
| 30 | 2,178 | ..... | 4,710 | 2,933 | 6,283 | 4,489 | 3,409 | 1,802 | 3,973 | 2,552 | 3,124 | 4,411 |
| 31 | 2,178 | ..... | 4,961 | ..... | 6,121 | ..... | 3,205 | 1,665 | ..... | 2,425 | ..... | 4,117 |
| Mean | 2,721 | 2,446 | 5,197 | 3,560 | 3,863 | 3,629 | 4,347 | 2,377 | 2,268 | 3,[illegible] | 3,124 | 3,974 |

*Estimated monthly discharge of St. Joseph River at Buchanan, Mich.*

[Drainage area, 3,935 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| April | 7,476 | 4,148 | 5,074 | 1.29 | 1.44 |
| May | 3,913 | 2,490 | 2,990 | .76 | .87 |
| June | 2,693 | 1,725 | 2,057 | .53 | .59 |
| July | 2,499 | 1,102 | 1,750 | .45 | .52 |
| August | 2,081 | 1,028 | 1,507 | .38 | .44 |
| September | 2,160 | 1,380 | 1,774 | .45 | .50 |
| October | 4,577 | 1,442 | 2,804 | .71 | .82 |
| November | 2,966 | 2,478 | 2,785 | .70 | .78 |
| December | 4,333 | 2,471 | 3,220 | .82 | .94 |
| 1902. | | | | | |
| January | 3,260 | 2,178 | 2,721 | .69 | .79 |
| February | 3,347 | 1,808 | 2,446 | .62 | .64 |
| March | 6,545 | 4,195 | 5,197 | 1.32 | 1.52 |
| April | 4,961 | 2,683 | 3,560 | .90 | 1.00 |
| May | 6,377 | 2,666 | 3,863 | .98 | 1.13 |
| June | 5,940 | 2,205 | 3,629 | .92 | 1.02 |
| July | 6,024 | 3,192 | 4,347 | 1.10 | 1.27 |
| August | 3,409 | 1,665 | 2,377 | .60 | .69 |
| September | 3,973 | 1,436 | 2,268 | .58 | .64 |
| October | 4,045 | 1,665 | 3,291 | .84 | .97 |
| November | 3,477 | 2,425 | 3,124 | .79 | .88 |
| December | 6,289 | 3,192 | 3,974 | 1.00 | 1.15 |
| The year | 6,545 | 1,436 | 3,400 | .86 | 11.70 |

ST. JOSEPH RIVER AT MENDON, MICH.

A gaging station was established at the Maranteke bridge on the south line of sec. 33, T. 5 S., R. 10 W., October 25, 1902. This bridge is located about one-half mile downstream from the gage, which is in the village of Mendon. The bridge has a single span of 136.5 feet between abutments, stands squarely across the direction of the current, and affords a fairly permanent cross section for gaging, the bed being of smooth clay. There is a bend in the stream a short distance above this bridge. The channel below for some distance is

straight. The gage is a vertical scale attached to a braced cedar post near the water's edge. Its datum is elevation 80.04 feet, or 19.95 feet below the bench mark, which is the top of the head of a spike driven into the brick wall at the southeast corner of Masonic Hall building, 150 feet northwest from the gage.

Little Portage River flows parallel to and about 1 mile distant from St. Joseph River at Mendon, and was at one time diverted across the divide, affording water power with a fall of 20 feet. This has been discontinued. Franchises have been granted for a number of water powers on St. Joseph River in this locality:

(1) Michigan Hydraulic Company at Colon, Mich., 18 feet fall at dam under construction.
(2) Michigan Hydraulic Company, 4 miles below Colon, 8 feet fall obtainable.
(3) W. P. McCoy, Mendon, Mich., 8 feet fall.
(4) Site, 3 miles below Mendon; stated fall, 7 feet.
(5) Seven miles below Mendon; 18 feet fall claimed.

The drainage area above Maranteke bridge is 844 square miles. The gage is read twice each day by William P. McCoy. The means of the daily gage readings are given in the accompanying table.

During 1902 the following discharge measurements were made by R. E. Horton and W. V. Savicki:

August 21: Gage height, —[a]; discharge, 406 second-feet.
October 12: Gage height, 1.9 feet; discharge, 786 second-feet.

*Mean daily gage height, in feet, of St. Joseph River at Mendon, Mich.*

| Day. | Oct. | Nov. | Dec. | Day. | Oct. | Nov. | Dec. | Day. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | 1902. | | | | 1902 | | | |
| 1 | ..... | 1.30 | 1.20 | 12 | ..... | 1.60 | 1.50 | 23 | ..... | 1.40 | 2.60 |
| 2 | ..... | 1.30 | 1.25 | 13 | ..... | 1.50 | 2.80 | 24 | ..... | 1.40 | 2.58 |
| 3 | ..... | 1.28 | 1.30 | 14 | ..... | 1.50 | 1.80 | 25 | ..... | 1.30 | 2.50 |
| 4 | ..... | 1.28 | 1.43 | 15 | ..... | 1.45 | 1.60 | 26 | 1.40 | 1.25 | 2.20 |
| 5 | ..... | 1.30 | 1.60 | 16 | ..... | 1.45 | 1.50 | 27 | 1.43 | 1.25 | 2.18 |
| 6 | ..... | 1.40 | 1.70 | 17 | ..... | 1.50 | 1.70 | 28 | 1.43 | 1.30 | 2.10 |
| 7 | ..... | 1.35 | 1.70 | 18 | ..... | 1.50 | 1.65 | 29 | 1.45 | 1.30 | 2.00 |
| 8 | ..... | 1.53 | 1.70 | 19 | ..... | 1.50 | 1.60 | 30 | 1.40 | 1.30 | 2.00 |
| 9 | ..... | 1.60 | 1.58 | 20 | ..... | 1.50 | 1.65 | 31 | 1.40 | ..... | 3.40 |
| 10 | ..... | 1.60 | 1.53 | 21 | ..... | 1.40 | 1.70 | | | | |
| 11 | ..... | 1.60 | 1.50 | 22 | ..... | 1.40 | 2.50 | | | | |

## KALAMAZOO RIVER DRAINAGE BASIN.

Kalamazoo River rises in the south-central part of the Lower Peninsula of Michigan and flows in a northwesterly direction, debouching into Lake Michigan 3¼ miles below the village of Saugatuck. Its current is slow, averaging about 3 miles an hour, and its slope uniform, there being no waterfalls and no considerable rapids except at two

[a] Gage not installed.

points, at each of which there occurs a descent of 3 or 4 feet within a distance of a few rods. The river flows through a rich agricultural region, in a valley from one-fourth of a mile to 2 or 3 miles in width, backed by low hills or sloping gently to the upland. The flat lands in the valley are often flooded and serve largely as permanent meadows through which the river winds, often in a very tortuous manner. Two branches unite at Albion to form the main stream. The total length from the point of juncture to the outlet is 101 miles.

In respect to the climate, topography, and run-off of its drainage basin, Kalamazoo River may be considered as typical of the larger streams of southern Michigan, including the Grand, the St. Joseph, and the Raisin, all of which find their sources within a few miles of each other and of the Kalamazoo. The drainage area covers 1,750 square miles. A detailed description of a part of Lower Kalamazoo Basin is given in the third report, Bureau of Soils, Department of Agriculture, pages 93–124.

### KALAMAZOO RIVER NEAR ALLEGAN, MICH.

A gaging station was established at the dam of the Kalamazoo Valley Electric Company, Trowbridge Township, 6 miles upstream by river from Allegan, April 4, 1901. The dam is of timber crib work filled with stone, resting on pile foundation in clay hardpan. The dam is equipped with three Taintor segmental flood gates, each of 19.7 feet clear width. In the adjacent power house, forming a portion of the dam, are eight 43-inch Leffel-Samson turbines arranged in two sets on a horizontal shaft, each set controlled by a separate governor. The gaging record includes the number of hours of daily run; the average gate opening of the turbines, as indicated by the index wheels of the governors; the stage of water on the tailrace gage; and the reading of the crest gage. The crest gage is set with its zero at the elevation of the horizontal spillways of 20 feet crest width each, which are closed by the Taintor gates. The crest gage also serves to show the depth flowing over the crests of the Taintor gates or of flashboards placed thereon. A record of the opening and closing of the Taintor gates is also kept. The pond above the dam covers an area of 1,000 acres. The turbines run continuously and the flow of the stream is nearly all utilized, except in times of extreme freshet. At such times the water level is controlled by means of the flood gates described.

The crest and tailrace gages are set with a difference of elevation of 12 feet, and both are referred to the top of the masonry pier at the entrance to the flume as a bench mark.

The elevation of the zero of the crest gage is 83.95 feet; that of the zero of the tailrace gage, 71.95 feet.

The effective head varies from 21 to 23 feet. The record is maintained in cooperation with the Kalamazoo Valley Electric Company.

The gages were set under the direction of H. C. Hoagland, superintendent. The power plant contains a 1,500-kilowatt multipolar generator, and the power is used for long-distance transmission to drive interurban electric railroads. The Kalamazoo Valley Electric Company contemplates the erection of other similar power plants both above and below the present plant, in the near future. A test by current meter, at the highway bridge, just below the dam, was made on August 22, 1902, with results as follows:

| | | |
|---|---|---|
| Head on turbines | feet | 21.9 |
| Discharge of four turbines, 0.1 to 0.3 gate | second-feet | 223.8 |
| Discharge of four turbines, 0.5 to 0.6 gate | do | 470 |
| Flow over spillways | do | 61.7 |
| Leakage | do | 5 |
| Total estimated discharge | do | 760.5 |
| Discharge measured by current meter | do | 785.1 |

A measurement of the high-water discharge of North Branch Kalamazoo River at Albion, Mich., March 9, 1903, at the electric railroad bridge, showed the flow to be 232 second-feet, or 1.68 second-feet per square mile from the tributary drainage area of 138 square miles.

The following tables give the result of a series of flood measurements of Kalamazoo River made by William G. Fargo, C. E., of Jackson, Mich. In each case a number of floats were run to determine the maximum surface velocity, and soundings were taken in the float sections to determine the cross-sectional area. The first table gives the results of gagings at the highway bridge just below the Trowbridge dam, on the west line of sec. 12, T. 1 N., R. 13 W. The second table gives the results of similar measurements near the north-south line of sec. 22, T. 2 S., R. 7 W. (Emmet Township, 3 miles below Ceresco village). The drainage area at this point is 489 square miles.

*Discharge measurements of Kalamazoo River above Allegan, Mich.*

| Measurements. | Mar. 21, 1897. | May 19, 1897. | Oct. 7, 1897. | May 12, 1898. |
|---|---|---|---|---|
| Width of section, feet | 154 | 154 | 154 | 154 |
| Area of section, square feet | 746 | 510 | 338 | 422.2 |
| Central surface velocity per second, feet | 4.10 | 2.95 | 2.35 | 2.78 |
| Mean velocity coefficient | .83 | .83 | .83 | .83 |
| Mean velocity per second, feet | 3.40 | 2.45 | 1.95 | 2.3 |
| Discharge, second-feet | 2,536 | 1,249.5 | 659.1 | 970.1 |
| Discharge per square mile, do | 1.72 | .85 | 4.48 | .66 |

*Discharge measurements of Kalamazoo River 3 miles below Ceresco, Mich.*

| Measurements. | May 22, 1897. | Dec. 8, 1897. |
|---|---|---|
| Area cross-section ..... square feet.. | 261 | 204 |
| Central surface velocity per second ..... feet.. | 2.21 | 1.64 |
| Mean velocity coefficient ..... | .83 | .83 |
| Mean velocity per second ..... feet.. | 1.83 | 1.36 |
| Discharge ..... second-feet.. | 478.5 | 277.4 |
| Discharge per square mile ..... do.... | .97 | .56 |

The following tables give the daily discharge and run-off at the Trowbridge dam:

*Mean daily discharge, in second-feet, of Kalamazoo River at Trowbridge dam, near Allegan, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | ..... | ..... | ..... | ..... | 874 | 785 | 852 | 822 | 823 | 404 | 861 | 637 |
| 2 | ..... | ..... | ..... | ..... | 933 | 850 | 844 | 856 | 803 | 674 | 845 | 837 |
| 3 | ..... | ..... | ..... | ..... | 907 | 926 | 766 | 828 | 810 | 578 | 721 | 747 |
| 4 | ..... | ..... | ..... | 1,013 | 863 | 801 | 778 | 784 | 852 | 478 | 845 | 762 |
| 5 | ..... | ..... | ..... | 1,041 | 730 | 813 | 777 | 872 | 811 | 369 | 803 | 746 |
| 6 | ..... | ..... | ..... | 1,001 | 845 | 812 | 647 | 876 | 590 | 172 | 845 | 739 |
| 7 | ..... | ..... | ..... | 1,027 | 870 | 802 | 797 | 883 | 606 | 511 | 967 | 754 |
| 8 | ..... | ..... | ..... | 998 | 847 | 808 | 102 | 816 | 570 | 408 | 1,011 | 739 |
| 9 | ..... | ..... | ..... | 1,003 | 863 | 814 | 689 | 804 | 570 | 525 | 946 | 798 |
| 10 | ..... | ..... | ..... | 1,009 | 863 | 814 | 663 | 799 | 648 | 482 | 987 | 786 |
| 11 | ..... | ..... | ..... | 977 | 846 | 808 | 647 | 660 | 594 | 713 | 987 | 814 |
| 12 | ..... | ..... | ..... | 825 | 900 | 845 | 738 | 598 | 829 | 743 | 889 | 865 |
| 13 | ..... | ..... | ..... | 870 | 890 | 845 | 888 | 660 | 829 | 879 | 912 | 857 |
| 14 | ..... | ..... | ..... | 888 | 895 | 837 | 420 | 660 | 829 | 1,041 | 1,008 | 979 |
| 15 | ..... | ..... | ..... | 878 | 849 | 861 | 880 | 694 | 782 | 892 | 823 | 824 |
| 16 | ..... | ..... | ..... | 858 | 790 | 822 | 841 | 514 | 829 | 940 | 891 | 821 |
| 17 | ..... | ..... | ..... | 1,004 | 790 | 853 | 859 | 625 | 857 | 996 | 751 | 698 |
| 18 | ..... | ..... | ..... | 1,015 | 800 | 837 | 858 | 727 | 844 | 838 | 904 | 700 |
| 19 | ..... | ..... | ..... | 952 | 652 | 829 | 823 | 726 | 829 | 838 | 790 | 631 |
| 20 | ..... | ..... | ..... | 914 | 645 | 861 | 829 | 799 | 791 | 690 | 764 | 816 |
| 21 | ..... | ..... | ..... | 939 | 645 | 861 | 759 | 804 | 811 | 729 | 694 | 846 |
| 22 | ..... | ..... | ..... | 989 | 645 | 867 | 753 | 799 | 504 | 877 | 761 | 839 |
| 23 | ..... | ..... | ..... | 983 | 686 | 829 | 747 | 796 | 510 | 841 | 777 | 959 |
| 24 | ..... | ..... | ..... | 911 | 666 | 833 | 741 | 794 | 736 | 858 | 777 | 893 |
| 25 | ..... | ..... | ..... | 905 | 716 | 806 | 753 | 624 | 836 | 988 | 829 | 781 |
| 26 | ..... | ..... | ..... | 894 | 760 | 914 | 844 | 874 | 693 | 907 | 777 | 868 |
| 27 | ..... | ..... | ..... | 926 | 645 | 847 | 852 | 848 | 788 | 967 | 761 | 888 |
| 28 | ..... | ..... | ..... | 961 | 650 | 771 | 696 | 802 | 785 | 975 | 813 | 818 |
| 29 | ..... | ..... | ..... | 836 | 650 | 986 | 860 | 829 | ..... | 967 | 869 | 668 |
| 30 | ..... | ..... | ..... | 813 | 650 | 773 | 827 | 837 | ..... | 879 | 822 | 850 |
| 31 | ..... | ..... | ..... | ..... | 701 | ..... | 800 | 804 | ..... | 882 | ..... | 813 |
| Mean | ..... | ..... | ..... | 940 | 776 | 837 | 752 | 768 | 741 | 741 | 847 | 799 |

*Mean daily discharge, in second-feet, of Kalamazoo River at Trowbridge dam, near Allegan, Mich.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 687 | 858 | 957 | 915 | 711 | 710 | 956 | 843 | 723 | 919 | 892 | 1,063 |
| 2 | 733 | 837 | 817 | 915 | 780 | 812 | 1,008 | 843 | 723 | 964 | 773 | 1,120 |
| 3 | 748 | 860 | 945 | 907 | 768 | 812 | 1,041 | 711 | 731 | 909 | 905 | 1,120 |
| 4 | 694 | 636 | 822 | 891 | 807 | 648 | 1,026 | 771 | 632 | 932 | 934 | 1,061 |
| 5 | 673 | 591 | 739 | 878 | 795 | 749 | 1,123 | 863 | 803 | 777 | 995 | 1,070 |
| 6 | 764 | 612 | 739 | 763 | 907 | 880 | 1,072 | 847 | 822 | 856 | 973 | 1,079 |
| 7 | 772 | 655 | 829 | 867 | 931 | 817 | 1,072 | 871 | 749 | 942 | 965 | 840 |
| 8 | 722 | 553 | 829 | 850 | 873 | 728 | 981 | 821 | 696 | 906 | 900 | 1,088 |
| 9 | 741 | 560 | 637 | 869 | 876 | 838 | 1,089 | 902 | 788 | 874 | 873 | 1,074 |
| 10 | 729 | 679 | 867 | 862 | 831 | 805 | 1,067 | 711 | 845 | 926 | 988 | 1,040 |
| 11 | 738 | 793 | 945 | 867 | 790 | 743 | 990 | 807 | 837 | 928 | 988 | 1,079 |
| 12 | 686 | 751 | 913 | 854 | 854 | 743 | 992 | 839 | 837 | 716 | 924 | 991 |
| 13 | 673 | 697 | 935 | 786 | 869 | 797 | 839 | 888 | 884 | 959 | 862 | 983 |
| 14 | 801 | 697 | 924 | 840 | 848 | 925 | 851 | 786 | 250 | 952 | 996 | 721 |
| 15 | 657 | 682 | 960 | 851 | 855 | 776 | 850 | 788 | 708 | 913 | 964 | 934 |
| 16 | 514 | 667 | 798 | 771 | 844 | 844 | 699 | 834 | 647 | 921 | 817 | 967 |
| 17 | 729 | 524 | 863 | 762 | 825 | 767 | 904 | 681 | 612 | 929 | 929 | 85 |
| 18 | 715 | 705 | 827 | 843 | 710 | 855 | 807 | 782 | 612 | 921 | 926 | 989 |
| 19 | 715 | 593 | 747 | 835 | 811 | 789 | 847 | 791 | 621 | 724 | 918 | 1,016 |
| 20 | 715 | 553 | 807 | 635 | 831 | 897 | 863 | 763 | 564 | 916 | 926 | 1,118 |
| 21 | 696 | 613 | 890 | 776 | 751 | 853 | 806 | 786 | 545 | 950 | 843 | 804 |
| 22 | 682 | 621 | 898 | 867 | 806 | 789 | 814 | 787 | 810 | 902 | 1,020 | 964 |
| 23 | 682 | 834 | 748 | 739 | 801 | 839 | 794 | 844 | 897 | 926 | 796 | 970 |
| 24 | 619 | 579 | 827 | 778 | 819 | 834 | 847 | 699 | 921 | 932 | 989 | 901 |
| 25 | 682 | 729 | 867 | 781 | 824 | 802 | 859 | 769 | 929 | 988 | 967 | 930 |
| 26 | 554 | 758 | 851 | 822 | 801 | 1,046 | 903 | 846 | 972 | 785 | 1,049 | 926 |
| 27 | 837 | 758 | 875 | 698 | 827 | 1,178 | 817 | 838 | 972 | 898 | 805 | 736 |
| 28 | 438 | 729 | 953 | 757 | 801 | 875 | 898 | 831 | 807 | 923 | 987 | 650 |
| 29 | 521 | ..... | 898 | 731 | 801 | 758 | 898 | 748 | 925 | 944 | 991 | 857 |
| 30 | 612 | ..... | 820 | 660 | 737 | 949 | 892 | 757 | 972 | 926 | 820 | 934 |
| 31 | 612 | ..... | 900 | ..... | 817 | ..... | 882 | 680 | ..... | 807 | ..... | 987 |
| Mean | 681 | 683 | 852 | 812 | 816 | 828 | 918 | 797 | 761 | 900 | 923 | 938 |

*Estimated monthly discharge of Kalamazoo River at Trowbridge dam, Michigan.*

[Drainage area, 1,471 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| April | 1,041 | 813 | 940 | 0.64 | 0.71 |
| May | 933 | 645 | 776 | .53 | .61 |
| June | 986 | 771 | 837 | .57 | .64 |
| July | 888 | 102 | 752 | .51 | .59 |
| August | 883 | 514 | 768 | .52 | .60 |
| September | 857 | 504 | 741 | .50 | .56 |
| October | 1,041 | 172 | 741 | .50 | .58 |
| November | 1,011 | 721 | 847 | .57 | .64 |
| December | 979 | 631 | 799 | .54 | .62 |
| 1902. | | | | | |
| January | 837 | 438 | 681 | 0.46 | 0.53 |
| February | 860 | 524 | 683 | .46 | .48 |
| March | 960 | 637 | 852 | .58 | .67 |
| April | 915 | 635 | 812 | .55 | .62 |
| May | 931 | 710 | 816 | .55 | .64 |
| June | 1,178 | 648 | 828 | .56 | .63 |
| July | 1,123 | 699 | 918 | .62 | .72 |
| August | 902 | 680 | 797 | .54 | .62 |
| September | 972 | 250 | 761 | .52 | .58 |
| October | 988 | 716 | 900 | .61 | .70 |
| November | 1,049 | 773 | 923 | .63 | .70 |
| December | 1,120 | 85 | 938 | .64 | .73 |
| The year | 1,178 | 85 | 826 | .56 | 7.62 |

## GRAND RIVER DRAINAGE BASIN.

This is the largest stream in Michigan. Its drainage basin, which includes a total area of 5,572 square miles, is situated in the central portion of the lower peninsula, and drains into Lake Michigan. It lies in the southern border of the pine belt, and is for the most part cleared. Occasional tracts of forest remain. The basin receives an annual rainfall varying from 25 inches in the region of the headwaters to 30 or 35 inches near the mouth of the river.

The drainage basin is comparatively flat. The total fall of the river from the extreme headwaters to the mouth, a distance of more than 200 miles, is about 350 feet.

The northwestern and southeastern portions of the basin are thickly interspersed with small lakes. A considerable number of these have no surface outlets, and their drainage basins do not contribute to the run-off of the river except through ground water.

### GRAND RIVER AT GRAND RAPIDS, MICH.

A gaging station was established at the Fulton street bridge, Grand Rapids, March 12, 1901, and a record of the stage of the stream at this and other gages in the city has been maintained by L. W. Anderson, city engineer. The accompanying table gives the results of discharge measurements made by Charles Redman, C. E. The gage is attached to the upstream end of the ice breaker of the left-hand bridge pier and has its zero at elevation 0.55 feet below the city datum. All gage readings, as well as the stream stage given in the table of discharge measurements, have been reduced to elevations above city datum. The direction of the current makes an angle of 10° 15′ with the bridge from which discharge measurements have been taken. The discharge measurements have been made with a large Price meter, No. 88, by the 0.6 depth method. A rating curve has been prepared and the daily discharge and run-off have been calculated, as given in the accompanying tables.

The mean daily readings at Wealthy avenue gage, situated below the Fulton street station, are also given. These readings were taken on the United States engineers' gage, which has its datum 7.38 feet below Grand Rapids city datum.

*Discharge measurements of Grand River at Fulton street bridge, Grand Rapids, Mich.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1901. | | *Feet.* | *Second-feet.* |
| March 15 | Charles Redman | 3.73 | 6,033 |
| March 16 | do | 4.13 | 6,035 |
| March 18 | do | 4.96 | 7,830 |
| March 22 | do | 9.87 | 18,146 |
| March 23 | do | 10.47 | 20,324 |
| April 8 | do | 3.86 | 7,234 |
| April 11 | do | 2.79 | 5,759 |
| April 13 | do | 2.18 | 4,783 |
| May 3 | do | 1.34 | 3,863 |
| June 3 | do | .46 | 2,847 |
| June 28 | do | — .15 | 1,749 |
| September 27 | do | — .30 | 1,466 |
| October 8 | do | — .45 | 1,276 |
| 1902. | | | |
| April 3 | do | —5.17 | 9,305 |

*Mean daily gage height, in feet, of Grand River at Fulton street, Grand Rapids, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 0.57 | 0.06 | 3.32 | 4.60 | 1.20 | ..... | 1.44 | 1.84 | 0.80 | 2.40 | 0.95 | 1.13 |
| 2 | .52 | —.16 | 3.71 | 5.02 | 1.02 | 0.55 | 1.86 | 1.68 | .55 | 2.40 | ..... | 1.13 |
| 3 | .79 | .16 | 3.82 | 5.16 | 1.01 | .60 | 5.68 | ..... | .70 | 2.30 | .78 | 1.50 |
| 4 | .67 | .08 | 3.90 | 5.02 | 1.11 | .71 | 6.78 | 1.46 | .53 | 2.15 | .83 | 1.95 |
| 5 | .54 | .16 | 3.63 | 4.63 | 1.65 | .85 | 7.15 | 1.30 | .28 | ..... | 1.08 | 2.35 |
| 6 | .69 | .20 | 3.19 | 4.32 | 1.99 | .72 | ..... | 1.08 | .36 | ..... | 2.20 | 2.65 |
| 7 | .39 | .21 | 2.56 | 3.95 | 3.54 | .84 | 7.24 | .97 | ..... | 1.28 | 2.80 | ..... |
| 8 | .26 | .10 | 2.31 | 3.69 | 4.64 | ..... | 7.25 | .80 | .54 | 1.28 | 3.35 | 2.00 |
| 9 | .26 | —.07 | 2.10 | 3.34 | 4.96 | .89 | 7.40 | .58 | .63 | 1.35 | ..... | 1.60 |
| 10 | .30 | .22 | 1.75 | 3.03 | 5.37 | 1.29 | 6.89 | ..... | .45 | 1.28 | 3.10 | 1.45 |
| 11 | .34 | .08 | 1.71 | 2.76 | 5.21 | 1.41 | 6.02 | .46 | .58 | 1.15 | 2.80 | 1.43 |
| 12 | .25 | —.03 | 2.57 | 2.48 | 4.90 | 1.32 | 5.06 | .42 | .48 | ..... | 2.58 | 1.23 |
| 13 | .47 | .03 | 5.45 | 2.12 | 4.45 | 1.16 | ..... | .40 | .70 | 1.88 | 2.35 | 1.20 |
| 14 | .28 | —.04 | 5.96 | 1.90 | 4.09 | 1.20 | 3.69 | .25 | ..... | 2.03 | 2.25 | ..... |
| 15 | .28 | —.07 | 6.15 | 1.76 | 3.68 | ..... | 3.17 | .13 | .70 | 2.13 | 2.45 | 1.10 |
| 16 | .20 | —.28 | 6.24 | 1.44 | 3.34 | 1.93 | 2.80 | .13 | .75 | 1.95 | ..... | 1.28 |
| 17 | .30 | .08 | 5.97 | 1.23 | 2.95 | 2.04 | 2.44 | ..... | .70 | 1.68 | 2.45 | 1.45 |
| 18 | .00 | —.11 | 5.47 | 1.17 | ..... | 1.95 | 2.26 | .05 | .60 | 1.45 | 2.43 | 1.48 |
| 19 | —.08 | —.06 | 5.26 | .98 | 2.85 | 1.76 | 2.26 | .18 | .50 | ..... | 2.33 | 1.53 |
| 20 | .08 | —.21 | 4.25 | .84 | 2.83 | 1.65 | ..... | .22 | .48 | 1.23 | 2.23 | 1.80 |
| 21 | —.17 | —.20 | 3.86 | .75 | 2.74 | 1.55 | 2.79 | .18 | ..... | 1.08 | 2.18 | ..... |
| 22 | —.21 | —.21 | 3.52 | .71 | 2.68 | ..... | 3.08 | .18 | .50 | 1.05 | 2.08 | 3.65 |
| 23 | .19 | —.26 | 3.13 | .60 | 2.59 | 1.15 | 3.40 | .22 | .40 | 1.08 | ..... | 3.93 |
| 24 | —.10 | .00 | 2.87 | .51 | 2.55 | 1.02 | 3.48 | ..... | .21 | 1.05 | 1.93 | 3.63 |
| 25 | .19 | —.19 | 2.52 | .44 | ..... | 1.01 | 3.21 | .26 | .35 | 1.05 | 1.80 | ..... |
| 26 | —.27 | .06 | 2.31 | .58 | 1.98 | .92 | 3.14 | .20 | .54 | ..... | 1.53 | 3.38 |
| 27 | .50 | .38 | 2.03 | .89 | 1.63 | .85 | ..... | .38 | 1.28 | 1.10 | ..... | 2.90 |
| 28 | .65 | 1.71 | 1.99 | 1.33 | 1.30 | .64 | 2.71 | .43 | ..... | 1.10 | 1.18 | ..... |
| 29 | .37 | ..... | 2.20 | 1.50 | 1.02 | ..... | 2.51 | .43 | 1.93 | 1.10 | 1.13 | 2.50 |
| 30 | .27 | ..... | 2.79 | 1.43 | 1.00 | .97 | 2.33 | .43 | 2.00 | 1.10 | ..... | 2.58 |
| 31 | .09 | ..... | 3.65 | ..... | .55 | ..... | 2.09 | ..... | ..... | 1.00 | ..... | 2.60 |

*Mean daily gage height, in feet, of Grand River at Wealthy avenue, Grand Rapids, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 7.39 | 6.65 | 10.52 | 11.64 | 8.10 | ..... | 8.33 | 8.86 | 5.53 | 9.33 | 7.88 | 8.08 |
| 2 | 7.42 | 6.41 | 10.86 | 12.08 | 7.90 | 7.35 | 8.80 | 8.86 | 5.66 | 9.40 | ..... | 8.08 |
| 3 | 7.67 | 6.71 | 10.92 | 12.20 | 7.83 | 7.45 | 12.79 | ..... | 5.53 | 9.25 | 7.73 | 8.45 |
| 4 | 7.48 | 6.59 | 10.95 | 12.06 | 7.98 | 7.55 | 13.93 | 8.47 | 5.78 | 9.10 | 7.78 | 8.90 |
| 5 | 7.30 | 6.51 | 10.74 | 11.65 | 8.05 | 7.71 | 14.25 | 8.31 | 5.86 | ..... | 8.03 | 9.30 |
| 6 | 7.44 | 6.42 | 10.21 | 11.34 | 8.93 | 7.54 | ..... | 8.09 | 5.95 | ..... | 9.15 | 9.60 |
| 7 | 7.22 | 6.57 | 9.61 | 11.08 | 10.54 | 7.70 | 14.33 | 8.00 | ..... | 8.23 | 9.75 | ..... |
| 8 | 7.13 | 6.59 | 9.34 | 10.66 | 11.69 | ..... | 14.38 | 7.78 | 5.75 | 8.20 | 10.28 | 8.95 |
| 9 | 7.11 | 6.47 | 9.08 | 10.35 | 12.06 | 7.73 | 14.54 | 7.54 | 5.84 | 8.28 | ..... | 8.55 |
| 10 | 7.12 | 6.69 | 8.71 | 10.02 | 12.42 | 8.19 | 14.04 | ..... | 5.83 | 8.28 | 10.05 | 8.40 |
| 11 | 7.23 | 6.52 | 8.65 | 9.74 | 12.26 | 8.31 | 13.13 | 7.44 | 5.71 | 8.10 | 9.75 | 8.35 |
| 12 | 7.22 | 6.46 | 9.55 | 9.47 | 11.95 | 8.17 | 11.77 | 7.33 | 5.73 | ..... | 9.53 | 8.18 |
| 13 | 7.29 | 6.45 | 12.56 | 9.14 | 11.50 | 8.05 | ..... | 7.20 | 5.72 | 8.80 | 9.30 | 8.15 |
| 14 | 7.15 | 6.44 | 13.13 | 8.88 | 11.13 | 8.06 | 10.75 | 7.06 | ..... | 9.00 | 9.22 | ..... |
| 15 | 7.05 | 6.39 | 13.22 | 8.70 | 10.70 | ..... | 10.28 | 6.93 | 5.49 | 9.13 | 9.40 | ..... |
| 16 | 6.96 | 6.18 | 13.33 | 8.40 | 11.36 | 8.82 | 9.95 | 6.88 | 5.52 | 8.90 | ..... | ..... |
| 17 | 6.87 | 6.61 | 13.08 | 8.19 | 9.93 | 8.98 | 9.59 | ..... | 5.50 | 8.68 | 9.38 | ..... |
| 18 | 6.80 | 6.50 | 12.55 | 8.07 | ..... | 8.87 | 9.29 | 6.60 | 5.53 | 8.40 | 9.40 | ..... |
| 19 | 6.60 | 6.55 | 11.84 | 7.84 | 9.85 | 8.68 | 9.33 | 6.56 | 5.69 | ..... | 9.28 | ..... |
| 20 | 6.75 | 6.29 | 11.30 | 7.65 | 9.87 | 8.59 | ..... | 6.49 | 5.89 | 8.15 | 9.18 | ..... |
| 21 | 6.65 | 6.38 | 10.92 | 7.72 | 9.69 | 8.50 | 9.77 | 6.44 | ..... | 7.98 | 9.13 | ..... |
| 22 | 6.53 | 6.30 | 10.53 | 7.59 | 9.64 | ..... | 10.08 | 6.38 | 5.73 | 7.98 | 9.03 | ..... |
| 23 | 6.47 | 6.61 | 10.13 | 7.46 | 9.58 | 8.01 | 10.41 | 6.32 | 5.98 | 8.08 | ..... | ..... |
| 24 | 6.55 | 6.84 | 9.90 | 7.33 | 9.54 | 7.89 | 10.52 | ..... | 6.71 | 8.03 | 8.88 | ..... |
| 25 | 6.41 | 6.74 | 9.52 | 7.24 | ..... | 7.88 | 10.29 | 6.18 | 7.09 | 8.00 | 8.70 | ..... |
| 26 | 6.27 | 6.79 | 9.26 | 7.38 | 8.95 | 7.74 | 10.16 | 6.22 | 7.39 | ..... | 8.48 | ..... |
| 27 | 6.40 | 7.23 | 9.00 | 7.71 | 8.56 | 7.63 | ..... | 6.05 | 8.14 | 8.05 | ..... | ..... |
| 28 | 7.57 | 8.79 | 8.94 | 8.20 | 8.23 | 7.50 | 9.77 | 5.97 | ..... | 8.05 | 8.13 | ..... |
| 29 | 7.21 | ..... | 9.18 | 8.43 | 7.93 | ..... | 9.58 | 5.90 | 8.85 | 8.05 | 8.08 | ..... |
| 30 | 6.94 | ..... | 9.83 | 8.35 | 7.74 | 7.88 | 9.44 | 5.84 | 8.93 | 8.05 | ..... | ..... |
| 31 | 6.80 | ..... | 10.68 | ..... | 7.40 | ..... | 9.18 | ..... | ..... | 7.95 | ..... | ..... |

*Mean daily discharge, in second-feet, of Grand River at Fulton street, Grand Rapids, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | ..... | ..... | ..... | 18,255 | 4,240 | 2,810 | 2,332 | 2,810 | 3,008 | 1,500 | 2,076 | 1,884 |
| 2 | ..... | ..... | ..... | 15,556 | 3,960 | 2,546 | 2,076 | 2,744 | 2,678 | 1,538 | 2,076 | 2,142 |
| 3 | ..... | ..... | ..... | 13,380 | 3,536 | 2,480 | 2,076 | 2,398 | 2,332 | 1,628 | 1,948 | 2,076 |
| 4 | ..... | ..... | ..... | 11,500 | 3,272 | 2,480 | 1,666 | 2,076 | 2,204 | 1,500 | 2,076 | 1,948 |
| 5 | ..... | ..... | ..... | 9,770 | 3,074 | 2,398 | 8,488 | 2,332 | 2,014 | 1,396 | 2,014 | 1,729 |
| 6 | ..... | ..... | ..... | 8,565 | 2,876 | 2,332 | 11,680 | 1,692 | 1,820 | 1,206 | 2,014 | 1,436 |
| 7 | ..... | ..... | ..... | 7,805 | 2,678 | 2,204 | 11,950 | 1,948 | 1,742 | 1,436 | 2,948 | 1,372 |
| 8 | ..... | ..... | ..... | 7,280 | 2,942 | 2,014 | 11,382 | 1,884 | 1,564 | 1,372 | 2,014 | 1,410 |
| 9 | ..... | ..... | ..... | 6,680 | 3,140 | 1,756 | 10,268 | 1,820 | 1,500 | 1,372 | 1,884 | 2,014 |
| 10 | ..... | ..... | ..... | 6,179 | 3,536 | 1,860 | 8,719 | 1,756 | 1,500 | 1,334 | 1,756 | 2,014 |
| 11 | ..... | ..... | ..... | 5,814 | 3,744 | 2,204 | 7,205 | 1,110 | 1,666 | 1,436 | 1,948 | 2,076 |
| 12 | ..... | ..... | 4,240 | 5,303 | 4,176 | 2,204 | 7,355 | 1,732 | 2,146 | 1,604 | 2,076 | 2,142 |
| 13 | ..... | ..... | 5,010 | 4,800 | 4,176 | 2,480 | 4,940 | 1,666 | 2,332 | 1,500 | 2,270 | 2,398 |
| 14 | ..... | ..... | 6,252 | 4,660 | 3,820 | 2,810 | 4,030 | 1,564 | 2,076 | 730 | 2,204 | 3,272 |
| 15 | ..... | ..... | 7,430 | 4,240 | 3,612 | 3,404 | 3,612 | 1,476 | 2,270 | 3,744 | 2,204 | 2,546 |
| 16 | ..... | ..... | 7,880 | 4,030 | 3,272 | 3,206 | 3,140 | 1,396 | 2,332 | 4,590 | 2,204 | 2,546 |
| 17 | ..... | ..... | 8,030 | 3,960 | 3,008 | 3,272 | 2,876 | 1,308 | 2,270 | 4,240 | 1,948 | 4,590 |
| 18 | ..... | ..... | 9,258 | 4,240 | 2,678 | 3,008 | 2,810 | 1,040 | 2,142 | 4,100 | 2,076 | 4,730 |
| 19 | ..... | ..... | 12,220 | 4,660 | 2,546 | 2,810 | 2,678 | 1,372 | 1,948 | 3,744 | 2,010 | 4,800 |
| 20 | ..... | ..... | 15,556 | 4,940 | 2,546 | 2,678 | 2,398 | 2,204 | 1,874 | 3,404 | 2,010 | 5,010 |
| 21 | ..... | ..... | 16,998 | 4,940 | 2,480 | 2,480 | 2,142 | 2,142 | 1,820 | 3,206 | 2,010 | 4,730 |
| 22 | ..... | ..... | 18,600 | 4,870 | 2,546 | 2,204 | 2,270 | 1,884 | 1,614 | 2,876 | 1,948 | 5,230 |
| 23 | ..... | ..... | 20,100 | 5,010 | 2,744 | 2,014 | 2,142 | 2,014 | 1,846 | 2,810 | 2,014 | 5,230 |
| 24 | ..... | ..... | 20,500 | 5,522 | 2,744 | 2,014 | 2,076 | 2,014 | 1,692 | 2,810 | 1,948 | 5,010 |
| 25 | ..... | ..... | 22,100 | 5,960 | 2,942 | 2,142 | 2,142 | 1,884 | 1,604 | 2,678 | 2,142 | 4,940 |
| 26 | ..... | ..... | 23,800 | 5,960 | 3,272 | 1,948 | 2,480 | 2,142 | 1,614 | 2,480 | 2,142 | 4,660 |
| 27 | ..... | ..... | 25,600 | 6,106 | 3,404 | 2,014 | 2,810 | 2,076 | 1,618 | 2,142 | 2,076 | 6,536 |
| 28 | ..... | ..... | 26,480 | 5,376 | 3,348 | 1,742 | 2,612 | 2,076 | 1,564 | 2,398 | 1,948 | 3,348 |
| 29 | ..... | ..... | 25,300 | 4,940 | 3,206 | 1,860 | 3,140 | 1,948 | 1,362 | 2,270 | 2,142 | 2,876 |
| 30 | ..... | ..... | 23,200 | 4,520 | 3,074 | 2,204 | 3,074 | 2,014 | 1,564 | 2,204 | 2,076 | 3,820 |
| 31 | ..... | ..... | 20,700 | ..... | 2,876 | ..... | 3,140 | 2,270 | ..... | 2,204 | ..... | 2,678 |
| Mean | ..... | ..... | 15,963 | 6,827 | 3,209 | 2,386 | 4,507 | 1,864 | 1,924 | 2,305 | 2,073 | 3,168 |

*Mean daily discharge, in second-feet, of Grand River at Fulton street, Grand Rapids, Mich.*—Continued.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 2,612 | 1,948 | 6,471 | 8,411 | 3,470 | ..... | 3,820 | 4,380 | 2,942 | 5,150 | 3,140 | 3,404 |
| 2 | 2,546 | 1,692 | 7,053 | 9,027 | 3,196 | 2,612 | 4,380 | 4,176 | 2,612 | 5,150 | ..... | 3,404 |
| 3 | 2,942 | 2,076 | 7,203 | 9,258 | 3,196 | 2,678 | 10,179 | ..... | 2,810 | 5,010 | 2,942 | 3,896 |
| 4 | 2,744 | 2,014 | 7,353 | 9,027 | 3,348 | 2,810 | 12,130 | 3,820 | 2,612 | 4,800 | 3,008 | 4,520 |
| 5 | 2,612 | 2,076 | 6,980 | 8,488 | 4,100 | 3,008 | 12,760 | 3,612 | 2,270 | ..... | 3,348 | 5,080 |
| 6 | 2,810 | 2,142 | 6,325 | 7,957 | 4,586 | 2,810 | ..... | 3,206 | 2,332 | ..... | 4,730 | 5,522 |
| 7 | 2,398 | 2,142 | 5,376 | 7,430 | 6,836 | 3,008 | 12,940 | 3,140 | ..... | 3,612 | 5,738 | ..... |
| 8 | 2,204 | 2,014 | 5,010 | 7,053 | 8,488 | ..... | 12,940 | 2,942 | 2,612 | 3,612 | 6,544 | 4,596 |
| 9 | 2,204 | 1,794 | 4,730 | 6,544 | 8,950 | 3,074 | 13,260 | 2,678 | 2,744 | 3,668 | ..... | 4,036 |
| 10 | 2,270 | 2,142 | 4,240 | 6,106 | 9,566 | 3,612 | 12,310 | ..... | 2,480 | 3,612 | 6,179 | 3,820 |
| 11 | 2,332 | 2,014 | 4,176 | 5,668 | 9,335 | 3,744 | 10,680 | 2,480 | 2,678 | 3,404 | 5,738 | 3,820 |
| 12 | 2,204 | 1,846 | 5,376 | 5,300 | 8,873 | 3,612 | 9,104 | 2,398 | 2,546 | ..... | 5,446 | 3,536 |
| 13 | 2,480 | 1,948 | 9,770 | 4,730 | 8,180 | 3,404 | ..... | 2,398 | 2,810 | 4,456 | 5,080 | 3,480 |
| 14 | 2,270 | 1,820 | 10,600 | 4,456 | 7,657 | 3,480 | 7,053 | 2,204 | ..... | 4,660 | 4,940 | ..... |
| 15 | 2,270 | 1,794 | 10,932 | 4,240 | 7,053 | ..... | 6,252 | 2,076 | 2,810 | 4,800 | 5,230 | 3,348 |
| 16 | 2,042 | 1,524 | 11,098 | 3,820 | 6,544 | 4,520 | 5,738 | 2,076 | 2,876 | 4,520 | ..... | 3,612 |
| 17 | 2,270 | 2,014 | 10,600 | 3,536 | 5,960 | 4,660 | 5,230 | ..... | 2,810 | 4,176 | 5,230 | 3,820 |
| 18 | 1,884 | 1,742 | 9,770 | 3,404 | ..... | 4,520 | 4,940 | 1,948 | 2,678 | 3,820 | 5,230 | 3,896 |
| 19 | 1,780 | 1,820 | 9,412 | 3,216 | 5,814 | 4,240 | 4,940 | 2,076 | 2,546 | ..... | 5,080 | 3,960 |
| 20 | 2,014 | 1,628 | 7,880 | 3,008 | 5,814 | 4,100 | ..... | 2,142 | 2,546 | 3,536 | 4,940 | 4,316 |
| 21 | 1,666 | 1,628 | 7,280 | 2,876 | 5,668 | 3,960 | 5,738 | 2,076 | ..... | 3,348 | 4,870 | ..... |
| 22 | 1,628 | 1,628 | 6,836 | 2,810 | 5,592 | ..... | 6,179 | 2,076 | 2,546 | 3,272 | 4,730 | 6,980 |
| 23 | 2,142 | 1,564 | 6,252 | 2,678 | 5,446 | 3,404 | 6,617 | 2,142 | 2,398 | 3,348 | ..... | 7,430 |
| 24 | 1,756 | 1,884 | 5,814 | 2,546 | 5,376 | 3,216 | 6,680 | ..... | 2,142 | 3,272 | 4,520 | 6,980 |
| 25 | 2,142 | 1,628 | 5,300 | 2,480 | ..... | 3,216 | 6,325 | 2,204 | 2,332 | 3,272 | 4,316 | ..... |
| 26 | 1,538 | 1,948 | 5,010 | 2,678 | 4,590 | 3,074 | 6,252 | 2,142 | 2,612 | ..... | 3,960 | 6,617 |
| 27 | 2,546 | 2,398 | 4,660 | 3,074 | 4,100 | 3,008 | ..... | 2,398 | 3,612 | 3,348 | ..... | 5,884 |
| 28 | 2,744 | 4,176 | 4,590 | 3,668 | 3,612 | 2,744 | 5,592 | 2,480 | ..... | 3,348 | 3,480 | ..... |
| 29 | 2,332 | ..... | 4,870 | 3,886 | 3,196 | ..... | 5,300 | 2,480 | 4,520 | 3,348 | 3,404 | 5,300 |
| 30 | 2,204 | ..... | 5,738 | 3,820 | 3,206 | 3,140 | 5,080 | 2,480 | 4,596 | 3,348 | ..... | 5,446 |
| 31 | 2,014 | ..... | 6,980 | ..... | 2,612 | ..... | 4,730 | ..... | ..... | 3,206 | ..... | 5,446 |
| Mean | 2,245 | 1,965 | 6,893 | 5,039 | 5,667 | 3,426 | 7,709 | 2,624 | 2,787 | 3,888 | 4,659 | 4,698 |

*Estimated monthly discharge of Grand River at Grand Rapids, Mich.*

[Drainage area, 4,900 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| March | 26,480 | 4,240 | 15,963 | 3.25 | 3.75 |
| April | 18,255 | 3,960 | 6,827 | 1.39 | 1.55 |
| May | 4,240 | 2,480 | 3,209 | .66 | .76 |
| June | 3,404 | 1,742 | 2,386 | .49 | .55 |
| July | 11,950 | 1,666 | 4,507 | .92 | 1.06 |
| August | 2,810 | 1,040 | 1,864 | .38 | .44 |
| September | 3,008 | 1,362 | 1,924 | .39 | .44 |
| October | 4,590 | 730 | 2,305 | .47 | .54 |
| November | 2,948 | 1,756 | 2,073 | .42 | .47 |
| December | 5,230 | 1,372 | 3,168 | .65 | .75 |
| The year | 26,480 | 730 | ..... | ..... | 10.33 |
| 1902. | | | | | |
| January | 2,942 | 1,628 | 2,245 | .46 | .53 |
| February | 4,176 | 1,524 | 1,965 | .40 | .42 |
| March | 11,098 | 4,176 | 6,893 | 1.41 | 1.63 |
| April | 9,258 | 2,480 | 5,039 | 1.03 | 1.15 |
| May | 9,566 | 3,196 | 5,667 | 1.15 | 1.33 |
| June | 4,660 | 2,612 | 3,426 | .70 | .78 |
| July | 13,260 | 3,820 | 7,709 | 1.57 | 1.81 |
| August | 4,380 | 1,948 | 2,624 | .53 | .61 |
| September | 4,596 | 2,142 | 2,787 | .57 | .63 |
| October | 5,150 | 3,272 | 3,888 | .79 | .91 |
| November | 6,544 | 3,008 | 4,659 | .95 | 1.05 |
| December | 7,430 | 3,348 | 4,698 | .96 | 1.10 |
| The year | 13,260 | 1,524 | 4,300 | .88 | 11.95 |

## CROCKERY CREEK AT SLOCUMS GROVE, MICHIGAN.

Crockery Creek is a tributary of Grand River, Michigan. It rises in T. 11 N., R. 13 W., and flows southerly through central Muskegon County, entering Grand River 10 miles from Lake Michigan. A gaging station was established at the Toledo, Saginaw and Muskegon (Pere Marquette system) Railroad bridge at Slocum Station, on the north branch of the stream, October 1, 1902. The gaging station was

established in cooperation with Charles W. Garfield, president of the State forestry commission, and Walter C. Winchester, of the Foster-Winchester Lumber Company, of Grand Rapids. The gage scale is attached vertically to the bridge piling on the left-hand end, downstream side of bridge. A reading was taken once each day, as a rule, during a part of November and December, 1902, by Ray M. Beardsley. December 6, 1902, the record was discontinued for the winter, owing to obstruction of the stream channel by ice.

The bench mark is the top of the timber pile coping over the gage; elevation, 100 feet. The elevation of the zero of the gage is 82.43 feet.

The gage is located about 1,000 feet below a dam forming a log pond for the Foster-Winchester sawmill. The pond level is regulated by flashboards, and the flow past the gage varies accordingly. A discharge measurement by W. V. Savicki, October 4, 1902. gage height 1.4, gave a discharge of 97.7 second-feet.

The drainage area, as nearly as may be determined in the absence of topographic maps, is as follows:[a]

*Crockery Creek drainage area.*

| Location. | Square miles. | Increment, square miles. |
|---|---|---|
| Above Slocum | 45 | ..... |
| Above mouth | 174 | 129 |

The length of the stream above the gaging station is about 10 miles. Beginning at Slocum, extending upstream and covering an aggregate area of between 5,000 and 6,000 acres, is a hard-wood and hemlock forest which is now being lumbered. The remainder of the basin is mostly cleared and much is under cultivation. The soil is sandy, and after the timber is cut the hitherto forest-covered area rapidly grows up to brush and shrubs, so that the soil is shaded and protected much as in the original forest.

Aside from the lumbering dam at Slocum, there are no lakes or dams within the basin above the point of gaging.

[a] From John F. Nellist, road map of Lower Michigan.

*Daily gage height, in feet, of Crockery Creek at Slocums Grove, Mich.*

| Date. | Gage height. | Date. | Gage height. |
|---|---|---|---|
| 1902. | *Feet.* | 1902. | *Feet.* |
| October 31 | 1.3 | November 13 | 0.7 |
| November 1 | 1.2 | November 14 | .8 |
| November 2 | 1.1 | November 15 | .8 |
| November 3 | 1.1 | November 16 | 1.1 |
| November 4 | 1.0 | November 17 | 1.1 |
| November 5 | 2.4 | November 18 | 1.2 |
| November 6 | 2.3 | November 19 | 1.1 |
| November 7 | 1.5 | November 20 | 1.0 |
| November 8 | ..... | November 21 | 1.2 |
| November 9 | 1.3 | November 22 | 1.1 |
| November 10 | 1.4 | December 4 | 1.2 |
| November 11 | 1.3 | December 5 | 1.3 |
| November 12 | .8 | December 6 | 1.3 |

GRAND RIVER AT NORTH LANSING, MICH.

The gaging station, which is located at Seymour street bridge, North Lansing, was established by H. K. Vedder, C. E., March 2, 1901. The gage is attached vertically to the downstream end of the central pier of the bridge, and is read twice each day by Thomas Costigan. The bridge has two spans of 92 feet each. The bed is of earth and the current is smooth and uniform.

About November 8, 1901, a low submerged dam was constructed a short distance downstream from the gaging station to furnish water supply to the adjacent factory of the Michigan Beet Sugar Company during its season of operation. In this factory the beets are transferred from the storage bins to the various operations by floating in troughs of water. The diversion is small, compared with the flow of the stream. In order to determine the effect of the submerged dam on the gage readings, a second gage has been established a short distance downstream and comparative readings have been taken, from which the gage readings prior to the construction of the dam have been corrected to conform to the later readings. A rating table has been prepared by means of discharge measurements made during 1902 and 1903.

The gaging station is located a short distance below the North Lansing dam and is but little affected by ice. Water-power improvements and extensions are contemplated on this stream at North Lansing, and at Delta, 8 miles below.

*Discharge measurements of Grand River at Seymour street, North Lansing, Mich.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| March 22 | H. K. Vedder | 4.36 | 1,386 |
| August 27 | R. E. Horton | [a] 2.50 | [a] 382 |
| August 30 | do | [a] 2.46 | 337 |
| September 30 | W. M. Gregory | 1.80 | 299 |
| October 6 | W. V. Savicki | 4.58 | 1,548 |
| October 8 | do | 5.40 | 1,994 |
| October 10 | do | 4.27 | 1,290 |

[a] Gage height raised by temporary extension of submerged dam below.

*Mean daily gage height, in feet, of Grand River at North Lansing, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 3.36 | 1.54 | 5.66 | 6.20 | 3.30 | 2.75 | 5.23 | 4.15 | 2.20 | 5.68 | 2.47 | 2.91 |
| 2 | 3.21 | 1.60 | 5.60 | 6.09 | 3.30 | 2.90 | 5.60 | 4.40 | 2.45 | 5.33 | 2.75 | 2.99 |
| 3 | 3.02 | 2.10 | 5.20 | 5.71 | 3.15 | 2.95 | 6.54 | 4.20 | 2.30 | 4.83 | 2.69 | 3.66 |
| 4 | 2.85 | 2.28 | 4.80 | 5.50 | 3.34 | 3.08 | 7.65 | 3.95 | 2.35 | 4.33 | 2.63 | 4.40 |
| 5 | 2.55 | 2.35 | 4.51 | 5.30 | 3.52 | 2.84 | 9.73 | 3.69 | 1.83 | 4.00 | 2.67 | 4.35 |
| 6 | 2.75 | 2.40 | 4.19 | 4.98 | 3.90 | 2.65 | 9.50 | 3.56 | 2.20 | 4.34 | 3.35 | 4.00 |
| 7 | 3.05 | 2.90 | 3.89 | 4.73 | 5.60 | 3.50 | 8.23 | 3.39 | 1.90 | 4.68 | 3.82 | 3.86 |
| 8 | 3.12 | 2.95 | 3.94 | 4.49 | 6.69 | 4.36 | 6.84 | 3.37 | 2.05 | 4.52 | 3.85 | 3.60 |
| 9 | 2.86 | 1.80 | 3.84 | 4.35 | 6.36 | 4.72 | 6.20 | 3.25 | 2.05 | 4.30 | 3.63 | 3.13 |
| 10 | 3.14 | 2.43 | 3.92 | 4.20 | 5.70 | 4.40 | 5.56 | 3.29 | 2.10 | 4.00 | 3.42 | 2.96 |
| 11 | 2.93 | 2.56 | 4.02 | 4.00 | 5.43 | 4.04 | 5.04 | 3.22 | 2.15 | 3.68 | 3.30 | 3.02 |
| 12 | 2.50 | 2.45 | 4.86 | 3.90 | 4.94 | 3.68 | 4.63 | 3.06 | 2.08 | 3.70 | 3.28 | 3.12 |
| 13 | 2.65 | 2.31 | 6.05 | 3.76 | 4.62 | 3.75 | 4.43 | 3.13 | 2.15 | 3.49 | 3.08 | 2.74 |
| 14 | 3.05 | 2.34 | 6.08 | 3.60 | 4.49 | 4.63 | 4.26 | 3.00 | 2.09 | 3.48 | 3.25 | 2.58 |
| 15 | 3.05 | 2.80 | 5.74 | 3.50 | 4.45 | 5.03 | 4.08 | 3.00 | 2.13 | 3.43 | 3.30 | 2.77 |
| 16 | 3.00 | 1.40 | 5.29 | 3.44 | 4.16 | 5.05 | 3.91 | 3.05 | 2.13 | 3.39 | 3.33 | 2.78 |
| 17 | 2.93 | 2.60 | 5.49 | 3.25 | 3.74 | 4.99 | 3.68 | 2.90 | 1.85 | 3.27 | 3.56 | 3.00 |
| 18 | 3.33 | 2.50 | 4.95 | 3.20 | 3.90 | 4.91 | 3.79 | 2.75 | 1.95 | 3.18 | 3.90 | 3.20 |
| 19 | 2.65 | 2.35 | 4.59 | 3.13 | 4.43 | 4.36 | 4.28 | 2.73 | 1.89 | 3.31 | 3.78 | 3.19 |
| 20 | 2.79 | 2.20 | 4.47 | 3.27 | 4.84 | 4.30 | 5.50 | 2.72 | 1.78 | 3.28 | 3.66 | 3.23 |
| 21 | 2.85 | 2.73 | 4.25 | 3.00 | 4.85 | 3.91 | 6.08 | 2.48 | 2.02 | 3.24 | 3.40 | 4.00 |
| 22 | 2.74 | 2.40 | 4.11 | 3.00 | 4.69 | 3.75 | 6.24 | 2.28 | 1.85 | 3.27 | 3.35 | 4.80 |
| 23 | 2.75 | 1.25 | 4.17 | 2.70 | 4.29 | 3.48 | 5.90 | 2.23 | 2.03 | 3.04 | 3.31 | 5.18 |
| 24 | 2.58 | 1.90 | 3.95 | 2.55 | 4.00 | 3.15 | 5.46 | 2.51 | 2.33 | 2.89 | 3.13 | 4.76 |
| 25 | 2.74 | 2.40 | 3.87 | 2.76 | 3.82 | 3.24 | 5.03 | 2.59 | 4.43 | 2.77 | 3.01 | 3.70 |
| 26 | 2.18 | 2.28 | 3.72 | 4.10 | 3.72 | 3.00 | 4.65 | 2.39 | 5.13 | 2.81 | 2.85 | 3.37 |
| 27 | 2.75 | 4.04 | 3.55 | 4.65 | 3.41 | 2.90 | 4.65 | 2.26 | 4.84 | 2.98 | 2.89 | 3.45 |
| 28 | 2.90 | 5.00 | 3.49 | 4.25 | 3.12 | 2.73 | 4.30 | 2.15 | 5.66 | 3.16 | 2.79 | 3.50 |
| 29 | 2.78 | ..... | 4.38 | 3.88 | 3.14 | 3.15 | 4.16 | 2.28 | 5.79 | 3.00 | 2.81 | 3.63 |
| 30 | 4.34 | ..... | 5.08 | 3.60 | 3.05 | 4.10 | 3.89 | 2.13 | 5.94 | 2.87 | 2.91 | 3.60 |
| 31 | 2.18 | ..... | 5.60 | ..... | 2.88 | ..... | 3.69 | 1.95 | ..... | 2.63 | ..... | 3.37 |

*Mean daily discharge, in second-feet, of Grand River at North Lansing, Mich.*

| Day. | Jan. | Feb. | Mar. | Apr. | May | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | ..... | ..... | ..... | 2,22 | 653 | 488 | 577 | 864 | 577 | 440 | 360 | 456 |
| 2 | ..... | ..... | ..... | 1,998 | 653 | 539 | 577 | 732 | 577 | 332 | 360 | 424 |
| 3 | ..... | ..... | 456 | 1,874 | 577 | 488 | 520 | 710 | 754 | 318 | 206 | 424 |
| 4 | ..... | ..... | 558 | 1,630 | 520 | 392 | 504 | 539 | 886 | 332 | 304 | 424 |
| 5 | ..... | ..... | 634 | 1,510 | 504 | 360 | 1,750 | 930 | 710 | 276 | 332 | 392 |
| 6 | ..... | ..... | 710 | 1,450 | 456 | 346 | 3,262 | 732 | 732 | 290 | 332 | 424 |
| 7 | ..... | ..... | 672 | 1,480 | 456 | 332 | 2,801 | 615 | 672 | 248 | 346 | 392 |
| 8 | ..... | ..... | 615 | 1,396 | 472 | 304 | 2,258 | 1,080 | 615 | 248 | 304 | 392 |
| 9 | ..... | ..... | 615 | 1,342 | 691 | 290 | 1,750 | 672 | 577 | 234 | 276 | 440 |
| 10 | ..... | ..... | 864 | 1,261 | 1,005 | 290 | 1,396 | 596 | 472 | 248 | 178 | 558 |
| 11 | ..... | ..... | 1,261 | 1,080 | 1,080 | 346 | 1,055 | 577 | 488 | 304 | 376 | 864 |
| 12 | ..... | ..... | 1,630 | 1,005 | 1,055 | 262 | 842 | 776 | 634 | 248 | 440 | 908 |
| 13 | ..... | ..... | 1,812 | 980 | 456 | 446 | 691 | 710 | 798 | 1,261 | 456 | 1,005 |
| 14 | ..... | ..... | 2,258 | 930 | 691 | 536 | 634 | 691 | 653 | 1,843 | 596 | 1,261 |
| 15 | ..... | ..... | 842 | 886 | 558 | 440 | 634 | 577 | 346 | 1,812 | 596 | 1,423 |
| 16 | ..... | ..... | 2,323 | 820 | 504 | 488 | 615 | 615 | 577 | 1,660 | 634 | 1,570 |
| 17 | ..... | ..... | 2,649 | 842 | 440 | 440 | 488 | 488 | 504 | 1,369 | 524 | 1,570 |
| 18 | ..... | ..... | 3,446 | 930 | 376 | 318 | 539 | 504 | 456 | 1,030 | 577 | 1,570 |
| 19 | ..... | ..... | 6,120 | 1,180 | 424 | 392 | 615 | 691 | 332 | 908 | 596 | 1,480 |
| 20 | ..... | ..... | 8,792 | 1,180 | 424 | 332 | 596 | 615 | 424 | 776 | 558 | 1,315 |
| 21 | ..... | ..... | 9,035 | 1,130 | 360 | 304 | 539 | 577 | 488 | 710 | 634 | 1,130 |
| 22 | ..... | ..... | 7,577 | 1,396 | 392 | 304 | 577 | 634 | 456 | 634 | 539 | 930 |
| 23 | ..... | ..... | 6,387 | 1,600 | 392 | 332 | 634 | 710 | 520 | 615 | 440 | 754 |
| 24 | ..... | ..... | 7,010 | 1,812 | 504 | 290 | 583 | 732 | 472 | 504 | 392 | 615 |
| 25 | ..... | ..... | 5,898 | 1,690 | 710 | 304 | 456 | 791 | 392 | 577 | 348 | 504 |
| 26 | ..... | ..... | 6,298 | 1,510 | 776 | 472 | 424 | 754 | 440 | 488 | 376 | 577 |
| 27 | ..... | ..... | 5,676 | 1,261 | 776 | 691 | 798 | 732 | 424 | 392 | 634 | 520 |
| 28 | ..... | ..... | 4,362 | 1,055 | 710 | 710 | 886 | 864 | 440 | 408 | 440 | 615 |
| 29 | ..... | ..... | 3,584 | 908 | 672 | 672 | 886 | 842 | 276 | 376 | 539 | 710 |
| 30 | ..... | ..... | 2,924 | 798 | 520 | 615 | 886 | 930 | 472 | 408 | 360 | 776 |
| 31 | ..... | ..... | 2,538 | ..... | 691 | ..... | 820 | 886 | ..... | 346 | ..... | 798 |

*Mean daily discharge, in second-feet, of Grand River at North Lansing, Mich.*—Cont'd.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 864 | 234 | 2,159 | 2,538 | 842 | 612 | 1,905 | 1,261 | 248 | 2,192 | 504 | 672 |
| 2 | 798 | 248 | 2,126 | 2,464 | 842 | 672 | 2,126 | 1,396 | 318 | 1,967 | 615 | 710 |
| 3 | 710 | 392 | 1,874 | 2,192 | 776 | 694 | 2,801 | 1,288 | 276 | 1,660 | 596 | 1,005 |
| 4 | 653 | 456 | 1,630 | 2,060 | 864 | 754 | 3,780 | 1,155 | 290 | 1,369 | 577 | 1,396 |
| 5 | 539 | 472 | 1,450 | 1,936 | 930 | 653 | 6,565 | 1,030 | 150 | 1,180 | 577 | 1,369 |
| 6 | 615 | 488 | 1,288 | 1,750 | 1,130 | 577 | 6,120 | 955 | 248 | 1,369 | 864 | 1,180 |
| 7 | 732 | 672 | 1,130 | 1,600 | 2,126 | 930 | 4,420 | 886 | 164 | 1,570 | 1,080 | 1,105 |
| 8 | 754 | 691 | 1,155 | 1,450 | 2,924 | 1,369 | 3,047 | 864 | 206 | 1,450 | 1,105 | 980 |
| 9 | 653 | 304 | 1,105 | 1,369 | 2,649 | 1,570 | 2,538 | 820 | 206 | 1,342 | 1,005 | 776 |
| 10 | 776 | 504 | 1,130 | 1,288 | 2,192 | 1,396 | 2,091 | 842 | 220 | 1,180 | 886 | 694 |
| 11 | 672 | 539 | 1,180 | 1,180 | 2,029 | 1,207 | 1,781 | 798 | 234 | 1,030 | 842 | 710 |
| 12 | 520 | 504 | 1,660 | 1,130 | 1,720 | 1,030 | 1,540 | 732 | 220 | 1,030 | 842 | 754 |
| 13 | 574 | 456 | 2,427 | 1,055 | 1,510 | 1,055 | 1,423 | 776 | 234 | 930 | 754 | 615 |
| 14 | 732 | 472 | 2,464 | 980 | 1,450 | 1,510 | 1,315 | 710 | 220 | 930 | 820 | 558 |
| 15 | 732 | 634 | 2,225 | 930 | 1,423 | 1,781 | 1,234 | 710 | 234 | 908 | 842 | 615 |
| 16 | 710 | 192 | 1,936 | 908 | 1,261 | 1,781 | 1,130 | 732 | 408 | 886 | 886 | 634 |
| 17 | 791 | 558 | 2,060 | 820 | 1,055 | 1,750 | 1,030 | 672 | 318 | 842 | 955 | 710 |
| 18 | 864 | 520 | 1,720 | 798 | 1,130 | 1,690 | 1,080 | 615 | 346 | 798 | 1,130 | 798 |
| 19 | 574 | 472 | 1,510 | 776 | 1,423 | 1,369 | 1,342 | 615 | 332 | 842 | 1,080 | 798 |
| 20 | 634 | 424 | 1,423 | 820 | 1,657 | 1,342 | 2,060 | 596 | 304 | 842 | 1,005 | 820 |
| 21 | 653 | 615 | 1,315 | 710 | 1,660 | 1,130 | 2,464 | 520 | 360 | 820 | 886 | 440 |
| 22 | 615 | 488 | 1,234 | 710 | 1,570 | 1,055 | 2,575 | 456 | 318 | 842 | 864 | 732 |
| 23 | 615 | 150 | 1,261 | 596 | 1,342 | 930 | 2,324 | 440 | 376 | 732 | 842 | 908 |
| 24 | 558 | 332 | 1,155 | 539 | 1,180 | 776 | 2,029 | 520 | 472 | 672 | 776 | 710 |
| 25 | 615 | 488 | 1,105 | 615 | 1,080 | 820 | 1,781 | 558 | 1,423 | 615 | 710 | 346 |
| 26 | 424 | 456 | 1,030 | 1,234 | 1,030 | 710 | 1,540 | 488 | 1,843 | 634 | 653 | 248 |
| 27 | 615 | 1,207 | 955 | 1,540 | 886 | 672 | 1,540 | 440 | 1,657 | 710 | 672 | 276 |
| 28 | 672 | 1,750 | 930 | 1,315 | 754 | 612 | 1,342 | 234 | 2,159 | 776 | 634 | 290 |
| 29 | 634 | ..... | 1,396 | 1,130 | 776 | 776 | 1,261 | 276 | 2,258 | 710 | 634 | 1,005 |
| 30 | 1,369 | ..... | 1,812 | 980 | 732 | 1,234 | 1,130 | 234 | 2,357 | 672 | 672 | 980 |
| 31 | 424 | ..... | 2,126 | ..... | 672 | ..... | 1,030 | 178 | ..... | 577 | ..... | 864 |

*Estimated monthly discharge of Grand River at North Lansing, Mich.*

[Drainage area, 1,230 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| March | 9,035 | 456 | 3,363 | 2.73 | 3.15 |
| April | 2,225 | 798 | 1,305 | 1.06 | 1.18 |
| May | 1,055 | 360 | 596 | .48 | .55 |
| June | 710 | 262 | 417 | .34 | .38 |
| July | 3,262 | 424 | 954 | .78 | .90 |
| August | 1,080 | 488 | 715 | .58 | .67 |
| September | 886 | 276 | 538 | .44 | .49 |
| October | 1,843 | 234 | 633 | .51 | .59 |
| November | 634 | 178 | 435 | .35 | .39 |
| December | 1,570 | 392 | 813 | .66 | .76 |
| 1902. | | | | | |
| January | 1,369 | 424 | 680 | .55 | .63 |
| February | 1,750 | 150 | 525 | .43 | .45 |
| March | 2,464 | 930 | 1,547 | 1.26 | 1.45 |
| April | 2,538 | 539 | 1,247 | 1.02 | 1.14 |
| May | 2,924 | 672 | 1,342 | 1.09 | 1.26 |
| June | 1,781 | 577 | 1,081 | .88 | .98 |
| July | 6,565 | 1,030 | 2,204 | 1.78 | 2.05 |
| August | 1,396 | 178 | 703 | .57 | .66 |
| September | 2,357 | 150 | 613 | .50 | .56 |
| October | 2,192 | 577 | 1,034 | .84 | .97 |
| November | 1,130 | 504 | 810 | .66 | .73 |
| December | 1,396 | 248 | 764 | .62 | .71 |
| The year | 6,565 | 150 | 1,046 | .85 | 11.59 |

## RED CEDAR RIVER AT AGRICULTURAL COLLEGE, MICH.

This gaging station was established August 30, 1902. The gage is located at the highway bridge just below the Agricultural College grounds. The bridge has a single span of 75 feet between abutments. The bed is of sand and gravel, fairly smooth and permanent. The channel is straight for a distance of about 400 feet downstream from the gage. A short distance upstream is a low dam forming an ice pond, below which the stream does not ordinarily freeze over. In this stretch of the river is the railroad bridge of the college spur of the

Pere Marquette Railroad, from which gagings are made at high water or when the stream is frozen across at the gaging station. Near this bridge low-water measurements are also made by wading. The gage is of the usual wire type, and is attached to the downstream guard rail of the bridge. The upstream corner of the right-hand wing wall of the bridge abutment is used as a bench mark, with an arbitrary elevation of 100 feet. The elevation of the datum plane of the gage is 85.45 feet. The gage is read twice each day by Clifford Walters.

The gaging station is situated about 4 miles from the mouth of the stream. Sycamore Creek, an important tributary, enters in this section. The drainage area above the gaging station is 358 square miles, and from the gaging station to the mouth of the stream 114 square miles, making the total above Grand River 472 square miles.

*Discharge measurements of Red Cedar River at Agricultural College, Mich.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| March 13 | H. K. Vedder | ..... | 796 |
| August 28 | R. E. Horton | 1.48 | 7 |
| August 30 | ....do | 1.50 | 11 |
| September 19 | W. M. Gregory | 1.78 | 37 |
| October 10 | W. V. Savicki | 5.66 | 535 |

*Mean daily gage height, in feet, of Red Cedar River at Agricultural College, Mich.*

| Day. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | 1902. | | | | | |
| 1 | 1.70 | 6.60 | 3.15 | 3.42 | 17 | ..... | 1.70 | 3.53 | 4.10 | 3.57 |
| 2 | 1.75 | 6.30 | 3.07 | 3.30 | 18 | ..... | 1.85 | 3.37 | 4.63 | 3.70 |
| 3 | 1.90 | 5.67 | 3.08 | 4.17 | 19 | ..... | 1.97 | 3.40 | 4.55 | 3.70 |
| 4 | 2.05 | 5.07 | 3.05 | 5.30 | 20 | ..... | 1.77 | 3.50 | 4.22 | 3.82 |
| 5 | 1.95 | 4.63 | 3.00 | 5.07 | 21 | ..... | 1.67 | 3.35 | 4.00 | 4.82 |
| 6 | 1.80 | 5.30 | 4.07 | 4.55 | 22 | ..... | 1.55 | 3.27 | 3.77 | 6.35 |
| 7 | 1.93 | 5.90 | 4.92 | 4.13 | 23 | ..... | 2.12 | 3.17 | 3.67 | 6.68 |
| 8 | 1.80 | 5.50 | 4.50 | 3.90 | 24 | ..... | 2.75 | 3.10 | 3.53 | 6.15 |
| 9 | 1.85 | 5.35 | 4.28 | 3.88 | 25 | ..... | 4.37 | 3.08 | 3.35 | 6.15 |
| 10 | 1.82 | 4.55 | 4.05 | 3.72 | 26 | ..... | 5.30 | 3.10 | 3.27 | 6.17 |
| 11 | 2.02 | 4.12 | 3.80 | 3.62 | 27 | ..... | 5.25 | 3.45 | 3.23 | 6.10 |
| 12 | 1.97 | 3.77 | 3.70 | 3.52 | 28 | ..... | 6.02 | 3.75 | 3.22 | 5.85 |
| 13 | 2.12 | 3.77 | ..... | 3.87 | 29 | ..... | 6.82 | 3.57 | 3.28 | 5.35 |
| 14 | 1.48 | 3.73 | ..... | 3.47 | 30 | ..... | 6.95 | 3.43 | 3.35 | 5.05 |
| 15 | 1.67 | 3.65 | 3.72 | 3.20 | 31 | 1.62 | ..... | 3.30 | ..... | 4.42 |
| 16 | 1.65 | 3.57 | 3.78 | 3.33 | | | | | | |

## MUSKEGON RIVER DRAINAGE BASIN.

The drainage basin of this stream lies immediately north of that of Grand River. Originally it was covered with pine timber, but now it is almost entirely cleared. Much of the soil is sand and gravel, unfit for profitable cultivation. Large stump-covered areas form a conspicuous feature of the topography.

In the upper portion of the basin there is a total lake area of about 110 square miles.

### MUSKEGON RIVER AT NEWAYGO, MICH.

A gaging station was established at the dam of the Newaygo Portland Cement Company, April, 1901. The crest gage is attached to a crib 50 feet upstream from the center of the dam. The dam contains a fishway 17 feet in length, 4 Taintor flood gates of 20 feet each, a spillway 20 feet in length, a logway 21.5 feet in length, and a main overflow 120 feet in length. A record is kept of the depth on the crest gage and on a tailrace gage having its datum 14 feet lower, and of the opening and closing of the logway and flood gates. The hours of running of the three sets of 35-inch horizontal Samson turbines in the adjacent power plant, and the gate opening at which they are operated, are also recorded.

A survey of the dam was made and tests of the turbine discharge were taken by current meter August 29, 1902. The daily discharge has not been calculated from the record. The gaging station is maintained through the cooperation of the Newaygo Portland Cement Company, and the record is kept by E. N. Hanlon, C. E.

## RIFLE RIVER DRAINAGE BASIN.

Rifle River rises in the vicinity of Rose City, northern Ogemaw County, flows southward to the northwest corner of T. 19 N., R. 4 W., turns easterly, and then gradually to the southeast, finally entering Saginaw Bay. The basin is heavily overlain with glacial deposits—sand, overwash gravel, and till—sand predominating. There are two old lumber dams in the basin, and a water-power dam at Omer. There are numerous small glacial lakes, but no controlled storage, and a very small percentage of natural water surface in the drainage basin. The basin is narrow and elongated, having a width of about 3 miles at the mouth. Ramifying tributaries in the headwaters give the stream a relatively large volume at the entrance of West Branch, in T. 21 N., R. 3 E. Just below the junction of the branches, at the south line of section 9 of this township, the stream is at an elevation of 771 feet, or 176 feet above Lake Huron. The distance from Omer, measured along the winding stream, is 23 miles; the average fall 7.7 feet per mile. At this place the stream flows over sandstone ledges.

An abandoned lumber dam gives 8 feet fall. It is stated that a head of 15 feet is obtainable. The drainage area is 217 square miles.

Much of the fall from this point to Omer is concentrated in rapids over sandstone shale. The fall in the first 3 miles is 51 feet, the lower portion being known as Isle Rapids, covering a length of three-fourths of a mile. In the next succeeding 2 miles the stream falls from an elevation of 720 feet to an elevation of 693 feet, partly over arenaceous limestone. For 10 miles below this point the fall is slight. The stream has in places bold clay banks 40 feet in height. At the foot of this stretch an old lumber dam near Melita gives a head of 15 feet. Rapids occur below this dam.

### RIFLE RIVER AT OMER, MICH.

At Omer the stream falls from an elevation of 608 to 595 feet over a dam affording power for a grist and saw mill. A lumbermen's canal, long since abandoned, was constructed from the northwest corner of sec. 25, T. 19 N., R. 5 E., to Wigwam Bay, a distance of 15 miles, giving 15 feet fall, by cutting off a stretch of about 4 miles of the river running parallel to the bay.

The drainage area at Omer is 364 square miles, and at the mouth of the stream 385 square miles. The gaging station is at the Detroit and Mackinaw Railroad bridge, one-half mile below the dam in Omer village. A weight and wire gage with a boxed scale graduated to feet and tenths is attached to the downstream guard rail of the bridge. The datum is referred to the right-hand downstream corner of the left-hand bridge abutment. The elevation of the bench mark is 100 feet; of the zero of the gage, 84.25 feet.

The bridge has a single span of 109 feet. The bed is of sand and fine drift. Bends occur a short distance above and below the gaging bridge, and the current passes underneath the bridge at a slight angle in times of low water. The gaging station was established September 1, 1902, and the river stage is observed twice each day by M. D. Murchison. The following table contains the results of discharge measurements which were made during 1902:

*Discharge measurements of Rifle River at Omer, Mich.*

| Date. | Hydrograph | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| August 15 | Horton and Gregory | 4.96 | 265 |
| Do | do | 4.87 | 213 |
| September 12 | W. M. Gregory | 4.85 | 218 |
| September 13 | do | 5.28 | 284 |
| October 5 | W. V. Savicki | 5.50 | 289 |
| Do | do | 5.46 | 260 |

*Mean daily gage height, in feet, of Rifle River at Omer, Mich.*

| Day. | Sept. | Oct. | Nov. | Dec. | Day. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | 1902. | | | | |
| 1 | 4.68 | 5.53 | 5.65 | 6.25 | 17 | 5.13 | 5.53 | 6.90 | 6.18 |
| 2 | 5.03 | 5.33 | 5.48 | 5.53 | 18 | 5.00 | 5.25 | 6.75 | 6.03 |
| 3 | 5.10 | 5.28 | 5.75 | 5.95 | 19 | 4.95 | 5.25 | 6.38 | 6.00 |
| 4 | 4.90 | 5.40 | 5.50 | 6.13 | 20 | 5.08 | 5.55 | 6.28 | 5.98 |
| 5 | 4.63 | 5.10 | 5.68 | 6.28 | 21 | 4.88 | 5.20 | 6.05 | 6.00 |
| 6 | 5.28 | 5.33 | 6.80 | 5.90 | 22 | 5.15 | 5.20 | 5.93 | 6.38 |
| 7 | 4.93 | 5.03 | 6.80 | 5.63 | 23 | 5.33 | 5.63 | 6.05 | 7.03 |
| 8 | 4.88 | 5.25 | 6.13 | 5.55 | 24 | 5.30 | 5.50 | 5.90 | 6.88 |
| 9 | 4.85 | 5.15 | 6.10 | 6.10 | 25 | 5.20 | 5.43 | 5.75 | 6.08 |
| 10 | 4.98 | 5.20 | 5.85 | 5.68 | 26 | 5.03 | 5.65 | 5.70 | 6.33 |
| 11 | 4.93 | 5.03 | 6.05 | 6.33 | 27 | 5.33 | 6.70 | 5.53 | 6.13 |
| 12 | 5.20 | 4.98 | 5.85 | 6.03 | 28 | 4.98 | 6.63 | 5.65 | 6.40 |
| 13 | 4.88 | 5.90 | 6.25 | 6.30 | 29 | 5.15 | 6.08 | 5.83 | 6.78 |
| 14 | 4.88 | 5.93 | 6.25 | 6.33 | 30 | 5.43 | 5.93 | 5.88 | 6.95 |
| 15 | 4.93 | 5.80 | 6.30 | 6.05 | 31 | ..... | 5.78 | ..... | 6.93 |
| 16 | 4.98 | 5.63 | 7.30 | 5.90 | | | | | |

## AU SABLE RIVER DRAINAGE BASIN.

Au Sable River rises in southern Otsego County, flows south to Grayling, thence east to the west line of Alcona County, from which point it follows a tortuous course in a general southeasterly direction to its outlet in Lake Huron at Oscoda. Its drainage basin embraces a region at one time noted for the abundance of white pine. The area is now almost entirely cleared of its valuable native timber and contains a large extent of what are termed "jack-pine lands"—sandy plains covered with scrub conifers. There are also areas of diversified soils, pink clay, loam, and gravel. The basin is underlain by Coldwater shales. Rock outcrops are very rare, the stream bed being usually clay or sand.

The basin contains numerous small lakes, wet sand areas, and undrained hollows, the topographic features being mainly the work of the retreating ice of the glacial epoch. At the junction of the north and south branches, in sec. 1, T. 26 N., R. 1 W., the stream is at an elevation of about 1,100 feet above sea level, or 520 feet above Lake Huron. This point is about 90 miles from the mouth of the river, measured along the stream channel.

At Bamfield, about 40 miles from the outlet, following the river, the elevation is about 850 feet above sea level. From this point to the mouth of the stream numerous excellent sites for water-power development occur. These water powers are favored by a stream bed of firm clay, the river being flanked in many places with high terraced clay bluffs, rising often 60 to 100 feet above the river. In some places the upper half or two-thirds of the bluff is sand, the lower portion being

clay. At the clay horizon numerous springs appear. The precipitation over the drainage area varies from 25 or 30 inches a year in the vicinity of the source to 35 or 40 inches at the mouth of the stream. The tributaries are not important, nearly all the rainfall being directly absorbed by the porous sand areas.

It is stated that the fall between Flat Rock, near the south line of sec. 33, T. 26 N., R. 5 E., and Bamfield is about 20 feet. From Bamfield to sec. 16, T. 24 N., R. 16 W., occurs a drop of 200 feet, 50 or 55 feet of which is concentrated within a series of rapids lying in Iosco County, covering a total distance of 4 miles.

### AU SABLE RIVER AT BAMFIELD, MICH.

A gaging station was established at the highway bridge at Bamfield August 27, 1902, and gage readings have been taken since that date each morning and evening by William H. Bamfield. The gage is a vertical scale graduated to feet and tenths, attached to the left-hand downstream side of the left pier supporting the main bridge span. The stream channel is straight for a distance of 800 feet or more downstream, and in this distance slight rifts occur. A bend occurs about 500 feet upstream from the gage. The bed is of sand and gravel, with a relatively smooth deep current. The banks are low and are skirted on the right by a flood plain, which is, however, seldom overflowed. Beyond the flood plain on the right, and close to the river on the left, are high gravel banks. The bridge has a main Pratt truss span of 92 feet, with auxiliary flood channe s at both ends. Wire spikes, driven into the upstream end of the left-hand pier, serve as a temporary bench mark. The elevation of the bench mark is 100 feet; of the zero of the gage, 92 feet.

The stream freezes over in winter and special discharge measurements are required to determine the flow from gage readings for that season.

During 1902 the following discharge measurements were made by Messrs. Horton, Gregory, and Savicki:

August 14: Discharge, 1,133 second-feet.
August 26: Gage height, 0.82 foot; discharge 1,026 second-feet.
September 17: Gage height, 0.80 foot; discharge, 998 second-feet.
October 7: Gage height, 0.72 foot; discharge, 981 second-feet.

In addition to the above, a gaging of Bamfield Creek, a small stream entering from the right just below the gaging station, was made by W. V. Savicki October 7, 1902, showing a discharge of 8.3 second-feet. The drainage area above the junction of the two branches of Au Sable River is 1,005 square miles; above the gaging station at Bamfield, 1,425 square miles, and above its mouth at Oscoda, 1,932 square miles.

*Mean daily gage height, in feet, of Au Sable River at Bamfield, Mich.*

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | 1902. | | | | | |
| 1 | ..... | 0.80 | 1.00 | 1.00 | 1.50 | 17 | ..... | 0.80 | 0.90 | 1.90 | 1.40 |
| 2 | ..... | .80 | .90 | 1.00 | 1.50 | 18 | ..... | .80 | .90 | 1.70 | 1.40 |
| 3 | ..... | .80 | .80 | .90 | 1.50 | 19 | ..... | .80 | .80 | 1.60 | 1.40 |
| 4 | ..... | .85 | .80 | .90 | 1.50 | 20 | ..... | .80 | .80 | 1.60 | 1.30 |
| 5 | ..... | .80 | .80 | 1.10 | 1.50 | 21 | ..... | .80 | .80 | 1.50 | 1.30 |
| 6 | ..... | .80 | .80 | 2.10 | 1.50 | 22 | ..... | .80 | .80 | 1.50 | 1.30 |
| 7 | ..... | .80 | .80 | 2.00 | 1.70 | 23 | ..... | .80 | .90 | 1.40 | 1.30 |
| 8 | ..... | .80 | .75 | 1.80 | 1.70 | 24 | ..... | .80 | 1.00 | 1.40 | 1.30 |
| 9 | ..... | .80 | .80 | 1.55 | 1.70 | 25 | ..... | .80 | 1.00 | 1.40 | 1.30 |
| 10 | ..... | .80 | .80 | 1.55 | 1.70 | 26 | ..... | .80 | 1.05 | 1.40 | 1.25 |
| 11 | ..... | .80 | .80 | 1.50 | 1.50 | 27 | 0.85 | .90 | 1.70 | 1.40 | 1.20 |
| 12 | ..... | .80 | .80 | 1.65 | 1.50 | 28 | .80 | .90 | 1.30 | 1.30 | 1.20 |
| 13 | ..... | .80 | .95 | 1.70 | 1.50 | 29 | .80 | .80 | 1.25 | 1.30 | 1.20 |
| 14 | ..... | .80 | .90 | 1.80 | 1.50 | 30 | .80 | 1.05 | 1.25 | 1.50 | 1.20 |
| 15 | ..... | .80 | .90 | 1.80 | 1.40 | 31 | .80 | ..... | 1.10 | ..... | 1.20 |
| 16 | ..... | .80 | .80 | 1.80 | 1.40 | | | | | | |

## THUNDER BAY RIVER DRAINAGE BASIN.

Thunder Bay River is joined by two large branches 8 and 10 miles above its mouth, respectively. These branches, as well as the main stream, are further subdivided at short distances upstream, so that the river is of relatively small magnitude, except for a few miles near its mouth. The Traverse shales outcrop in this part of the stream, and it is in passing over this rock ledge that the most rapid fall occurs. The drainage area was formerly heavily timbered with Michigan pine. Most of the pine has been cut, but a large amount of small conifers, hard woods, white birch, and cedar remains, so that the basin may be considered a forested rather than a cleared area.

The drainage basin contains 30 lakes, with an average area of about 1 square mile. In addition to these is Hubbard Lake, which has a water surface of 13.4 square miles. A timber dam at the foot of the latter lake produces a storage depth of 5 feet, with an aggregate storage capacity of 1,867,500,000 cubic feet, equivalent to a flow of 68 second-feet for thirty days. A similar dam at the foot of Beaver Lake gives a storage depth of 6 feet. The water from Beaver Lake is used chiefly for driving logs.

### THUNDER BAY RIVER NEAR ALPENA, MICH.

A gaging station was established at the dam of the Fletcher Paper Company, 4 miles above Alpena, April 4, 1901. The record includes two readings each day of the depth on the crest gage, located 75 feet upstream from the headgates, opposite the left-hand end of the dam.

The dam is of timber, practically water-tight, and is usually surmounted by flashboards. It contains, in addition to three spillway sections of lengths 90, 105, and 181.5 feet, respectively, a log slide 40 feet in width.

The crest of the dam was originally level, but settlement of the middle section has made it necessary to subdivide the spillways into several short sections, each assumed level at its average elevation, for purposes of calculation.

The discharge over the main dam has been calculated by the weir formula, using coefficients derived from Cornell University Experiment No. 13 for a dam of similar cross section. Discharge over flashboard sections has been calculated by means of the Francis formula.

There is also a subsidiary log way and a headrace overflow, the latter 3 feet in width, the flow through which has been calculated by suitable formulas.

The adjoining pulp and paper mill has 14 pairs of 26-inch Trump model turbines, arranged in three groups, each containing four turbines on horizontal shafts, with one double horizontal turbine. The daily run of the turbines and the working head on the wheels, which is determined from readings of the crest and tailrace gages, is also recorded.

A survey of the dam was made August 13, 1902. The accompanying tables show the estimated daily discharge and monthly run-off of the stream at this station. A measurement of the discharge at the highway bridge, 2 miles downstream, August 13, 1902, showed the flow to be 1,537 second-feet, with water wheels running. The mean flow for the day was much less.

*Mean daily discharge, in second-feet, of Thunder Bay River near Alpena, Mich.*

[Drainage area, 1,260 square miles.]

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1901. | | | | | | | | | | | | |
| 1 | ..... | ..... | ..... | 1,968 | 2,072 | 1,237 | 993 | 1,262 | 2,060 | 576 | 689 | 809 |
| 2 | ..... | ..... | ..... | 2,133 | 1,898 | 1,038 | 639 | 1,159 | 3,265 | 616 | 704 | 804 |
| 3 | ..... | ..... | ..... | 2,356 | 2,072 | 1,587 | 774 | 964 | 554 | 612 | 30 | 564 |
| 4 | ..... | ..... | ..... | 3,356 | 2,397 | 1,322 | 655 | 444 | 548 | 641 | 860 | 377 |
| 5 | ..... | ..... | ..... | 3,332 | 2,008 | 1,267 | 844 | 596 | 543 | 610 | 770 | 395 |
| 6 | ..... | ..... | ..... | 3,600 | 2,013 | 1,423 | 910 | 596 | 456 | 60 | 786 | 509 |
| 7 | ..... | ..... | ..... | 3,350 | 1,487 | 1,296 | 481 | 634 | 373 | 616 | 864 | 565 |
| 8 | ..... | ..... | ..... | 3,765 | 1,380 | 1,106 | 773 | 610 | 582 | 603 | 752 | 446 |
| 9 | ..... | ..... | ..... | 3,443 | 1,616 | 509 | 902 | 505 | 703 | 625 | 641 | 624 |
| 10 | ..... | ..... | ..... | 3,550 | 1,616 | 903 | 765 | 503 | 317 | 587 | 406 | 652 |
| 11 | ..... | ..... | ..... | 3,817 | 1,254 | 973 | 718 | 20 | 373 | 604 | 806 | 591 |
| 12 | ..... | ..... | ..... | 3,571 | 1,447 | 600 | 687 | 561 | 550 | 116 | 754 | 643 |
| 13 | ..... | ..... | ..... | 3,545 | 2,095 | 531 | 548 | 561 | 702 | 97 | 891 | 670 |
| 14 | ..... | ..... | ..... | 3,572 | 1,532 | 451 | 20 | 507 | 574 | 946 | 1,000 | 646 |
| 15 | ..... | ..... | ..... | 3,219 | 1,421 | 522 | 657 | 508 | 276 | 1,670 | 796 | 947 |
| 16 | ..... | ..... | ..... | 3,090 | 968 | 673 | 559 | 526 | 879 | 1,400 | 653 | 608 |
| 17 | ..... | ..... | ..... | 2,685 | 815 | 757 | 587 | 354 | 888 | 1,365 | 479 | 608 |
| 18 | ..... | ..... | ..... | 3,263 | 701 | 603 | 483 | 325 | 898 | 1,181 | 906 | 595 |
| 19 | ..... | ..... | ..... | 3,200 | 590 | 648 | 453 | 399 | 643 | 1,662 | 918 | 583 |
| 20 | ..... | ..... | ..... | 2,533 | 750 | 666 | 483 | 853 | 649 | 1,301 | 662 | 506 |
| 21 | ..... | ..... | ..... | 3,350 | 630 | 603 | 349 | 481 | 639 | 1,246 | 930 | 490 |
| 22 | ..... | ..... | ..... | 3,386 | 582 | 503 | 455 | 511 | 88 | 817 | 773 | 324 |
| 23 | ..... | ..... | ..... | 2,988 | 609 | 20 | 543 | 635 | 612 | 819 | 574 | 522 |
| 24 | ..... | ..... | ..... | 1,870 | 730 | 548 | 519 | 519 | 535 | 700 | 474 | 481 |
| 25 | ..... | ..... | ..... | 2,403 | 804 | 461 | 433 | 164 | 590 | 729 | 760 | 20 |
| 26 | ..... | ..... | ..... | 2,766 | 560 | 376 | 483 | 596 | 624 | 784 | 725 | 548 |
| 27 | ..... | ..... | ..... | 2,301 | 730 | 405 | 426 | 736 | 523 | 180 | 550 | 544 |
| 28 | ..... | ..... | ..... | 3,408 | 967 | 491 | 310 | 790 | 475 | 798 | 496 | 551 |
| 29 | ..... | ..... | ..... | 2,900 | 933 | 429 | 1,025 | 750 | 38 | 826 | 629 | 356 |
| 30 | ..... | ..... | ..... | 147 | 837 | 142 | 1,576 | 1,005 | 589 | 806 | 750 | 584 |
| 31 | ..... | ..... | ..... | ..... | 830 | ..... | 1,841 | 954 | ..... | 805 | ..... | 675 |
| Mean | ..... | ..... | ..... | 2,962 | 1,236 | 736 | 673 | 611 | 684 | 788 | 700 | 556 |

*Mean daily discharge, in second-feet, of Thunder Bay River near Alpena, Mich.*—Cont'd.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1902. | | | | | | | | | | | | |
| 1 | 558 | 393 | 720 | 1,126 | 1,664 | 857 | 839 | 721 | a 22 | 347 | 768 | 747 |
| 2 | 534 | 245 | 627 | 1,280 | 1,451 | 906 | 582 | 751 | 20 | 353 | 513 | 770 |
| 3 | 505 | 410 | 1,026 | 1,127 | 1,233 | 931 | 517 | 231 | 21 | 338 | 799 | 837 |
| 4 | 488 | 410 | 1,070 | 983 | 1,105 | 999 | 346 | 787 | 20 | 350 | 676 | 792 |
| 5 | 499 | 402 | 882 | 1,082 | 1,603 | 1,869 | 546 | 510 | 20 | 150 | 714 | 752 |
| 6 | 528 | 410 | 896 | 622 | 1,081 | 1,543 | 559 | 721 | 20 | 851 | 892 | 572 |
| 7 | 527 | 410 | 835 | 1,125 | 1,118 | 1,536 | 663 | 751 | 20 | 952 | 1,047 | 20 |
| 8 | 519 | 393 | 766 | 1,113 | 1,149 | 1,186 | 913 | 747 | 47 | 440 | 1,159 | 560 |
| 9 | 546 | 251 | 454 | 1,127 | 1,132 | 983 | 813 | 772 | 20 | 561 | 749 | 550 |
| 10 | 549 | 410 | 823 | 1,111 | 892 | 979 | 815 | 231 | 21 | 41 | 1,100 | 608 |
| 11 | 539 | 410 | 1,126 | 1,127 | 622 | 698 | 946 | 932 | 21 | 21 | 1,088 | 665 |
| 12 | 528 | 410 | 1,326 | 1,081 | 1,125 | 672 | 448 | 787 | 22 | 20 | 1,098 | 733 |
| 13 | 527 | 410 | 1,270 | 623 | 1,125 | 646 | 20 | 698 | 432 | 395 | 1,100 | 739 |
| 14 | 527 | 369 | 2,159 | 1,103 | 1,066 | 1,014 | 721 | 799 | 432 | 426 | 1,145 | 20 |
| 15 | 539 | 403 | 3,798 | 1,125 | 1,000 | 454 | 759 | 792 | 432 | 615 | 1,455 | 654 |
| 16 | 553 | 251 | 2,368 | 1,047 | 1,014 | 1,123 | 759 | 792 | 155 | 517 | 729 | 546 |
| 17 | 565 | 410 | 2,237 | 1,000 | 1,007 | 1,194 | 759 | 231 | 176 | 562 | 1,102 | 482 |
| 18 | 439 | 410 | 1,700 | 884 | 120 | 830 | 753 | 745 | 177 | 682 | 1,102 | 482 |
| 19 | 528 | 410 | 1,668 | 903 | 593 | 727 | 740 | 812 | 177 | 288 | 1,100 | 482 |
| 20 | 527 | 410 | 1,301 | 621 | 728 | 564 | 539 | 794 | 438 | 1,208 | 1,144 | 463 |
| 21 | 521 | 410 | 954 | 1,094 | 719 | 562 | 813 | 806 | 335 | 766 | 1,086 | 20 |
| 22 | 527 | 393 | 1,143 | 1,021 | 796 | 20 | 810 | 811 | 178 | 618 | 857 | 473 |
| 23 | 535 | 247 | 590 | 1,031 | 814 | 617 | 823 | 808 | 178 | 621 | 605 | 482 |
| 24 | 490 | 410 | 1,209 | 1,047 | 1,184 | 529 | 759 | 231 | 176 | 665 | 996 | 316 |
| 25 | 483 | 410 | 1,386 | 1,037 | 1,112 | 439 | 759 | 870 | 174 | 615 | 921 | 71 |
| 26 | 496 | 406 | 990 | 1,041 | 1,667 | 517 | 759 | 831 | 171 | 530 | 828 | 482 |
| 27 | 490 | 420 | 944 | 622 | 1,838 | 583 | 20 | 579 | 504 | 797 | 906 | 463 |
| 28 | 480 | 500 | 1,086 | 1,664 | 1,702 | 628 | 988 | 729 | 352 | 957 | 858 | 20 |
| 29 | 470 | ..... | 1,055 | 1,664 | 1,459 | 20 | 813 | 709 | 439 | 904 | 757 | 482 |
| 30 | 468 | ..... | 602 | 1,665 | 1,314 | 689 | 759 | 721 | 315 | 945 | 485 | 482 |
| 31 | 470 | ..... | 1,099 | ..... | 1,021 | ..... | 759 | ..... | ..... | 812 | ..... | 233 |
| Mean | 514 | 386 | 1,229 | 1,069 | 1,111 | 810 | 699 | 689 | 183 | 559 | 925 | 483 |

a Mill shut down; storage pond refilling September 1 to 12.

*Estimated monthly discharge of Thunder Bay River near Alpena, Mich.*

[Drainage area, 1,260 square miles.]

| Month. | Discharge in second-feet. | | | Run-off. | |
|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Second-feet per square mile. | Depth in inches. |
| 1901. | | | | | |
| April | 3,817 | 147 | 1,882 | 1.49 | 1.66 |
| May | 2,397 | 582 | 1,490 | 1.18 | 1.36 |
| June | 1,587 | 20 | 798 | .63 | .71 |
| July | 1,841 | 20 | 931 | .74 | .85 |
| August | 1,262 | 20 | 641 | .51 | .58 |
| September | 3,265 | 38 | 1,654 | 1.31 | 1.46 |
| October | 1,670 | 97 | 884 | .70 | .81 |
| November | 1,000 | 30 | 515 | .41 | .46 |
| December | 809 | 20 | 414 | .32 | .36 |
| 1902. | | | | | |
| January | 565 | 439 | 502 | .40 | .46 |
| February | 500 | 245 | 372 | .29 | .30 |
| March | 3,798 | 454 | 2,126 | 1.31 | 1.51 |
| April | 1,665 | 621 | 1,143 | .91 | 1.02 |
| May | 1,838 | 120 | 979 | .78 | .90 |
| June | 1,869 | 20 | 944 | .74 | .82 |
| July | 988 | 20 | 504 | .40 | .46 |
| August | 932 | 231 | 582 | .46 | .52 |
| September | 504 | 20 | 262 | .21 | .24 |
| October | 1,208 | 20 | 614 | .48 | .55 |
| November | 1,455 | 485 | 970 | .77 | .86 |
| December | 837 | 20 | 428 | .34 | .39 |
| The year | 3,798 | 20 | 786 | .59 | 8.03 |

## LOW-WATER MEASUREMENTS OF STREAMS NORTH OF SAGINAW BAY, MICH.

Following roughly the coast line at a distance of 40 to 50 miles northerly from Saginaw Bay to Mackinaw is what may be termed a "fall line," forming the border of the central plateau of the State. A descent of 200 to 300 feet occurs here within a short distance. The longer streams, rising in the plateau at an elevation of 1,000 to 1,300 feet above sea level, make a rapid descent in crossing this slope. The principal streams of the region, all of which are tributary to Lake Huron, are as follows:[a]

| Stream. | Drainage area at mouth. |
|---|---|
| | *Square miles.* |
| Rifle River | 385 |
| Au Gres River | 478 |
| Au Sable River | 1,932 |
| Thunder Bay River | 1,267 |
| Cheboygan River | 1,594 |

The rainfall of the basins increases as we pass downstream, ranging from 25 or 30 inches a year in the vicinity of the sources to 35 or 40 inches at the mouths of the streams. The region is largely underlain by Coldwater shales, some of which are nearly pure calcium carbonate. There is a cover of Pleistocene deposits of varying thickness, the soil being largely sand, with wet plains, morainal hills, and undrained hollows. All these features are conducive to the direct retention of the precipitation. The ground waters, passing down to the alluvial clay deposits of the lower lake extension, travel along the clay horizon, entering the stream valleys as springs and seepage. At the middle of the last century this region bore an almost incalculable wealth of white-pine timber, which is now practically destroyed, leaving the sand plain barren or covered with jack pines, with occasional hard-wood swamp hollows. During the dry summer season of 1902 a series of discharge measurements were made on the streams of this locality. In order that the drought during which the summer flow was measured may be compared in intensity with those of other years, the following table is given, showing the meteorological conditions which prevailed while measurements were in progress:

[a] Horton, Robert E., Available Water Power of Michigan: Michigan Engineer, 1901, pp. 73-92.

*Rainfall, northern part of Southern Peninsula, Michigan.*

| Days on which rain fell. | Precipitation in inches at— | | | | | | |
|---|---|---|---|---|---|---|---|
| | Cheboygan. | Onaway. | Alpena. | Mio. | East Tawas. | West Branch. | Omer. |
| 1902. | | | | | | | |
| August 10 | Trace. | 0.09 | 0.57 | 0.07 | | | |
| August 11 | | Trace. | .01 | .14 | 0.13 | Trace. | |
| August 13 | | | | .01 | | | |
| August 17 | | .11 | .02 | .01 | | | |
| August 18 | 0.66 | .62 | 1.30 | .50 | .89 | | |
| August 19 | | .10 | .02 | | | | |
| August 20 | Trace. | .08 | .06 | .24 | Trace. | | Trace. |
| August 31 | .23 | .05 | .09 | .38 | .67 | 0.05 | |
| September 1 | .10 | | .14 | | | | |
| September 3 | .16 | .31 | .12 | .12 | .05 | | Trace. |
| September 4 | .18 | .24 | .01 | Trace. | | | |
| September 6 | Trace. | | .12 | .12 | .32 | .10 | 0.10 |
| September 7 | | | .01 | | | | .05 |
| September 9 | | .54 | .35 | .18 | | .38 | .56 |
| September 10 | | | .02 | | | | |
| September 13 | | | .01 | .02 | .62 | .05 | |

The following notes relative to the several streams have been furnished by W. M. Gregory.[a] The elevations were obtained by aneroid or from railroad profile.[b]

Au Gres River rises in Stiles Lake. A lumbering dam 8 feet high controls the lake level. The greatest available fall occurs in the vicinity of the Detroit and Mackinaw Railroad near Whittemore. The river is here at an elevation of 655 feet.

The East Branch of Au Gres River in sec. 28, T. 22 N., R. 6 E., has high banks and flows over a rock bed. The fall is rapid.

Tawas River in Iosca County has its source in a small group of glacial lakes in sec. 31, T. 23 N., R. 7 E. It flows eastward between high clay banks, and has an elevation at the southeast corner of sec. 24 of this township of 666 feet.

Pine River in Arenac County has a fall of 44 feet between Standish and Saginaw Bay.

Nearly all the streams have one or more small lumber dams constructed of logs, many of which are abandoned.

The streams are located in an artesian basin which has recently been extensively utilized. In some cases the flow from the large numbers of wells undoubtedly increases the low-water stream discharge to some extent. The flowing wells waste in some cases directly on the sandy soil, their waters being absorbed and appearing later as springs or seepage. In regions of clay soil direct drains are dug to the water courses.

[a] Preliminary Report on Geology of Arenac County, Mich., pp. 21–23.

[b] In reference to the elevations given, it should be borne in mind that Lake Huron has an average water-service elevation of 581 feet.

In the limestone region north of Thunder Bay, there is also watershed leakage, occasioned by fissures in the lime rock. Through the gradual southwesterly tilting of the State the basins of the streams are undoubtedly increasing northward as far as Cheboygan River. In the Cheboygan drainage basin are a series of coast lakes, probably left as bayous by the recession of earlier Great Lake extensions. These have been encroached upon by sand and silt, forming inland lagoons lying below the 700-foot contour and having short outlets with little fall.

The following table gives the measured discharge and the drainage areas of the several streams. The measurements were mostly made by W. M. Gregory.

*Low-water discharge of streams north of Saginaw Bay.*

| Date. | Stream. | Location. | Second-feet. | Drainage area. | Second-feet per square mile. |
|---|---|---|---|---|---|
| 1902. | | | | *Sq. miles.* | |
| Aug. 15 | Rifle River | Omer [a] | 244.3 | 364 | 0.67 |
| Sept. 2 | ....do | ....do [b] | 222.9 | 364 | .61 |
| 13 | ....do | ....do [c] | 290.7 | 364 | .79 |
| 1 | Au Gres River | Au Gres [d] | 98.3 | 422 | .23 |
| 8 | East Branch Au Gres River. | Near Au Gres [e] | 60.2 | 170 | .35 |
| Aug. 19 | Tawas River | Tawas City [f] | 53.3 | 125 | .42 |
| 26 | Au Sable River | Bamfield [g] | 1,026.0 | 1,425 | .72 |
| Sept. 17 | ....do | ....do | 839.0 | 1,425 | .59 |
| Oct. 7 | ....do | ....do | 981.0 | 1,425 | .69 |
| Aug. 27 | Pine River | Indian bridge [h] | 111.0 | 231 | .48 |
| 27 | ....do | Near Indian bridge [i] | 106.0 | 231 | .46 |
| 28 | Black River | Near Black River [j] | 30.0 | 65 | .46 |
| Sept. 4 | South Branch Thunder Bay River. | Below King Creek [k] | 117.0 | 295 | .39 |
| 4 | North Branch Thunder Bay River. | Mouth [l] | 13.6 | 200 | .06 |
| Aug. 13 | Thunder Bay River | 2 miles above Alpena [m] | 1,537.0 | 1,265 | 1.21 |
| Sept. 14 | Ocqueoc River | Brader bridge [n] | 8.5 | 58 | .14 |

[a] Gage 4.91. [b] Gage 4.85. [c] Gage 5.28. [d] W. S. 14.4 below top left-hand abutment.
[e] Measured near mouth, north of Au Gres, Mich.
[f] Water surface 10.45 feet below top of left-hand abutment.
[g] August 26, gage not set. September 17, gage 0.80. October 7, gage 0.72.
[h] Water surface 4.85 feet below top of left-hand bridge abutment.
[i] Measured 150 feet below Indian bridge; tributary to Au Sable near mouth.
[j] Stream fed by springs from Alcona morraine. Considerable fall utilized. Water surface 8.1 feet below top of bowlder on left-hand bank.
[k] Sec. 21, T. 31 N., R. 7 E. Water surface 9.28 feet below top of left-hand abutment.
[l] Sec. 33, T. 32 N., R. 7 E., mouth of river.
[m] At Red bridge, 2 miles below Fletcher dam.
[n] Sec. 33, T. 35 N., R. 3 E.

*Low-water discharge of streams north of Saginaw Bay*—Continued.

CHEBOYGAN RIVER DRAINAGE.

| Date. | Stream. | Location. | Second-feet. | Drainage area. | Second-feet per square mile. |
|---|---|---|---|---|---|
| 1902. | | | | *Sq. miles.* | |
| Sept. 8 | Black River | 5 miles above Black Lake. | 175.0 | 369 | 0.47 |
| 12 | Rainy River | Near Onoway [a] | 7.8 | 100 | .07 |
| 13 | Black Lake Outlet | Near Sova [b] | 175.0 | 612 | .28 |
| 15 | Cheboygan River | County house [c] | 522.4 | 939 | .55 |
| 15 | Indian River | Indian River [d] | 463.8 | 660 | .47 |

[a] Drinker bridge, sec. 24, T. 35 N., R. 2 E.

[b] At covered bridge, sec. 18, T. 34 N., R. 2 E. Water surface 9.35 feet below top of right-hand abutment.

[c] Sec. 18, T. 37 N., R. 1 W. Water surface 5.9 feet below top of left-hand abutment.

[d] Water surface 9.9 feet below top of left-hand abutment.

## FOX RIVER DRAINAGE BASIN.

Fox River connects Lakes Poygan, Winnebago, and Butte des Mortes with Lake Michigan; it enters the latter lake in Green Bay, near the city of Green Bay. The principal tributary in this basin is Wolf River, which rises in Forest County, Wis., and flows south into Lake Poygan.

Lake Winnebago is the largest inland lake in Wisconsin, being 26 miles long and having a maximum width of 10 miles. Its area is 212 square miles. The United States Geological Survey is maintaining, in cooperation with the Wisconsin Geological and Natural History Survey, the following stations in this drainage: On Fox River at Omro, Oshkosh, and Wrightstown, and on the Wolf River at Winneconne. The Omro, Oshkosh, and Winneconne stations measure practically all the water flowing into Lake Winnebago, while the station on the lower Fox River at Wrightstown measures all the discharge from this lake. It is hoped that a careful analysis of the discharge measurements secured at these stations will throw some light on the rate of evaporation over water surfaces in this latitude.

### FOX RIVER AT OMRO, WIS.

This station was established November 22, 1902, by L. R. Stockman. It is located on the city bridge in Omro, Wis. The gage is a plain staff, graduated to feet and tenths. It is fastened to a pile in the center guard pier. It is read twice daily by William Herner. The stream is straight for a thousand feet both above and below the station: the right bank is high, the left bank is low; neither is liable to overflow. The bed of the stream is black loam. The initial point for

sounding is on the right bank at a nail in the footboard of the bridge. The bench mark is on the water table of the southwest corner of Robinson's store; elevation, 14.24 feet above zero of gage.

Elevation of bench mark No. 2, 8.97 feet above zero of gage.

The following discharge measurements were made during 1902:

November 22: Gage height, 4.60 feet; discharge, 680 second-feet.
December 13: Gage height, 4.50 feet; discharge, 600 second-feet.

*Daily gage height, in feet, of Fox River at Omro, Wis.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | 4.65 | 12 | | 4.50 | 23 | | 4.80 |
| 2 | | 4.60 | 13 | | 4.50 | 24 | | 4.80 |
| 3 | | 4.65 | 14 | | 4.50 | 25 | 4.70 | 4.80 |
| 4 | | 4.65 | 15 | | 4.50 | 26 | 4.75 | 4.70 |
| 5 | | 4.70 | 16 | | 4.55 | 27 | 4.60 | 4.70 |
| 6 | | 4.70 | 17 | | 4.50 | 28 | 4.50 | 4.70 |
| 7 | | 4.50 | 18 | | 4.55 | 29 | 4.60 | 4.75 |
| 8 | | 4.50 | 19 | | 4.55 | 30 | 4.50 | 4.80 |
| 9 | | 4.50 | 20 | | 4.65 | 31 | | 4.80 |
| 10 | | 4.50 | 21 | | 4.70 | | | |
| 11 | | 4.50 | 22 | | 4.80 | | | |

## FOX RIVER AT OSHKOSH, WIS.

This station was established November 26, 1902, by L. R. Stockman. It was located at the Wisconsin avenue highway bridge in Oshkosh, Wis. The gage was a plain staff, graduated to feet and tenths, and fastened to the guard of the center pier. It was read twice daily by the bridge tender. The channel is straight, both above and below the station. The right bank is low, and the left bank is high; neither is very liable to overflow. The bed of the stream is loam and clay. The initial point for sounding is a nail in the footboard at the left end of the bridge. Two bench marks are located on the piers of the bridge. This station was discontinued soon after it was established, because it was found that, as a result of its proximity to Lake Winnebago, the elevation of the water depended as much upon the direction of the wind as upon the volume of the discharge. Besides, lumber rafts anchored at this bridge made observations for discharge both difficult and unreliable.

The following discharge measurement was made in 1902:

November 26: Gage height, 4.15 feet; discharge, 4,932 second-feet.

*Daily gage height, in feet, of Fox River at Oshkosh, Wis.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | 4.05 | 12 | | 4.05 | 23 | | 4.1 |
| 2 | | 4.15 | 13 | | 4.0 | 24 | | 4.1 |
| 3 | | 4.15 | 14 | | 4.0 | 25 | | 4.05 |
| 4 | | 4.10 | 15 | | 4.0 | 26 | 4.15 | 4.1 |
| 5 | | 4.10 | 16 | | 4.0 | 27 | 4.2 | 4.1 |
| 6 | | 4.10 | 17 | | 4.0 | 28 | 4.1 | 4.1 |
| 7 | | 4.10 | 18 | | 4.0 | 29 | 3.9 | 4.1 |
| 8 | | 4.05 | 19 | | 4.0 | 30 | 3.95 | 4.1 |
| 9 | | 4.05 | 20 | | 4.05 | 31 | | 4.1 |
| 10 | | 4.05 | 21 | | 4.05 | | | |
| 11 | | 4.05 | 22 | | 4.05 | | | |

## FOX RIVER AT WRIGHTSTOWN, WIS.

This station was established November 19, 1902, by L. R. Stockman. It is located on the highway bridge in Wrightstown, Wis. The gage is a plain staff, graduated to feet and tenths, and fastened to the pile in the guard to the center pier. It is read twice daily by Peter Van Lieshout. The initial point of sounding is a nail in the footboard on the left end of the bridge. The channel is straight for three-fourths of a mile above the bridge, and for a short distance below. The right bank is low and the left bank is high; neither bank is liable to overflow. The bed of the stream is gravelly loam. The bench mark is a projecting stone in the northwest corner of the foundation of the American House, 2 feet from the corner. Elevation above zero of gage is 20.21 feet. Elevation above bench mark No. 2 is 12.46 feet.

The following discharge measurements were made during 1902:

November 19: Gage height, 6.4 feet; discharge, 3,284 second-feet.
November 20: Gage height, 6.4 feet; discharge, 3,238 second-feet.
December 11: Gage height, 6.6 feet; discharge, 3,563 second-feet.

*Daily gage height, in feet, of Fox River at Wrightstown, Wis.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | 6.45 | 12 | | 6.50 | 23 | 5.40 | 6.35 |
| 2 | | 6.45 | 13 | | 6.50 | 24 | 5.48 | 6.30 |
| 3 | | 6.50 | 14 | | 5.70 | 25 | 6.45 | 5.60 |
| 4 | | 6.55 | 15 | | 5.50 | 26 | 6.55 | 5.50 |
| 5 | | 6.50 | 16 | | 6.55 | 27 | 6.50 | 6.35 |
| 6 | | 6.55 | 17 | | 6.45 | 28 | 6.45 | 5.60 |
| 7 | | 5.50 | 18 | | 6.40 | 29 | 6.50 | 5.45 |
| 8 | | 5.75 | 19 | 6.40 | 6.40 | 30 | 5.30 | 6.25 |
| 9 | | 6.40 | 20 | 6.45 | 6.45 | 31 | | 6.40 |
| 10 | | 6.45 | 21 | 6.45 | 5.70 | | | |
| 11 | | 6.60 | 22 | 6.45 | 5.45 | | | |

### WOLF RIVER AT WINNECONNE, WIS.

This station was established November 24, 1902, by L. R. Stockman. It is on the town highway bridge in Winneconne, Wis. The gage is a plain staff, graduated to feet and tenths, and fastened to one of the bridge piles. It is read twice daily by C. P. O'Toole. The channel is straight both above and below the bridge. The right bank is high and the left bank is low. They never overflow. The bed of the stream is loam. The bench mark is on the water table in the northeast corner of the Union Bank; elevation, 12.81 feet above zero of gage. The initial point of sounding is a nail in the footboard on the left bank.

The following measurements were made during 1902:

November 24: Gage height, 5.6 feet; discharge, 4,430 second feet.
December 15: Gage height, 5.4 feet; discharge, 1,144 second feet.

*Daily gage height, in feet, of Wolf River at Winneconne, Wis.*

| Day. | Nov. | Dec. | Day. | Nov. | Dec. | Day. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1902. | | | 1902. | | | 1902. | | |
| 1 | | 5.50 | 12 | | 5.40 | 23 | | 5.50 |
| 2 | | 5.50 | 13 | | 5.40 | 24 | 5.55 | 5.50 |
| 3 | | 5.50 | 14 | | 5.40 | 25 | 5.60 | 5.50 |
| 4 | | 5.50 | 15 | | 5.40 | 26 | 5.55 | 5.50 |
| 5 | | 5.50 | 16 | | 5.40 | 27 | 5.50 | 5.50 |
| 6 | | 5.50 | 17 | | 5.40 | 28 | 5.50 | 5.50 |
| 7 | | 5.50 | 18 | | 5.40 | 29 | 5.60 | 5.50 |
| 8 | | 5.50 | 19 | | 5.40 | 30 | 5.50 | 5.50 |
| 9 | | 5.50 | 20 | | 5.40 | 31 | | 5.50 |
| 10 | | 5.50 | 21 | | 5.50 | | | |
| 11 | | 5.45 | 22 | | 5.50 | | | |

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