Wm. A. Lamb.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 263

'ACE WATER SUPPLY OF THE UNITED STATES

1909

PART III. OHIO RIVER BASIN

'ARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

A. H. HORTON, M. R. HALL, AND
R. H. BOLSTER

WASHINGTON
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SURFACE WATER SUPPLY OF THE OHIO RIVER BASIN, 1909.

By A. H. HORTON, M. R. HALL, and R. H. BOLSTER.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of flow measurements made on certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with organizations mentioned herein. These investigations are authorized by the organic law of the Geological Survey (Stat. L., vol. 20, p. 394), which provides, among other things, as follows:

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

Inasmuch as water is the most abundant and most valuable mineral in nature, the investigation of water resources is included under the above provision for investigating mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

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

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

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

SCOPE OF INVESTIGATIONS.

These investigations of stream flow are not complete nor do they include all the river systems or parts thereof that might purposefully be studied. The scope of the work is limited by the appropriations available. The field covered is the widest and the character of the work is believed to be the best possible under the controlling conditions. The work would undoubtedly have greater scientific importance and ultimately be of more practical value if the money now expended for wide areas were concentrated on a few small drainage basins; but such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be kept during a period of years long enough to determine within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum. The length of such a period manifestly differs for different streams. Experience has shown that the records for some streams should cover from five to ten years, and for other streams twenty years or even more, the limit being determined by the relative importance of the stream and the interdependence of the results with other long-time records on adjacent streams.

In the performance of this work an effort is made to reach the highest degree of precision possible with a rational expenditure of time and a judicious expenditure of a small amount of money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-flow measurements. It is confidently believed that the stream-flow data presented in the publications of the Survey are in general sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of stations. All persons are cautioned to exercise the greatest care in using such incomplete records.

Records have been obtained at more than 1,550 different points in the United States, and in addition the surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, has been investigated. During 1909 regular gaging stations were maintained by the Survey and cooperating organizations at about 850 points in the United States, and many miscellaneous measurements were made at other points. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in the regular surface water-supply papers and in special papers from time to time.

PURPOSES OF THE WORK.

The results contained in this volume are requisite to meet the immediate demands of many public interests, including navigation, irrigation, domestic water supply, water power, swamp and overflow land drainage, and flood prevention.

Navigation.—The Federal Government has expended more than $250,000,000 for the improvement of inland navigation, and prospective expenditures will approximate several times this amount. It is obvious that the determination of stream flow is necessary to the intelligent solution of the many problems involved.

Irrigation.—The United States is now expending $51,000,000 on federal irrigation systems, and this amount is far exceeded by the private expenditures of this nature in the arid West. The integrity of any irrigation system depends absolutely on the amount of water available. Therefore investigations of stream flow in that portion of the country are not only of first importance in the redemption of the lands, but constitute an insurance of federal and private investments.

Domestic water supply.—The highest use of water is for domestic supply, and although this branch of the subject is of less direct federal interest than the branches already named, it nevertheless has so broad a significance with respect to the general welfare that the Federal Government is ultimately and intimately concerned.

Water power.—The development of the water power of the country is an economic necessity. Our stock of coal is being rapidly depleted, and the cost of steam power is increasing accordingly. Industrial growth and as a consequence the progress of the United States as a nation will cease if cheap power is not available. Water power affords the only avenue now open. When the electric transmission of power was accomplished, the relation of our water powers to national economy changed entirely. Before the day of electric transmission water power was important only at the locality at which it was generated, but it has now become a public utility in which the individual citizen is vitally interested. Inasmuch as the amount of water power that may be made available depends on the flow of rivers, the investigation of flow becomes a prerequisite in the judicious management of this source of energy.

Drainage of swamp and overflowed lands.—More than 70,000,000 acres of the richest land in this country are now practically worthless or of precarious value by reason of overflow and swamp conditions. When this land is drained, it becomes exceedingly productive, and its value increases manyfold. Such reclamation would add to the national assets at least $700,000,000. The study of run-off is the first consideration in connection with drainage projects. If the

drainage of a large area into any particular channel results in so gorging that channel with water that overflow conditions are created in places where previously the land was not subject to inundation, then drainage results merely in an exchange of land values. This is not the purpose of drainage improvement.

Flood prevention.—The damage from floods in the United States probably exceeds on the average $100,000,000 annually, and in the year 1908, according to estimates based on reliable data, the aggregate damage approximated $250,000,000. Such an annual tax on the property of great regions should be reduced in the orderly progress of government. It goes without saying that any consideration of flood prevention must be based on a thorough knowledge of stream flow, both in the contributing areas which furnish the water and along the great lowland rivers.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey since its inception have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications have varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1909. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1909.

Part.	No.	Title.	Part.	No.	Title.
I	261	North Atlantic coast.	VI	266	Missouri River basin.
II	262	South Atlantic coast and eastern Gulf of Mexico.	VII	267	Lower Mississippi River basin.
			VIII	268	Western Gulf of Mexico.
III	263	Ohio River basin.	IX	269	Colorado River basin.
IV	264	St. Lawrence River basin.	X	270	Great Basin.
V	265	Upper Mississippi River and Hudson Bay basin.	XI	271	California.
			XII	272	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the United States Geological Survey exclusive of all special papers. Numbers of reports are inclusive and dates also are inclusive so far as the data are available.

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

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

Report.	Character of data.	Year.
10th Ann., pt. 2	Descriptive information only	
11th Ann., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th Ann., pt. 2	....do	1884 to June 30, 1891.
13th Ann., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th Ann., pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B. 131	Descriptions, measurements, gage-heights, and ratings	1893 and 1894.
16th Ann., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 11	Gage heights (also gage heights for earlier years)	1896.
18th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for earlier years).	1895 and 1896.
W. S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th Ann., pt. 4	Monthly discharge (also for many earlier years)	1898.
W. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st Ann., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d Ann., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	....do	1903.
W. S. 124 to 135	....do	1904.
W. S. 165 to 178	....do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907-8.
W. S. 261 to 272	....do	1909.

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

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119. The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1909. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1909.

	1899.[a]	1900.[b]	1901.	1902.	1903.	1904.	1905.	1906.	1907–8.	1909.
Atlantic coast and eastern Gulf of Mexico:										
New England rivers.	35	47	65, 75	82	97	124	165	201	241	261
Hudson River to Delaware River, inclusive	35	47,(48)	65, 75	82	97	125	166	202	241	261
Susquehanna River to York River, inclusive	35	48	65, 75	82	97	126	167	203	241	261
James River to Yadkin River, inclusive	(35), 36	48	65, 75	(82), 83	(97), 98	126	167	203	242	262
Santee River to Pearl River, inclusive	36	48	65, 75	83	98	127	168	204	242	262
St. Lawrence River	36	49	65, 75	(82), 83	97	129	170	206	244	264
Hudson Bay	.....	.....	66, 75	85	100	130	171	207	245	265
Mississippi River:										
Ohio River	36	48,(49)	65, 75	83	98	128	169	205	243	263
Upper Mississippi River	36	49	65, 75	83	98,(99)	128, (130)	171	207	245	265
Missouri River	(36), 37	49,(50)	66, 75	84	99	130, (131)	172	208	246	266
Lower Mississippi River	37	50	(65), 66, 75	(83), 84	(98), 99	(128), 131	(169), 173	(205), 209	247	267
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248	268
Pacific coast and Great Basin:										
Colorado River	(37), 38	50	66, 75	85	100	133, (134)	175, (177)	211, (213)	249, (251)	269, (271)
Great Basin	38,(39)	51	66, 75	85	100	133, (134)	176, (177)	212, (213)	250, (251)	270, (271)
South Pacific coast to Klamath River, inclusive	(38), 39	51	66, 75	85	100	134	177	213	251	271
North Pacific coast	38	51	66, 75	85	100	135	(177), 178	214	252	272

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	Yuma and Salton Sea stations repeated.
271	Great Basin	Owens River basin.

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined on the basis of drainage area, local changes in name and lake surface being disregarded. After all stations from the source to the mouth of the main stem of the river have been given, the tributaries are taken up in regular order from source to mouth. The tributaries are treated the same as the main stream, all stations in each tributary basin being given before taking up the next one below.

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

DEFINITION OF TERMS.

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

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

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

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

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

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

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches equals 96 Colorado miner's inches.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches equals 104 California miner's inches.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equals about 1 kilowatt.

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

EXPLANATION OF TABLES.

For each drainage basin there is given a brief description of general conditions covering such features as area, source, tributaries, topography, geology, conditions of forestation, rainfall, ice conditions, irrigation, storage, power possibilities, and other special features of importance or interest.

For each regular current-meter gaging station are given in general, and so far as available, the following data: Description of station, list of discharge measurements, table of daily gage heights, table of daily discharges, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

In addition to statements regarding the location and installation of current-meter stations the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting conditions of flow, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights during ice conditions, backwater from obstructions, etc., are published as recorded, with suitable footnotes. The rating is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report, but can be determined from the daily gage heights and daily discharges for the purpose of verifying the published results as follows.

First, plot the discharge measurements for the current and earlier years on cross-section paper with gage heights in feet as ordinates and discharge in second-feet as abscissæ. Then tabulate a number of gage heights taken from the daily gage height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known backwater conditions.

The table of daily discharges gives the discharges in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge consequently larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 13, are based.

FIELD METHODS OF MEASURING STREAM FLOW.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir or dam; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v=c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the

flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions. It is seldom used by the United States Geological Survey. For full information regarding this method the reader is referred to the various text-books on hydraulics.

Weir method.—Relatively few stations are maintained at weirs or dams by the United States Geological Survey. Standard types of sharp-crested and broad-crested weirs within the limits for which accurate coefficients have been experimentally obtained give very accurate records of discharge if properly maintained. At practically all broad-crested weirs, however, there is a diversion of water either through or around the dam, usually for the purpose of development of water power. The flow is often complicated and the records are subject to errors from such sources as leakage through the dam, backwater at high stages, uncertainty regarding coefficient, irregularity of crest, obstructions from logs or ice, use of flashboards, old turbines with imperfect ratings, and many others depending on the type of development and the uses of the diverted water.

In general, records of discharge at dams are usually accurate enough for practical use if no others are available. It has been the general experience of the United States Geological Survey, however, that records at current meter gaging stations under unobstructed channel conditions are more accurate than those collected at dams, and where the conditions are reasonably favorable are practically as good as those obtained at sharp-crested weirs.[a]

Velocity method.—Streams in general present throughout their courses to a greater or less extent all conditions of permanent, semi-permanent, and varying conditions of flow. In accordance with the location of the measuring section with respect to these physical conditions, current-meter gaging stations may in general be divided into four classes—(1) those with permanent conditions of flow; (2) those with beds which change only during extreme high water; (3) those with beds which change frequently but which do not cause a variation of more than about 5 per cent of the discharge curves from year to year; and (4) those with constantly shifting beds. In determining the daily flow different office methods are necessary for each class. The field data on which the determinations are based and the methods of collecting them are, however, in general the same.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that

[a] The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200) and in the various text-books on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The edition of the latter water-supply paper is nearly exhausted. It can, however, be consulted at most of the larger libraries of the country or it can be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 20 cents. Remittances must be made by postal money order, express order, or New York draft.

the data may have the required degree of accuracy. They are located, as far as possible, at such points that the relation between gage height and discharge will always remain constant for any given stage. The experience of engineers of the Geological Survey has been that permanency of conditions of flow is the prime requisite of any current-meter gaging station when maintained for several years unless funds are available to cover all changes in conditions of flow. A straight, smooth section without cross currents, backwater, boils, etc., at any stage is highly desirable, but on most streams is not attainable except at the cost of a cable equipment. Rough, permanent sections, if measurements are properly made by experienced engineers, taking measuring points at a distance apart of 5 per cent or less of the total width, will within reasonable limits yield better results for a given outlay of money than semipermanent or shifting sections with smooth, uniform current. So far as possible stations are located where the banks are high and not subject to overflow at high stages and out of the influence of tributary streams, dams, or other artificial obstructions which might affect the relation between gage height and discharge.

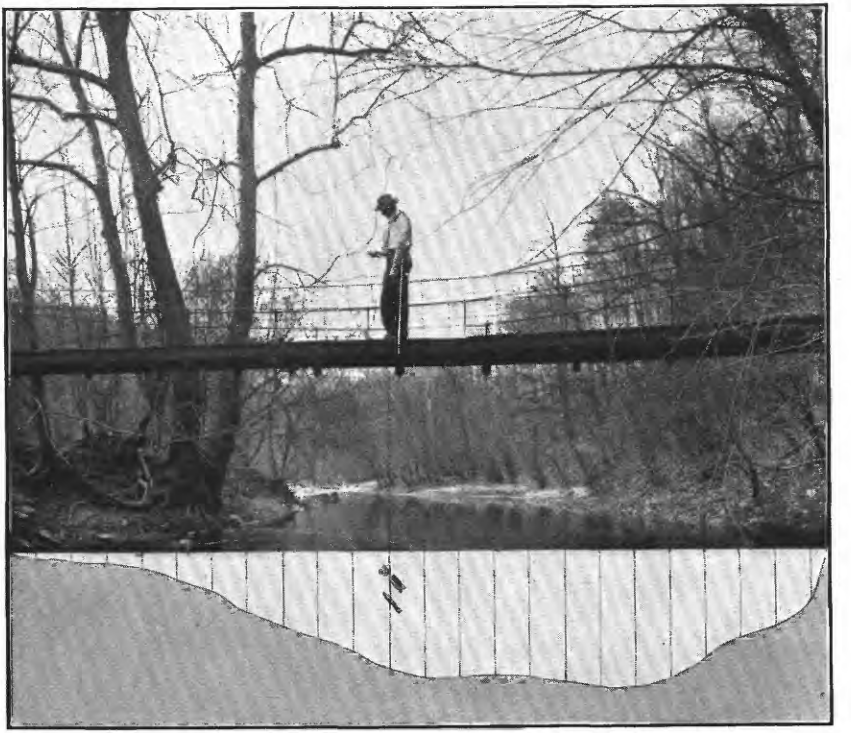
A gaging station consists essentially of a gage for determining the daily fluctuations of stage of the river and some structure or apparatus from which discharge measurements are made, usually a bridge or cable.

The two factors required to determine the discharge of a stream past a section perpendicular to the mean direction of the current are the area of the cross section and the mean velocity of flow normal to that section.

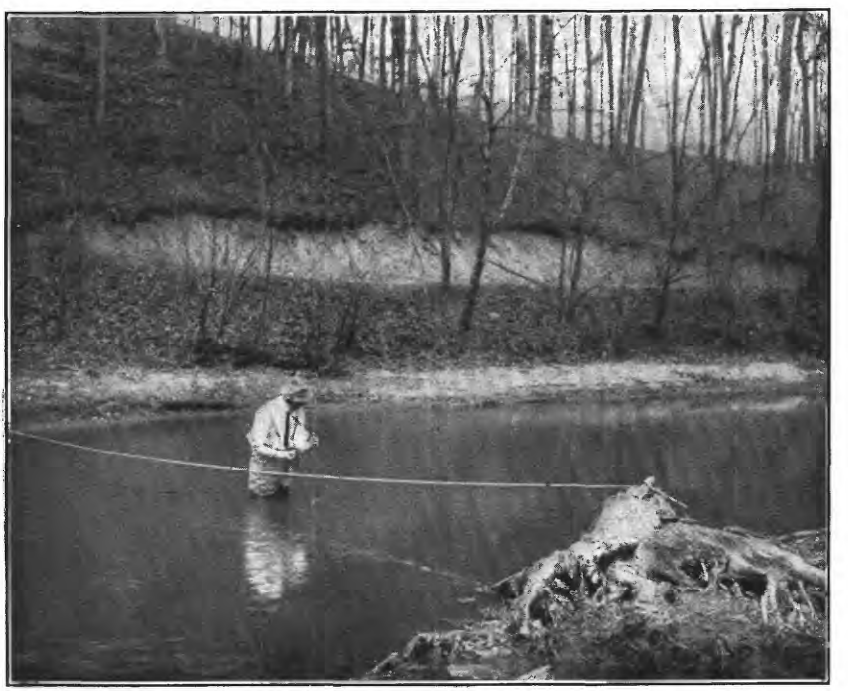
In making a measurement with a current meter a number of points, called measuring points, are measured off above and in the plane of the measuring section at which observations of depth and velocity are taken. (See Pl. I, *A*.) These points are spaced equally for those parts of the section where the flow is uniform and smooth and are spaced unequally for other parts according to the discretion and judgment of the engineer. In general the points should not be spaced farther apart than 5 per cent of the channel width, nor farther apart than the approximate mean depth of the section at the time of measurement.

The measuring points divide the total cross section into elementary strips, at each end of which observations of depth and velocity are made. The discharge of any elementary strip is the product of the average of the depths at the two ends times the width of the strip times the average of the mean velocities at the two ends of the strip. The sum of the discharges of the elementary strips is the total discharge of the stream.[a]

[a] For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.



A. FOR BRIDGE MEASUREMENT.



B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.

Depths for the determination of the area are usually obtained by sounding with the current meter and cable. In rough sections or swift current an ordinary weight and cable are used, particular care being taken that all observations shall be in the plane of the cross section.

Two methods of determining the velocity of flow of a stream are in general use—the float method and the current-meter method.

The float method with its various modifications of surface, subsurface, and tube or rod floats is now considered obsolete in the ordinary practice of the United States Geological Survey. The use of this method is limited to special conditions where it is impracticable to use the current meter, such as in places where large quantities of ice or débris which may damage the meter are flowing with the current, and for miscellaneous measurements or other work where a high degree of accuracy is not necessary. Tube floats are very satisfactory for use in canals with regular bottoms and even flow of current. Measurements by the float method are made as follows: The velocity of flow of the stream is obtained by observing the time which it takes floats set free at different points across the stream to pass between two range lines about 200 feet apart. The area used is the mean value obtained from several cross sections measured between the two range lines. The chief disadvantages of this method are difficulty in obtaining the correct value of mean area for the course used and uncertainty regarding the proper coefficient to apply to the observed velocity.[a]

The Price current meter is now used almost to the exclusion of other types of meters by the United States Geological Survey in the determination of the velocity of flow of water in open channels, a use for which it is adapted under practically all conditions.[b]

Plate II shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations; on the left the same type of meter is shown equipped for wading measurements to record by the acoustic method; the meter is shown on the right equipped to record electrically. (See Pl. I, *B*.) Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened steel point when immersed in moving water. The revolutions are indicated electrically. The rating, or relation between the velocity of the moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second of moving water for

[a] Further information regarding this method is given in Water-Supply Paper 95 and in the various text-books covering the general subject of stream flow.

[b] See Hoyt, J. C., and others, Use and care of the current meter as practiced by the U. S. Geological Survey: Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.

any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

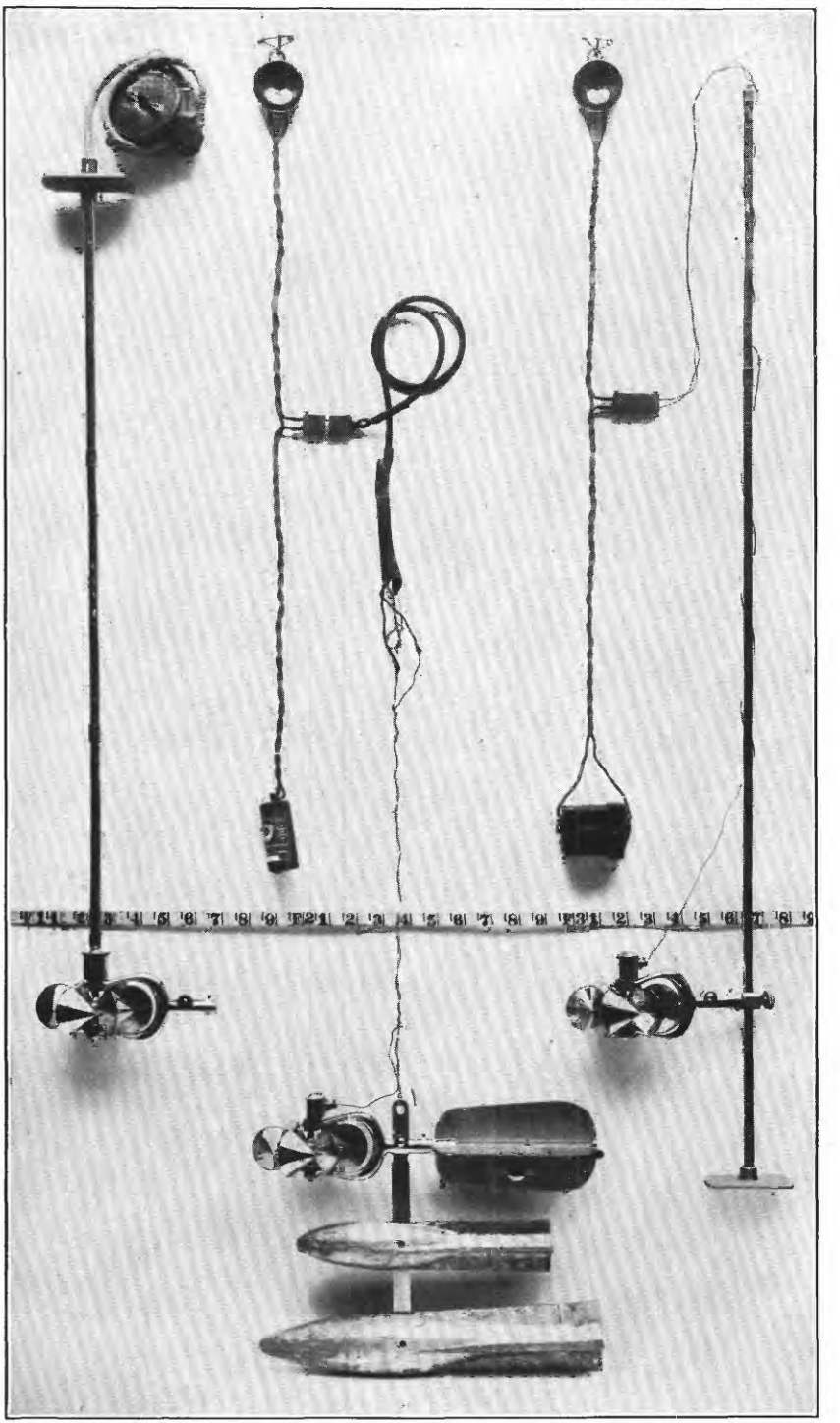
The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. (See Pl. I, *A*.) On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. Moreover, the indications are that it holds nearly as well for ice-covered rivers. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean



SMALL PRICE CURRENT METERS.

velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and the vertical velocity curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, and the thickness and character of the ice. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.[a]

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measurements, and full notes, are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharges, and

[a] For information in regard to flow under ice cover, see Water-Supply Paper U. S. Geol. Survey No. 187.

from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channel conditions which they represent. (See p. 17.) The discharge measurements for all classes of stations when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas define rating curves which are generally more or less parabolic in form. For many stations curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements, and for checking purposes to avoid errors in the form of the discharge curve and to determine and eliminate erroneous measurements.

For every rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating as stated in the footnote of each table is not applicable for known conditions of ice, log jams, or other similar obstructions; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean-discharge curve and the rating developed from that curve represents a very high degree of accuracy. For examples of this class see stations of the North Atlantic coast drainage basins.

Class 2 is confined mainly to stations on rough mountainous streams with steep slopes. The beds of such streams are as a rule comparatively permanent during low and medium stages and when the flow is sufficiently well defined by an adequate number of discharge

measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow. Stations of this type are found in the upper Missouri drainage basin.

Class 3 includes most of the current-meter gaging stations maintained by the United States Geological Survey. If sufficient measurements could be made at stations of this class, results would be obtained nearly equaling those of class 1, but owing to the limited funds at the disposal of the Survey this is manifestly impossible, nor is it necessary for the uses to which discharge data are applied. The critical points are as a rule at relatively high or low stages. The percentage error, however, is greater at low stages. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the past history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve, which may be called a standard curve. It has been found in practice that if a change caused by high stage is followed by a relatively constant condition of flow at medium and low stages all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to ordinates or gage heights. This law of the parallelism of ratings is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is of course fundamentally due to change in the channel caused by cut or fill, or both, at or near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section, there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either

reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect, and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) If a uniform change occurs along the crest of a weir or rocky controlling point the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to ordinates.

Of course in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another, and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of ratings. In complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes of an oscillating character at low or medium stages are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class. For examples see stations of the south Atlantic coast and eastern Gulf of Mexico drainage basins.

Class 4 comprises stations that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency varying from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is

assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases. Stations of this type are found in the Platte, Arkansas, Rio Grande, and lower Colorado drainage basins.

The computations have, as a rule, been carried to three significant figures. Computation machines, Crelle's tables, and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as feasible, by means of comparison with adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the monthly discharge tables.

For most of the northern stations estimates have been made of the monthly discharge during frozen periods. These are based on measurements under ice conditions whenever available, daily records of temperature and precipitation obtained from the United States Weather Bureau climate and crop reports, observers' notes of conditions, and a careful and thorough intercomparison of results with adjacent streams. Although every care possible is used in making these estimates, they are often very rough, the data for some of them being so poor that the estimates are liable to as much as 25 to 50 per cent error. It is believed, however, that estimates of this character are better than none at all and serve the purpose of indicating in a relative way the proportionate amount of flow during the frozen period. These estimates are, as a rule, included in the annual discharge. The large error of the individual months has a relatively small effect on the annual total, and it is for many purposes desirable to have the yearly discharge computed even though some error is involved in doing so.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is

much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions, the observers perform their work honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

The effort is made to visit every station at least once each year for the purpose of making a measurement to determine the constancy of conditions of flow since the last measurement made during the preceding year, and also to check the elevation of the gage. On account of lack of funds or for other causes some stations were not visited during the current year. If conditions of flow have been reasonably permanent up to the time of the last preceding measurement, it is considered best to publish values of discharge on the basis of the latest verified rating curve rather than to omit them altogether, although it should be distinctly understood that such records are at times subject to considerable error. This is also true, although to a less degree, of the period of records since the date of the last measurement of the current year. As a rule, the accuracy notes are based on the assumption that the rating curve used is strictly applicable to the current year.

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

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In

this column A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general the policy is followed of making available for the public the base data which are collected in the field each year by the Survey engineers. This is done to comply with the law, but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the data given in these papers will verify all ratings and make such adjustments in earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for five or ten year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The values in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

The daily discharges are published to allow a more detailed study of the variation in flow and to determine the periods of deficient flow.

COOPERATIVE DATA.

Cooperative data of various kinds and data regarding the run-off at many stations maintained wholly by private funds are incorporated in the surface water supply reports of the United States Geological Survey.

Many stations throughout the country are maintained for specific purposes by private parties who supply the records gratuitously to the United States Geological Survey for publication. When such records are supplied by responsible parties and appear to be reasonably accurate they are verified, so far as possible, and estimated values of accuracy are given. Records clearly known to be worthless or misleading are not published. As it is, however, impossible to completely verify all such records furnished because of lack of funds or for other causes, they are published for what they are worth, as

they are of value as a matter of record and afford at least approximate information regarding stream flow at the particular localities. The Survey does not, however, assume any responsibility for inaccuracies found in such records, although most of them are believed to be reasonably good.

COOPERATION AND ACKNOWLEDGMENTS.

For assistance rendered and records furnished special acknowledgment is due to members of the United States Corps of Engineers, the United States Weather Bureau, the Water Supply Commission of Pennsylvania, the North Carolina Geological Survey, and to F. W. Scheidenhelm. The State of Illinois has paid for the stream-gaging work in that State, the appropriation therefor being in charge of the Internal Improvement Commission, Isham Randolph, chairman.

DIVISION OF WORK.

The field data for Allegheny River at Red House, N. Y., have been collected under the direction of C. C. Covert, district engineer, assisted by W. G. Hoyt.

The field data for the Ohio River drainage basin, with the exception of Allegheny River at Red House, N. Y., and for the Tennessee River drainage basin have been collected under the direction of A. H. Horton, district engineer, assisted by H. J. Jackson, W. M. O'Neill, G. L. Parker, R. J. Taylor, and Max Chapman. Stations in Pennsylvania are now maintained and the stream-flow data collected by the Water Supply Commission of Pennsylvania.

The field data in the Tennessee River drainage basin have been collected under the direction of M. R. Hall, district engineer, assisted by W. A. Lamb and E. H. Swett.

The ratings, special estimates, and studies of the completed data were made by M. R. Hall, A. H. Horton, R. H. Bolster, and F. F. Henshaw. The computations and preparation of the completed data for publication were made under the direction of R. H. Bolster, assistant engineer, by F. F. Henshaw, R. C. Rice, G. C. Stevens, H. D. Padgett, J. G. Mathers, E. H. Swett, B. E. Jones, and M. I. Walters. The report has been edited by Mrs. B. D. Wood.

GENERAL DESCRIPTION OF OHIO RIVER DRAINAGE BASIN.

The drainage basin of Ohio River lies in the central part of the eastern half of the United States. The river is formed by the union of Allegheny and Monongahela rivers at Pittsburg, Pa., and flows in a general southwesterly direction to its junction with the Mississippi at Cairo, Ill. The principal tributaries below Pittsburg from the north and west are Beaver, Muskingum, Scioto, Miami, and Wabash

rivers; those from the south and east are Monongahela, Little Kanawha, Kanawha, Guyandotte, Big Sandy, Licking, Kentucky, Green, Cumberland, and Tennessee rivers. The total length of the river is 967 miles; the total drainage area is about 210,000 square miles.

The drainage basin of Ohio River comprises greater or less areas in the States of New York, Pennsylvania, Maryland, West Virginia, Virginia, North Carolina, Georgia, Alabama, Tennessee, Kentucky, Ohio, Indiana, and Illinois. Its northern boundaries are about 40 miles south of Buffalo, N. Y., its southern boundaries are within 300 miles of the Gulf of Mexico, and its eastern boundaries are about 225 miles from the Atlantic Ocean. The sources of the tributaries from the north lie in the glaciated area; those of the southern tributaries are located on the steep and rocky slopes of the western side of the Appalachian Mountains.

The topography of the basin varies from flat and rolling in the western and northern portions to rough and mountainous in the southern and eastern sections. In general the rock floor of the valley is 30 to 50 feet below the level of the stream at low water. Between Evansville, Ind., and Shawneetown, Ill., its level is 65 or 75 feet below the stream. It is thought that in the whole length of the valley no rock barrier crosses its entire width at a level as high as the bed of the present stream. In several places rock shelves extend out part way across the river bed, leaving a channel deep enough for the passage of boats along the opposite bank. At Letart Falls the rock dips toward the east bank sufficiently to allow boats to pass when the rock of the western part of the stream bed is above the water surface. Well data indicate that this descent continues eastward beneath the bottom lands to a level as low as in the neighboring parts of the channel. Near Ravenswood, W. Va., rocky reefs are exposed at low water fully halfway across the stream bed, but wells on the bottom lands near the village show the rock floor to be at least 25 feet below the stream at low water. At Louisville wells and bridge soundings indicate that a channel 25 feet or more lower than the present surface at the head of the rapids leads southwestward from near the south end of the Jeffersonville bridge a short distance and then turns westward, passing through the city. Thus a buried channel apparently occurs at the side of each of the three most conspicuous rock reefs touched by the stream.

Notwithstanding the great number of riffles and shoals, the Ohio is generally navigable throughout the entire season for boats drawing less than 3 feet of water. It is navigable for vessels drawing 6 feet of water during a few months of the early part of the season, but there is usually little traffic with such boats after July. The canal at Louisville affords opportunity for passing around the rapids during low water. During high-water stages the boats are able to pass over the rapids.

The narrowness of the valley of Ohio River has been a subject of remark from the early days of settlement. At very few places between Pittsburg and Louisville does its width exceed 2 miles, and usually it is scarcely more than 1 mile wide. In the vicinity of Louisville its width is perhaps 4 miles, but below the mouth of Salt River it narrows abruptly to about 1 mile, and remains narrow for nearly 100 miles. Beyond this narrow stretch it broadens out to a width of 6 or 8 miles, which it maintains for much of its course to Cairo, the only exception as it passes the elevated ridge below Shawneetown, where its width is reduced to about 2½ miles.

The depth of the valley ranges from about 600 feet down to scarcely 100 feet, being greatest on the border of the "panhandle" of West Virginia and least in the lower portion of its course. Its depth seldom falls below 300 feet in the portion above Louisville and probably averages 450 feet. The narrow portion below Louisville is about 300 feet deep. The broad portions at Louisville and in the lower parts of its course are but 100 to 150 feet deep. The work of the river in excavating its narrow valley through the elevated districts is apparently commensurate with that accomplished in eroding the wide valley in the low districts, but the stream has accomplished less than it should have in the time since the beginning of development of the drainage lines—far less in proportion to its size than has been achieved by the small tributaries that enter it from southern Indiana. The explanation of this meager amount of work is found in the enlargement of Ohio River in recent times. Investigations now in progress indicate that several independent drainage lines which formerly led northward from the Appalachian Mountains across southwestern New York, northwestern Pennsylvania, and Ohio into the Lake Erie basin have been united to form the present Ohio. The full extent of these changes is not yet determined, nor have all of the outlets for the old river systems been satisfactorily traced; but enough is known to justify the statement that the small size of the valley of the Ohio is attributable to the geologically recent union of the several independent drainage systems.

Between Pittsburg and Wheeling the bed of the river is composed of coarse gravel and bowlders and in places rock. Below Wheeling the gravel becomes finer, the bowlders are fewer, and bars of river sand appear. Below the mouth of the Kanawha the bed of the river becomes more distinctively sandy, although there are some gravel bars above Louisville.

The average width between banks does not increase materially from Pittsburg to Cincinnati. In the long pool above the falls of the Ohio at Louisville the average width is much greater than that above Cincinnati, while just below the falls there is a considerable narrowing. Below this the average width continues to increase toward the mouth

of the river. The maximum width between banks is found about 20 miles above the mouth, where it is considerably more than a mile. There are many islands in the river—more than 50 above Louisville and about 30 below—ranging in size from a few acres to 5,000 acres. Many of them are cultivated and all are practically permanent in position.

The river presents an interesting series of shoals and riffles separated by pools in which the water is deeper and the fall very low. The summary of the profile made by the Army engineers shows 187 pools with over 7 feet depth at low water, extending over 632.5 miles. Of these pools 127 are above Louisville and 60 are below Louisville.

On the borders of Ohio the riffles (103 in number) cover an aggregate length of 137 miles and have a total fall of 170 feet. The pools, with a length of 309 miles, have a fall of 64 feet, or but 2.5 inches per mile. The greatest fall noted for a single mile on the border of Ohio is 3.2 feet at Letart Falls, Meigs County. There are 11 riffles with a descent exceeding 2 feet per mile. The least fall reported is 8 to 15 miles below Cincinnati, where a pool 7 miles long has a fall of but 3.5 inches; and another pool with a fall about as low is 23 to 30 miles above Cincinnati. These two are the most conspicuous pools in this section of the Ohio.

On the borders of Indiana, aside from the Louisville rapids, there are 55 riffles showing a total fall of 80.28 feet in stretches aggregating 134.5 miles. At the Louisville rapids there is a fall of 23.09 feet in 2.25 miles. There is left but 18.13 feet for the fall of the stream in about 215 miles embraced in the pools, or only 1 inch per mile. The elevation of normal low water at Davis Island dam at Pittsburg is 692 feet, and low-water elevation at Cairo is 273 feet—a total fall of 419 feet, or an average fall of about 0.43 feet to the mile.

The northern and western portions of the drainage basin is deforested; the southern and eastern portions may be called partly forested, as large areas in the Appalachian Mountains at the sources of some of the southern tributaries are still covered with a heavy growth of trees; as the tributaries are descended the cleared areas increase until the forested area is small.

The mean annual rainfall in the basin is about 45 inches, ranging from 35 inches along its northern boundary to 70 inches in the southeastern part at the sources of Tennessee River. The winters in general are mild; ice does not form very thick—on some tributaries hardly at all; the snowfall is light and does not last long. In the region about the headwaters of Allegheny River, however, the winters are severe.

The basin affords many opportunities for storage, especially on the southern tributaries. From topographic maps covering part of the drainage area of the Ohio a large number of reservoir sites were

located, some of them of enormous capacity. Careful surveys would undoubtedly show many suitable sites for dams that would impound large reservoirs above them.

In quantity of discharge Ohio River is the main tributary of the Mississippi. Its mean annual discharge is about 300,000 cubic feet per second, which is much more than the discharge of St. Lawrence River at Ogdensburg, N. Y., although the drainage area of the St. Lawrence is nearly twice that of the Ohio. The maximum flow of the Ohio is approximately 1,500,000 cubic feet per second—about 30 times the low-water flow. A comparison of records of flow of Ohio River with those of the upper Mississippi and Missouri shows that although its drainage area is one-third that of the combined Mississippi and Missouri its mean and low water flow is 1.3 times as great as their combined flow, and its maximum flow is 1.5 times as great. This fact is accounted for by the greater rainfall in the Ohio basin and by the general character of the region.

Navigation in the Ohio is stopped not only by low stages of the river but also occasionally by ice for periods averaging ten to twelve days a year. Sometimes the ice forms and passes off without occasioning great loss; sometimes there may be more than one serious break-up during the same winter.

The United States Weather Bureau and the Army Engineer Corps have maintained a number of gages on Ohio River at various places. Measurements have been made by the engineers of the United States Geological Survey on Ohio River at Wheeling, W. Va., Marietta, and Cincinnati, Ohio, and Evansville, Ind.

GAGING STATIONS MAINTAINED IN OHIO RIVER BASIN.

The following list comprises the gaging stations maintained in Ohio River basin by the United States Geological Survey and cooperative parties. The stations are arranged by river basins, in downstream order, as explained on page 13, tributaries being indicated by indention. Data for these stations have been published in the reports listed in tables on pages 11 and 12.

Allegheny River at Red House, N. Y., 1903–1909.
Allegheny River at Kittanning, Pa., 1904–1909.
Ohio River:
  Conewango Creek—
    Chautauqua Lake outlet (Chadakoin River) near Jamestown, N. Y., 1895.
    Chadakoin River near Jamestown, N. Y., 1904–5.
  Kiskiminitas River at Avonmore, Pa., 1907–1909.
  Kiskiminitas River at Salina, Pa., 1904–1906.
    Blacklick Creek at Blacklick, Pa., 1904–1909.
  Tygart River at Belington, W. Va., 1907–1909.
  Tygart River at Fetterman, W. Va., 1907–1909.

Ohio River—Continued.
Monongahela River at Lock No. 4, Pa., 1886–1906. Flood stage record only.
Buckhannon River at Hall, W. Va., 1907–1909.
West Fork River at Enterprise, W. Va., 1907–1909.
Buffalo Creek at Barrackville, W. Va., 1907–8.
Cheat River at Morgantown, W. Va., 1899–1900; 1902–1905; 1908–9.
Youghiogheny River at Friendsville, Md., 1898–1904.
Youghiogheny River at Confluence, Pa., 1904–1909.
Casselman River at Confluence, Pa., 1904–1909.
Laurel Hill Creek at Confluence, Pa., 1904–1909.
Indian Creek in Westmoreland County, Pa., 1892–3.
Mahoning River at Youngstown, Ohio, 1903–1906.
Cross Creek near Mingo Junction, Ohio, 1903.
McMahon River at Steel, Ohio, 1903.
Muskingum River at Zanesville, Ohio, 1905–1909.[a]
Licking River at Pleasant Valley, Ohio, 1902–1906.
Jonathan Creek at Powells, Ohio, 1902–3.
New River (South Fork) at New River, N. C., 1900–1901.
New River (South Fork) near Crumpler, N. C., 1908–9.
New River at Oldtown, Va., 1900–1903.
New River near Grayson, Va., 1908–9.
New River at Radford, Va., 1898–1909.
New River at Fayette, W. Va., 1895–1904, 1908–9.
New River (North Fork) at Weaversford, N. C., 1900–1901.
New River (North Fork) near Crumpler, N. C., 1908–9.
Reed Creek at Grahams Forge, Va., 1908–9.
Big Reed Island Creek near Allisonia, Va., 1908–9.
Little River near Copper Valley, Va., 1908–9.
Walker Creek at Staffordsville, Va., 1908–9.
Wolf Creek near Narrows, Va., 1908–9.
Bluestone River at Lilly, W. Va., 1908–9.
Greenbrier River near Marlinton, W. Va., 1908–9.
Greenbrier River at Alderson, W. Va., 1895, 1908–9.
Gauley River at Allingdale, W. Va., 1908–9.
Gauley River near Summersville, W. Va., 1908–9.
Gauley River at Belva, W. Va., 1908–9.
Cherry River at Richwood, W. Va., 1908–9.
Meadow River near Russellville, W. Va., 1908–9.
Elk River at Webster Springs, W. Va., 1908–9.
Elk River at Gassaway, W. Va., 1908–9.
Elk River at Clendennin, W. Va., 1908–9.
Coal River at Brushton, W. Va., 1908–9.
Coal River at Tornado, W. Va., 1908–9.
Pocotaligo River at Sissonville, W. Va., 1908–9.
Scioto River near Columbus, Ohio, 1898–1906.
Olentangy River near Columbus, Ohio, 1898–1905.
Little Miami River at Loveland, Ohio, 1906.
Little Miami River near Morrow, Ohio, 1903.
Miami River at Dayton, Ohio, 1905–1907.
Mad River near Springfield, Ohio, 1904–1906.

[a] In House Doc. 2/8, 54th Cong., 1st sess., 1896, pp. 41–43, Lieut. Col. H. M. Chittenden, U. S. Engineer Corps, gives the discharge of the Muskingum at Zanesville from December 1, 1887, to November 30, 1895.

Ohio River—Continued.
Kentucky River at Frankfort, Ky., 1905–6.
Dicks River near Danville, Ky., 1905.
Salt River (Rolling Fork) at New Haven, Ky., 1905–6.
Wabash River at Logansport, Ind., 1903–1906.
Wabash River at La Fayette, Ind., 1901–1903.
Wabash River at Terre Haute, Ind., 1902–3 and 1905–6.
Wabash River at Mount Carmel, Ind., 1884–1909 (gage height records by United States Weather Bureau).
Tippecanoe River at Delphi, Ind., 1903–1906, 1908.
Embarrass River near Oakland, Ill., 1909.
Embarrass River at St. Marie, Ill., 1909.
West Branch of White River at Indianapolis, Ind., 1904–1906.
Eel River at Cataract, Ind., 1903–1906.
East Branch of White River at Shoals, Ind., 1903–1906, 1909.
Little Wabash River at Clay City, Ill., 1909.
Little Wabash River at Golden Gate, Ill., 1909.
Little Wabash River at Carmi, Ill., 1909.
Skillet Fork at Wayne City, Ill., 1909.
Skillet Fork at Mill Shoals, Ill., 1909.
Cumberland River at Nashville, Tenn., 1901–1904.
French Broad River at Rosman, N. C., 1907–1909.
French Broad River at Horseshoe, N. C., 1904–1906.
French Broad River at Asheville, N. C., 1895–1909.
French Broad River at Newport, Tenn., 1900–1905, 1907.
Tennessee River at Knoxville, Tenn., 1899–1909.
Tennessee River at Chattanooga, Tenn., 1895–1909.
Davidson River near Davidson River, N. C., 1904–1909.
Little River at Calhoun, N. C., 1907–8.
Mills River (North Fork) at Pinkbed, N. C., 1904–1909.
Mills River (South Fork) near Sitton, N. C., 1904–1909.
Mud Creek at Naples, N. C., 1907.
Swannanoa River at Swannanoa, N. C., 1907–1909.
Swannanoa River at Biltmore, N. C., 1905.
Ivy River at Democrat, N. C., 1907.
Pigeon River at Canton, N. C., 1907–1909.
Pigeon River at Newport, Tenn., 1900–1909.
Nolichucky River at Chucky Valley, Tenn., 1900–1901.
Nolichucky River at Greenville, Tenn., 1903–1908.
North Toe River at Spruce Pine, N. C., 1907–8.
Holston River (South Fork) near Chilhowie, Va., 1907–1909.
Holston River (South Fork) at Bluff City, Tenn., 1900–1909.
Holston River near Rogersville, Tenn., 1904–1909.
Holston River (Middle Fork) at Chilhowie, Va., 1907–1909.
Roan Creek at Butler, Tenn, 1900–1901.
Watauga River at Butler, Tenn., 1900–1901.
Watauga River near Elizabethton, Tenn., 1903–1908.
Elk Creek at Lineback, Tenn., 1900–1901.
Doe River at Elizabethton, Tenn., 1907–8.
Holston River (North Fork) at Saltville, Va., 1907–8.
Little Tennessee River at Franklin, N. C., 1907–8.
Little Tennessee River at Judson, N. C., 1896–1909.
Little Tennessee River at McGhee, Tenn., 1905–1909.
Cullasagee River at Cullasagee, N. C., 1907–1909.

Ohio River—Continued.
Tennessee River—Continued.
Nantahala River near Nantahala, N. C., 1907–1909.
Tuckasegee River near East Laport, N. C., 1907–1909.
Tuckasegee River at Bryson, N. C., 1896–1909.
Scotts Creek near Dillsboro, N. C., 1907–8.
Oconalufty River near Cherokee, N. C., 1907–8.
Cheoah River at Millsaps, N. C., 1907–8.
Clinch River at Clinchport, Va., 1907–1909.
Hiwassee River near Hayesville, N. C., 1907–1909.
Hiwassee River at Murphy, N. C., 1896–1909.
Hiwassee River at Reliance, Tenn., 1900–1909.
Hiwassee River at Charlestown, Tenn., 1899–1901, 1903.
Tusquitee Creek near Hayesville, N. C., 1907–1909.
Valley River at Tomotla, N. C., 1904–1909.
Nottely River at Ranger, N. C., 1901–1905.
Toccoa River near Dial, Ga., 1907–8.
Toccoa River at Blueridge, Ga., 1899–1903.
Ocoee River at McCays (Copper Hill), Tenn., 1903–1909.
Elk Creek near Elkmont, Ala., 1904–1908.
Duck River at Columbia, Tenn., 1904–1908.

ALLEGHENY RIVER DRAINAGE BASIN.

DESCRIPTION.

Allegheny River drains the western slopes of the Allegheny Mountains in Pennsylvania and New York.

The river rises in the central part of Potter County, in northern Pennsylvania, flows in a general northwesterly direction into New York to about the central part of Cattaraugus County, where it turns and flows southwestward back into Pennsylvania; at Franklin, in Venango County, it turns and flows southeastward to the mouth of Mahoning Creek, in Armstrong County, where it again bends to the southwest, and at Pittsburg joins the Monongahela to form the Ohio. The river is about 290 miles long (map measurement) and its drainage area, which is nearly 50 per cent greater than that of the Monongahela, comprises about 11,100 square miles.

The important tributaries, beginning at the source and following down the right bank, are Oswayo, Olean, Conewango, Brokenstraw, Oil, and French creeks; on the left bank are Potato, Tunugwant, and Tionesta creeks, Clarion River, Red Bank, Mahoning, and Crooked creeks, and Kiskiminitas River.

The elevation of the sources of the river is about 2,500 feet above sea level; at Olean, N. Y., the elevation is 1,420 feet; at Franklin, Pa., the elevation is 960 feet; at Pittsburg, the elevation is 692 feet.

The basin is somewhat regular in shape, being about 2½ times as long as it is wide. Its northwestern boundary is at one point about 8 miles from Lake Erie, lying within about 40 miles of Buffalo. Below Franklin, Pa., the river flows near the western boundary of its

basin. The surrounding country is made up of high hills or mountains separated by deep valleys, but west of the main river the country is less mountainous though the surface is still rolling and hilly.

The bed of the stream is composed chiefly of gravel ranging in size from small pebbles to cobblestones. The banks are made up of sand, gravel, or clay. The area is underlain by shales, and except in stream valleys the soil has little depth.

This basin is exceptionally rich in natural resources, coal, oil, gas, limestone, glass sand, and building stones occurring in abundance.

This basin was at one time covered with timber, the principal varieties being pine and hemlock. At present, however, only light forests and brush are found at the headwaters of the tributaries, the pine and hemlock having been cut off some time ago.

The mean annual rainfall in this region is about 40 inches and the winters are severe. Snowfall is heavy in the upper part of the basin and lasts for long periods, and ice forms to a thickness of about 2 feet. The heavy ice during the spring floods is very destructive. Jams frequently occur which cause considerable damage from backwater.

The basin affords good opportunities for storage reservoirs. Careful surveys would undoubtedly show a number of excellent sites for reservoirs of large capacity.

Allegheny River is subject to very severe floods, which cause heavy losses to manufacturing and other interests along the river.

The river is navigable for part of the year for small steamers to Franklin, 123 miles above the mouth.

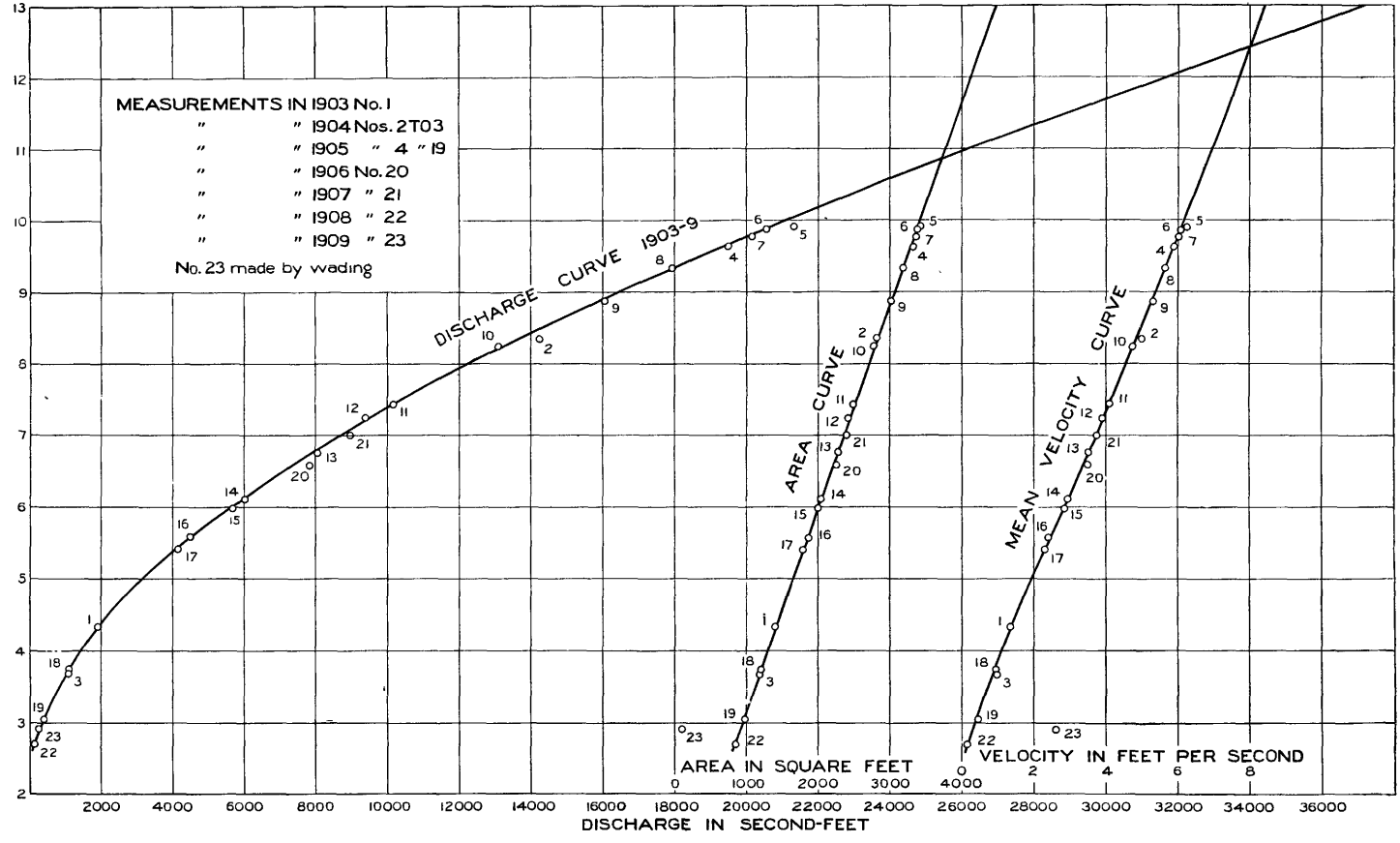
The fall of the main river and tributaries is comparatively large and if the stream were in a district where fuels were more expensive, it would undoubtedly be much used for power. When the price of coal advances so that water power can compete with steam, the water power on this stream will be more extensively developed.

The Cuba reservoir, which feeds the Erie Canal through Genesee River, lies on the divide between the Allegheny and Genesee drainage basins. Part of the overflow from this reservoir passes into the Allegheny and the rest into the Genesee.

ALLEGHENY RIVER AT RED HOUSE, N. Y.

This station, which is located at the Red House highway bridge, near the stations of the Erie and Pennsylvania railroads, about 5 miles below Salamanca, N. Y., and nearly 13 miles above the point where the river leaves New York State, was established September 4, 1903, to obtain general statistical data regarding the flow of the Allegheny, and is maintained in cooperation with the New York State engineer's department.

At Olean, N. Y., the wasteway from the Cuba reservoir enters the river through Olean Creek. This reservoir is located on the divide



DISCHARGE, AREA, AND MEAN VELOCITY CURVES FOR ALLEGHENY RIVER AT RED HOUSE, N. Y.

between Oil Creek, tributary to Allegheny River, and Genesee River. The storage is commonly turned into Genesee River through the abandoned summit level of Genesee Valley canal, but may be diverted into Oil Creek through the guard lock at the head of the canal. There are no lakes and no artificial storage tributary to the stream above the gaging station. Conewango Creek, the outlet of Chautauqua Lake, enters the Allegheny in the State of Pennsylvania.

The datum of the chain gage attached to the highway bridge has remained the same during the maintenance of the station. Conditions for obtaining the accurate discharge are good, and an excellent rating curve has been developed. (See Pl. III.) Moderate ice conditions usually prevail during the winter months.

Information in regard to this station is contained in the reports of the state engineer and surveyor, State of New York.

The following discharge measurement was made by C. C. Covert:

August 18, 1909:[a] Width, 80 feet; area, 103 square feet; gage height, 2.91 feet; discharge, 271 second-feet.

Daily gage height, in feet, of Allegheny River at Red House, N. Y., for 1909.

[Ora A. Gates, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.53	4.33	7.33	5.33	11.93	4.13	3.93	2.93	2.83	2.83	3.23	3.33
2	3.43	4.23	7.43	5.13	12.53	3.93	3.83	2.93	2.83	2.83	3.23	3.33
3	3.33	4.13	6.93	4.93	11.38	3.83	3.73	2.93	2.83	2.73	3.13	3.23
4	3.43	5.43	6.23	5.73	9.88	3.83	3.73	2.83	2.83	2.73	3.13	3.23
5	5.93	6.13	5.43	5.53	8.83	3.93	3.63	2.83	2.83	3.73	3.13	3.23
6	8.23	8.03	4.83	5.43	7.63	5.53	3.63	2.83	2.83	2.73	3.13	3.23
7	7.93	7.53	4.73	5.73	6.53	5.83	3.53	2.83	2.73	2.73	3.03	3.23
8	5.93	6.73	4.73	5.93	6.03	5.43	3.43	2.83	2.73	2.73	3.13	3.53
9	4.94	5.93	4.63	5.83	5.63	5.23	3.33	2.83	2.73	2.73	3.23	3.33
10	4.73	5.63	4.93	6.13	5.23	5.33	3.33	2.83	2.73	2.73	3.23	3.23
11	4.63	5.63	6.43	5.53	5.23	5.73	3.23	2.83	2.73	2.93	3.43	3.43
12	4.53	5.13	6.33	5.33	5.63	5.33	3.13	2.83	2.73	3.73	3.33	3.43
13	4.43	4.93	5.93	5.33	5.43	5.03	3.03	2.83	2.73	3.53	3.23	3.53
14	4.53	4.93	5.63	6.13	5.33	5.13	3.03	2.83	2.73	3.13	3.23	3.73
15	4.33	5.43	5.23	6.73	5.23	4.93	2.93	2.83	2.73	2.93	3.23	3.73
16	4.23	8.13	4.93	6.03	5.93	4.73	2.93	2.83	2.73	2.93	3.23	3.73
17	4.23	7.53	4.73	5.53	6.13	4.63	2.83	2.93	2.73	3.03	3.33	.....
18	4.03	6.83	4.63	5.43	6.03	4.63	2.83	2.93	2.73	2.93	3.33	3.80
19	4.03	7.13	4.53	5.33	5.73	4.53	2.83	2.93	2.73	3.03	3.33	.....
20	3.93	7.33	4.53	6.03	5.43	4.53	2.93	2.83	2.73	3.23	3.43	.....
21	3.83	6.73	4.43	6.43	5.23	4.73	2.93	2.83	2.73	3.43	3.53	.....
22	3.93	6.33	4.33	6.13	4.93	5.13	3.03	2.83	2.73	3.83	3.93	.....
23	5.73	6.73	4.33	5.83	4.83	5.13	3.13	2.83	2.73	3.73	4.53	3.80
24	7.43	8.78	4.93	5.63	4.53	5.03	3.23	2.83	2.73	3.63	4.43	.....
25	8.13	9.63	7.83	5.33	4.33	5.03	3.13	2.83	2.73	3.63	4.43	.....
26	7.23	8.93	7.93	5.43	4.23	4.93	3.13	2.83	2.73	3.53	3.93	.....
27	6.73	8.33	6.93	5.43	4.03	4.73	3.13	2.83	2.73	3.53	3.93	.....
28	5.93	7.83	6.33	5.43	3.93	4.63	3.03	2.83	2.73	3.43	3.83	.....
29	5.43	.....	5.73	5.33	4.23	4.33	3.03	2.83	2.73	3.33	3.53	.....
30	4.93	.....	5.63	10.73	4.23	4.13	3.03	2.83	2.83	3.33	3.43	.....
31	4.53	.....	5.43	.....	4.13	.....	2.93	2.83	.....	3.33	.....	3.80

[a] Measurement made at wading station one-half mile upstream.

NOTE.—No ice notes obtained for January, February, and March. Probably the river at the gage was not affected much by ice during this period. Ice conditions from about December 16 to 31.

Daily discharge, in second-feet, of Allegheny River at Red House, N. Y., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	900	1,940	9,840	3,890	31,300	1,650	1,380	320	242	242	588	685
2	788	1,790	10,200	3,420	34,600	1,380	1,250	320	242	242	588	685
3	685	1,650	8,510	2,980	28,300	1,250	1,130	320	242	168	497	588
4	788	4,140	6,340	4,910	20,500	1,250	1,130	242	242	168	497	588
5	5,460	6,040	4,140	4,390	15,800	1,380	1,010	242	242	168	497	588
6	13,200	12,400	2,780	4,140	10,900	4,390	1,010	242	242	168	497	588
7	12,000	10,500	2,600	4,910	7,240	5,180	900	242	168	168	407	588
8	5,460	7,870	2,600	5,460	5,750	4,140	783	242	168	168	497	685
9	3,000	5,460	2,420	5,180	4,650	3,650	685	242	168	168	588	685
10	2,600	4,650	2,980	6,040	3,650	3,890	685	242	168	168	588	588
11	2,420	4,650	6,940	4,390	3,650	4,910	588	242	168	320	788	788
12	2,250	3,420	6,640	3,890	4,650	3,890	497	242	168	1,130	685	788
13	2,090	2,980	5,460	3,890	4,140	3,200	407	242	168	900	588	900
14	2,250	2,980	4,650	6,040	3,890	3,420	407	242	168	497	588	1,130
15	1,940	4,140	3,650	7,870	3,650	2,980	320	242	168	320	588	1,130
16	1,790	12,800	2,980	5,750	5,460	2,600	320	242	168	320	588	1000
17	1,790	10,500	2,600	4,390	6,040	2,420	242	320	168	407	685	800
18	1,510	8,190	2,420	4,140	5,750	2,420	242	320	168	320	685	700
19	1,510	9,170	2,250	3,890	4,910	2,250	242	320	168	407	685	700
20	1,380	9,840	2,250	5,750	4,140	2,250	320	242	168	588	788	600
21	1,250	7,870	2,090	6,940	3,650	2,600	320	242	168	788	900	600
22	1,380	6,640	1,940	6,040	2,980	3,420	407	242	168	1,250	1,380	500
23	4,910	7,870	1,940	5,180	2,780	3,420	497	242	168	1,130	2,250	500
24	10,200	15,600	2,980	4,650	2,250	3,200	588	242	168	1,010	2,090	500
25	12,800	19,400	11,600	3,890	1,940	3,200	497	242	168	1,010	2,090	500
26	9,500	16,200	12,000	4,140	1,790	2,980	497	242	168	900	1,380	500
27	7,870	13,700	8,510	4,140	1,510	2,600	497	242	168	900	1,380	450
28	5,460	11,600	6,640	4,140	1,380	2,420	407	242	168	788	1,250	400
29	4,140	.....	4,910	3,890	1,790	1,940	407	242	168	685	900	400
30	2,980	.....	4,650	24,800	1,790	1,650	407	242	242	685	788	400
31	2,250	.....	4,140	.....	1,650	.....	320	242	.....	685	.....	400

NOTE.—Open water conditions assumed January 1 to March 31. Daily discharges January 1 to December 15 based on a well defined rating curve. Discharges December 16 to 31 estimated on the basis of the discharge from adjacent drainages.

Monthly discharge of Allegheny River at Red House, N. Y., for 1909.

[Drainage area, 1,640 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	13,200	685	4,080	2.49	2.87	A.
February	19,400	1,650	8,000	4.88	5.08	A.
March	12,000	1,940	4,960	3.02	3.48	A.
April	24,800	2,980	5,440	3.32	3.70	A.
May	34,600	1,380	7,500	4.57	5.27	A.
June	5,180	1,250	2,860	1.74	1.94	A.
July	1,380	242	593	.362	.42	B.
August	320	242	257	.157	.18	B.
September	242	168	185	.113	.13	B.
October	1,250	168	544	.332	.38	B.
November	2,250	407	877	.535	.60	A.
December	1,130	400	644	.393	.45	C.
The year	34,600	168	3,000	1.83	24.50	

ALLEGHENY RIVER AT KITTANNING, PA.

This station, which is located at the Market Street Bridge in the city of Kittanning, Pa., was established by the United States Geological Survey August 18, 1904, to obtain general comparative and statistical data regarding the flow of Allegheny River for the study of flood prevention at Pittsburg and on Ohio River and for the determination of the regimen of flow for power and navigation projects and

for the prevention of pollution. The station is now maintained by the Water Supply Commission of Pennsylvania, who have furnished the records of gage heights for 1909.

No important tributaries enter the Allegheny in the immediate vicinity of Kittanning. Crooked River enters from the east 4 miles below, and Kiskiminitas River enters from the east over 12 miles below the station.

The datum of the chain gage attached to the bridge has remained constant since the installation of the station.

The flow is obstructed by ice during short periods each winter. Conditions of flow are practically constant and an excellent low and medium stage rating curve has been developed. At high stages numerous measurements have been made. There is, however, a marked difference between the discharge at a given high gage height for rising and for falling stage, due to increase and decrease of slope. The difference at times amounts to as much as 15 per cent, and as the variation differs for each flood it is difficult to determine accurately the daily discharge at high stages.

No discharge measurements were made during 1909. The station was last inspected September 25, 1908. The accuracy of the daily and monthly discharges given in the following tables depends on the permanency of conditions of flow and of the elevation of the gage since that date:

Daily gage height, in feet, of Allegheny River at Kittanning, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.9	5.8	9.9	7.5	22.8	4.6	4.6	2.4	1.8	1.4	2.27	3.02
2	5.2	5.0	9.5	7.2	20.85	4.4	4.2	2.2	1.7	1.5	2.18	2.80
3	6.7	4.2	8.9	7.1	18.15	4.2	3.7	2.0	1.7	1.5	2.14	2.71
4	9.5	4.6	9.4	7.0	16.9	4.0	3.3	1.9	1.6	1.5	2.10	2.63
5	11.4	6.2	8.9	7.0	14.3	4.2	3.2	1.8	1.6	1.6	2.08	2.52
6	13.5	8.3	7.7	7.1	11.7	6.0	3.2	1.7	1.5	1.7	2.02	2.42
7	13.1	10.7	7.3	8.7	10.3	6.5	3.1	1.6	1.5	1.8	1.95	2.40
8	10.3	10.8	7.6	8.6	9.5	7.1	3.1	1.7	1.5	1.7	2.04	2.38
9	8.2	9.7	8.1	8.1	8.0	7.1	3.0	1.5	1.5	1.6	2.10	2.30
10	7.7	8.6	10.3	7.9	7.9	7.2	3.1	1.6	1.4	1.5	2.18	2.05
11	7.3	8.1	11.7	7.6	7.6	7.1	3.0	1.5	1.4	1.5	2.24	1.75
12	6.1	7.7	10.7	7.5	7.3	7.2	2.8	1.6	1.4	1.6	2.50	1.95
13	5.7	7.6	10.3	7.6	6.8	7.2	2.6	1.5	1.3	1.7	2.43	2.35
14	5.3	8.4	9.2	8.9	6.6	6.9	2.5	1.4	1.3	2.0	2.35	2.98
15	5.3	12.2	8.3	9.9	6.5	6.5	2.3	1.5	1.4	2.3	2.26	4.54
16	5.5	17.05	7.7	10.9	6.9	5.9	2.2	2.3	1.5	2.52	2.20	4.92
17	5.8	15.95	7.1	9.2	7.5	5.3	2.4	2.7	1.4	2.32	2.28	5.12
18	5.5	12.5	6.8	8.4	7.2	4.8	2.7	2.4	1.4	2.10	2.32	5.32
19	5.2	10.5	6.4	7.7	7.0	4.4	2.6	2.2	1.3	1.95	2.54	5.65
20	5.0	10.4	6.3	7.6	6.6	4.9	2.6	2.2	1.3	2.05	2.62	5.70
21	4.6	11.9	6.2	7.6	6.0	4.3	2.5	2.1	1.4	2.11	2.90	5.75
22	6.3	11.3	5.8	7.9	5.6	3.7	2.5	1.8	1.5	2.31	3.30	5.63
23	8.1	9.9	5.6	8.1	5.2	4.5	2.5	1.8	1.4	2.22	3.95	5.45
24	13.7	10.1	6.3	8.2	5.0	4.9	2.6	1.7	1.4	2.20	5.02	5.10
25	15.0	12.85	7.6	7.2	4.7	5.3	2.6	1.6	1.3	2.84	5.32	5.06
26	12.3	14.35	8.5	6.8	4.4	5.1	2.7	1.6	1.3	3.02	4.71	5.04
27	10.8	13.1	10.4	6.3	4.3	5.3	2.6	1.6	1.4	3.15	4.13	5.08
28	8.7	11.4	9.9	6.2	4.5	6.2	2.6	1.6	1.4	3.06	3.65	5.20
29	7.9	.....	9.4	6.15	4.8	5.7	2.6	1.7	1.4	2.95	3.44	5.05
30	7.2	.....	8.7	21.3	4.8	5.1	2.6	1.7	1.4	3.01	3.10	4.84
31	6.4	.....	8.1	.....	4.7	.....	2.5	1.8	.....	2.60	.....	4.66

NOTE.—River frozen December 21 to 31.

Daily discharge, in second-feet, of Allegheny River at Kittanning, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9,160	12,800	34,200	20,900	155,000	8,080	8,080	2,200	1,310	880	1,980	3,430
2	10,300	9,540	31,800	19,400	130,000	7,400	6,740	1,870	1,190	980	1,840	2,950
3	17,000	6,740	28,500	18,900	100,000	6,740	5,210	1,580	1,190	980	1,780	2,770
4	31,800	8,080	31,300	18,400	87,600	6,100	4,110	1,440	1,080	980	1,720	2,620
5	43,200	14,600	28,500	18,400	64,600	6,740	3,860	1,310	1,080	1,080	1,690	2,420
6	58,100	25,200	21,900	18,900	45,200	13,700	3,860	1,190	980	1,190	1,610	2,240
7	55,600	38,900	19,900	27,400	36,500	16,000	3,620	1,080	980	1,310	1,510	2,200
8	36,500	39,500	21,400	26,800	31,800	18,900	3,620	1,190	980	1,190	1,640	2,170
9	24,600	33,000	24,100	24,100	23,500	18,900	3,380	980	980	1,080	1,720	2,030
10	21,900	26,800	36,500	23,000	23,000	19,400	3,620	1,080	880	980	1,840	1,650
11	19,900	24,100	45,200	21,400	21,400	18,900	3,380	980	880	980	1,930	1,250
12	14,200	21,900	38,900	20,900	19,900	19,400	2,950	1,080	880	1,080	2,380	1,510
13	12,400	21,400	36,500	21,400	17,400	19,400	2,560	980	790	1,190	2,250	2,120
14	10,700	25,700	30,200	28,500	16,500	17,900	2,380	880	790	1,580	2,120	3,340
15	10,700	48,500	25,200	34,200	16,000	16,000	2,030	980	880	2,030	1,970	7,880
16	11,600	89,100	21,900	40,100	17,900	13,300	1,870	2,030	980	2,470	1,870	9,240
17	12,800	78,800	18,900	30,200	20,900	10,700	2,200	2,750	880	2,060	2,000	10,000
18	11,600	50,600	17,400	25,700	19,400	8,800	2,750	2,200	880	1,720	2,060	10,800
19	10,300	37,700	15,500	21,900	18,400	7,400	2,560	1,870	790	1,510	2,450	12,200
20	9,540	37,100	15,100	21,400	16,500	9,160	2,560	1,870	790	1,650	2,600	12,400
21	8,080	46,500	14,600	21,400	13,700	7,060	2,380	1,720	880	1,740	3,160	9,450
22	15,100	42,600	12,800	23,000	12,000	5,210	2,380	1,310	980	2,050	4,110	9,000
23	24,100	34,200	12,000	24,100	10,300	7,740	2,380	1,310	880	1,900	5,950	8,500
24	59,700	35,300	15,100	24,600	9,540	9,160	2,560	1,190	880	1,870	9,620	7,450
25	70,400	53,200	21,400	19,400	8,440	10,700	2,560	1,080	790	3,030	10,800	7,340
26	49,200	65,000	26,200	17,400	7,400	9,930	2,750	1,080	790	3,430	8,470	7,280
27	39,500	55,000	37,100	15,100	7,060	10,700	2,560	1,080	880	3,740	6,510	7,400
28	27,400	43,200	34,200	14,600	7,740	14,600	2,560	1,080	880	3,530	5,060	7,720
29	23,000	.....	31,300	14,400	8,800	12,400	2,560	1,190	880	3,270	4,480	7,300
30	19,400	.....	27,400	136,000	8,800	9,930	2,560	1,190	880	3,410	3,620	6,700
31	15,500	.....	24,100	.....	8,440	.....	2,380	1,310	.....	2,560	.....	6,290

NOTE.—These daily discharges are based on a rating curve well defined above a discharge of 1,950 second-feet. Discharges for December 21 to 31 have been reduced about 25 per cent because of ice conditions.

Monthly discharge of Allegheny River at Kittanning, Pa., for 1909.

[Drainage area, 8,690 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	70,400	8,080	25,200	2.90	3.34	A.
February	89,100	6,740	36,600	4.21	4.38	A.
March	45,200	12,000	25,800	2.97	3.42	A.
April	136,000	14,400	26,400	3.04	3.39	A.
May	155,000	7,060	31,700	3.65	4.21	A.
June	19,400	5,210	12,000	1.38	1.54	A.
July	8,080	1,870	3,190	.367	.42	A.
August	2,750	880	1,390	.160	.18	B.
September	1,310	790	930	.107	.12	C.
October	3,740	880	1,850	.213	.25	B.
November	10,800	1,510	3,360	.387	.43	A.
December	12,400	1,250	5,800	.667	.77	C.
The year	155,000	790	14,500	1.67	22.45	

KISKIMINITAS RIVER AT AVONMORE, PA.

Kiskiminitas River is formed at Saltsburg, Pa., by the union of Conemaugh River with Loyalhanna Creek. The station, which is about 5 miles below the junction, was established June 11, 1907, at the highway bridge near Avonmore station on the Pennsylvania Railroad, to obtain general comparative and statistical data regarding the flow of Kiskiminitas River for the study of power and water

pollution problems. It is maintained by the Water Supply Commission of Pennsylvania, which has furnished the records of gage height for 1909.

This river is subject to sudden violent floods similar to those which occur in the Youghiogheny and Monongahela rivers and which, when combined, have such disastrous effects at Pittsburg and other cities on Ohio River. In the flood of March 19, 1908, the Kiskiminitas rose to a crest height of 30.8 feet, and its discharge was estimated at 80,500 second-feet, or 46 second-feet per square mile from a drainage area of 1,750 square miles.

Blacklegs Creek enters from the right about 4 miles above the station, and Long Run enters from the right about 1 mile below the station.

The discharge is affected by ice for short periods during the winter months. The datum of the chain gage attached to the bridge has remained unchanged since the establishment of the station. Conditions of flow appear to be constant, and an excellent rating curve has been developed for stages below about 15 feet.

No discharge measurements were made during 1909. The station was last inspected September 25, 1908. The accuracy of the daily and monthly discharges given in the following table depends on the permanency of conditions of flow and of the elevation of the gage since that date.

Daily gage height, in feet, of Kiskiminitas River at Avonmore, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	3.7	7.7	5.7	13.0	2.85	3.45	2.85	2.55	1.85	2.45	2.15
2	4.1	3.6	9.2	5.6	12.8	3.8	3.1	2.6	2.25	1.85	2.45	2.15
3	4.2	3.8	11.5	5.5	9.8	3.25	2.85	2.35	2.15	1.85	2.35	2.15
4	4.1	4.0	13.7	5.5	9.8	3.5	2.8	2.2	2.05	1.85	2.35	2.05
5	3.6	4.1	11.5	5.7	8.7	3.55	2.55	2.05	2.1	1.9	2.30	2.05
6	3.7	6.0	8.8	5.6	7.8	6.05	2.45	2.05	2.05	1.85	2.25	2.05
7	5.1	6.5	8.0	10.4	7.1	5.6	2.5	2.0	2.05	1.75	2.25	2.05
8	4.0	5.6	7.5	8.8	6.3	4.45	2.35	1.95	2.05	1.75	2.25	2.25
9	3.5	4.5	7.5	7.5	5.8	4.3	2.4	2.0	1.95	1.75	2.25	2.55
10	3.5	5.5	8.5	6.9	4.7	5.45	2.25	1.85	2.0	1.8	2.4	2.55
11	3.5	6.1	8.5	6.2	5.4	11.95	2.15	1.85	1.95	1.85	2.45	2.75
12	3.7	5.3	7.3	5.8	5.2	9.0	2.2	1.9	1.95	2.15	2.45	2.75
13	3.6	5.5	6.6	5.6	4.7	6.95	2.15	1.85	1.95	4.15	2.35	2.95
14	3.6	6.5	6.3	10.5	4.4	6.5	2.2	1.9	1.95	3.15	2.35	4.95
15	4.7	7.8	5.8	12.2	4.1	5.65	2.25	2.05	1.9	2.6	2.2	6.15
16	7.8	8.9	5.4	9.3	4.1	4.95	2.25	3.7	2.05	2.55	2.25	5.25
17	6.2	11.1	5.1	7.9	3.8	4.5	2.3	3.7	1.85	2.35	2.25	6.75
18	7.6	7.2	4.9	7.0	3.7	4.45	2.15	3.65	2.05	2.15	2.25	6.05
19	7.0	6.9	4.6	6.3	3.5	4.4	2.1	3.1	1.95	2.15	2.25	5.95
20	5.4	7.1	5.6	5.8	3.3	4.35	2.05	2.85	1.9	2.3	2.3	5.45
21	5.0	7.6	6.2	8.1	3.5	3.55	2.05	2.65	1.85	2.45	2.25	5.45
22	4.9	6.9	5.5	11.5	4.6	3.5	2.0	2.6	1.85	2.45	2.25	5.45
23	4.8	6.9	5.1	11.2	4.3	3.25	2.25	2.35	1.75	2.45	2.25	5.45
24	8.5	15.7	4.7	9.5	3.4	3.6	3.9	2.3	2.15	3.45	2.25	5.55
25	8.2	14.1	5.1	8.6	3.2	3.25	3.15	2.15	2.1	5.2	2.5	5.55
26	7.6	10.8	8.0	8.4	3.1	3.05	2.75	2.15	2.35	3.95	2.45	5.55
27	5.7	9.2	7.5	8.1	3.1	3.1	2.6	2.2	2.15	3.45	2.35	5.55
28	5.2	8.5	7.3	7.6	3.2	4.55	2.35	2.15	2.05	3.05	2.35	5.55
29	4.7	.....	6.9	7.6	3.6	4.1	2.3	2.2	1.95	2.85	2.25	5.35
30	4.5	.....	5.2	11.0	3.3	3.95	2.15	2.05	1.9	2.65	2.3	5.05
31	4.2	.....	5.1	.....	3.1	.....	2.4	2.3	.....	2.6	.....	5.05

NOTE.—Ice conditions probably existed the latter part of December.

Daily discharge, in second-feet, of Kiskiminitas River at Avonmore, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	470	1,200	6,020	3,300	17,400	610	1,000	610	445	146	396	261
2	1,540	1,120	8,540	3,180	16,900	1,280	765	470	304	146	396	261
3	1,630	1,280	13,400	3,060	9,660	865	610	349	261	146	349	261
4	1,540	1,450	19,400	3,060	9,660	1,040	580	282	220	146	349	220
5	1,120	1,540	13,400	3,300	7,660	1,080	445	220	240	163	326	220
6	1,200	3,690	7,830	3,180	6,180	3,760	396	220	220	146	304	220
7	2,580	4,340	6,500	10,900	5,140	3,180	420	200	220	112	304	220
8	1,450	3,180	5,720	7,830	4,080	1,870	349	182	220	112	304	304
9	1,040	1,920	5,720	5,720	3,430	1,720	372	200	182	112	304	445
10	1,040	3,060	7,320	4,860	2,130	3,000	304	146	200	128	372	445
11	1,040	3,820	7,320	3,950	2,940	14,600	261	146	182	146	396	552
12	1,200	2,820	5,420	3,430	2,700	8,180	282	163	182	261	396	552
13	1,120	3,060	4,470	3,180	2,130	4,930	261	146	182	1,580	349	670
14	1,120	4,340	4,080	11,100	1,820	4,340	282	163	182	798	349	2,400
15	2,130	6,180	3,430	15,300	1,540	3,240	304	220	163	470	282	3,880
16	6,180	8,000	2,940	8,720	1,540	2,400	304	1,200	220	445	304	2,760
17	3,950	12,500	2,580	6,340	1,280	1,920	326	1,200	146	349	304	4,660
18	5,870	5,280	2,350	5,000	1,200	1,870	261	1,160	220	261	304	3,760
19	5,000	4,860	2,020	4,080	1,040	1,820	240	765	182	261	304	3,520
20	2,940	5,140	3,180	3,430	900	1,770	220	610	163	326	326	3,000
21	2,460	5,870	3,950	6,660	1,040	1,080	220	498	146	396	304	.....
22	2,350	4,860	3,060	13,400	2,020	1,040	200	470	146	396	304	.....
23	2,240	4,860	2,580	12,700	1,720	865	304	349	112	396	304	.....
24	7,320	25,100	2,130	9,090	970	1,120	1,360	326	261	1,000	304	.....
25	6,820	20,500	2,580	7,490	830	865	798	261	240	2,700	420	.....
26	5,870	11,800	6,500	7,150	765	732	552	261	349	1,400	396	.....
27	3,300	8,540	5,720	6,660	765	765	470	282	261	1,000	349	.....
28	2,700	7,320	5,420	5,870	830	1,970	349	261	220	732	349	.....
29	2,130	.....	4,860	5,870	1,120	1,540	326	282	182	610	304	.....
30	1,920	.....	2,700	12,200	900	1,400	261	220	163	498	326	.....
31	1,630	.....	2,580	.....	765	.....	372	326	.....	470	.....	.....

NOTE.—These discharges are based on a rating curve that is well defined between 65 and 23,000 second-feet. Discharges for December 21 to 25 have been estimated equivalent to 2,000 second-feet per day, and for December 26 to 31, to 1,500 second-feet per day.

Monthly discharge of Kiskiminitas River at Avonmore, Pa., for 1909.

[Drainage area, 1,750 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	7,320	470	2,670	1.53	1.76	A.
February	25,100	1,120	5,990	3.42	3.56	B.
March	19,400	2,020	5,600	3.20	3.69	A.
April	15,300	3,060	6,670	3.81	4.25	A.
May	17,400	765	3,580	2.05	2.36	A.
June	14,600	610	2,500	1.43	1.60	A.
July	1,360	200	426	.243	.28	A.
August	1,200	146	393	.225	.26	A.
September	445	112	214	.122	.14	A.
October	2,700	112	511	.292	.34	A.
November	420	282	336	.192	.21	A.
December	4,660	220	1,530	.874	1.01	C.
The year	25,100	112	2,540	1.45	19.12	

BLACKLICK CREEK AT BLACKLICK, PA.

This station was established by the United States Geological Survey at the highway bridge about one-fourth mile from the railroad station August 16, 1904, was discontinued July 15, 1906, and was reestablished January 8, 1907, by the Water Supply Commission of Pennsylvania, by which the records of gage heights in the following table are furnished. The records furnish data regarding the flow of Blacklick Creek available for power development and for the study of flood and pollution prevention.

The station is about 6 miles above the junction of Blacklick Creek with Conemaugh River and about 1 mile below the junction of Blacklick and Two Lick creeks.

The channel is obstructed by ice for short periods during the winter months. The datum of the gage has remained constant during the maintenance of the station.

During September, 1905, the original covered wooden bridge was torn down and replaced by a steel bridge. From September 1 to November 2, 1905, the gage readings were taken on a temporary gage 235 feet above the bridge, referred to the correct datum. On November 2 the chain gage was replaced on the new bridge. Construction work and changes in the abutments and pier changed the conditions of flow and required the use of a new rating curve beginning about September 1. The monthly discharge, September 1, 1905, to April 9, 1906, was revised and republished in Water-Supply Paper 243. The discharge for September and October, 1905, during the time that the temporary gage was used, is liable to some error, and the discharge April 10 to July 15, 1906, is suppressed owing to poor gage readings; otherwise all records of discharge for low and medium stages are excellent. The rating curve has not been developed above gage height 6 feet.

No discharge measurements were made during 1909. The station was last inspected September 24, 1908. The accuracy of the daily and monthly discharges depends on the conditions of flow, which are fairly permanent, and on the permanency of the elevation of the gage since that date.

Daily gage height, in feet, of Blacklick Creek at Blacklick, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.10	3.10	4.20	3.65	7.85	2.60	2.80	2.87	2.17	2.07	2.17	2.27
2	2.75	3.05	7.13	3.60	6.45	2.70	2.70	2.62	2.17	1.97	2.17	2.27
3	2.95	3.10	6.75	3.60	5.40	2.80	2.65	2.42	2.17	1.97	2.27	2.23
4	3.30	3.10	6.45	3.55	5.75	3.15	2.65	2.37	2.17	1.97	2.32	2.27
5	3.75	3.50	5.15	3.35	4.95	3.60	2.50	2.27	2.17	1.97	2.27	2.23
6	4.40	4.50	4.65	3.75	4.65	3.90	2.40	2.27	2.17	1.97	2.27	2.23
7	3.85	4.15	4.45	5.90	4.25	3.40	2.40	2.27	2.17	1.97	2.17	2.41
8	3.40	3.85	4.45	4.70	3.95	3.15	2.30	2.27	2.17	1.97	2.22	2.59
9	3.40	3.75	4.60	4.45	3.75	3.70	2.30	2.27	2.07	1.97	2.42	2.45
10	3.20	4.05	5.00	4.10	3.60	5.20	2.25	2.17	2.07	1.97	2.43	2.39

Daily gage height, in feet, of Blacklick Creek at Blacklick, Pa., for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	3.35	4.00	4.75	3.85	3.70	6.25	2.25	2.17	2.07	2.17	2.37	2.42
12	3.50	3.75	4.25	3.70	3.55	4.80	2.30	2.17	2.07	2.82	2.33	2.33
13	3.30	4.50	4.10	3.70	3.35	4.20	2.25	2.07	2.07	2.62	2.26	2.50
14	3.30	4.70	4.00	6.57	3.20	4.10	2.40	2.07	1.97	2.42	2.24	4.26
15	5.05	5.40	3.70	5.25	3.05	3.65	2.30	2.17	1.97	2.22	2.23	3.57
16	4.80	6.23	3.60	4.60	3.10	3.40	2.25	2.62	2.02	2.27	2.35	3.09
17	3.95	5.80	3.45	4.20	3.00	3.25	2.30	2.82	2.07	2.17	2.43	2.83
18	3.85	4.85	3.35	3.95	2.90	3.20	2.25	2.62	2.07	2.17	2.45	2.85
19	3.55	4.45	3.50	3.75	2.80	3.15	2.20	2.42	1.97	2.17	2.37	2.63
20	3.60	4.75	3.85	3.65	2.70	2.90	2.15	2.32	1.97	2.17	2.33	2.63
21	3.45	4.60	3.75	4.05	3.05	2.80	2.15	2.27	1.97	2.22	2.29	2.65
22	3.75	4.55	3.55	5.65	3.05	2.80	2.20	2.27	1.97	2.27	2.29	2.59
23	4.65	5.10	3.45	5.20	2.90	2.80	3.68	2.17	2.02	2.37	2.35	2.57
24	5.45	8.63	3.40	4.85	2.80	3.05	3.20	2.17	2.12	2.97	2.46	2.52
25	4.65	6.55	4.45	4.30	2.65	3.00	2.70	2.17	2.17	2.92	2.43	2.54
26	4.20	5.35	4.80	4.60	2.70	2.90	2.50	2.17	2.17	2.62	2.38	2.53
27	3.85	4.80	4.75	4.25	2.70	2.90	2.45	2.17	2.07	2.47	2.35	2.53
28	3.65	4.55	4.55	4.50	3.05	3.62	2.35	2.17	2.07	2.42	2.31	2.50
29	3.50	.....	4.25	4.60	2.95	3.55	2.30	2.17	2.07	2.32	2.29	2.55
30	3.35	.....	3.95	7.20	2.65	3.05	2.70	2.17	2.07	2.27	2.30	2.55
31	3.10	.....	3.85	.....	2.70	.....	3.27	2.17	.....	2.17	.....	2.49

NOTE.—No ice conditions reported.

Daily discharge, in second-feet, of Blacklick Creek at Blacklick, Pa., for 1909.

Day.	Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	365	365	1,140	695	5,620	172	240	268	53	33	53	76
2	222	342	4,590	660	3,680	205	205	179	53	17	53	76
3	300	365	4,060	660	2,370	240	188	116	53	17	76	66
4	470	365	3,680	625	2,780	390	188	102	53	17	88	76
5	768	590	2,100	498	1,880	660	140	76	53	17	76	66
6	1,320	1,420	1,570	768	1,570	885	110	76	53	17	76	66
7	845	1,100	1,370	2,960	1,180	525	110	76	53	17	53	113
8	525	845	1,370	1,620	925	390	83	76	53	17	64	169
9	525	768	1,520	1,370	768	730	83	76	33	17	116	125
10	415	1,010	1,930	1,050	660	2,150	71	53	33	17	119	107
11	498	965	1,670	845	730	3,420	71	53	33	53	102	116
12	590	768	1,180	730	625	1,720	83	53	33	248	91	91
13	470	1,420	1,050	730	498	1,140	71	33	33	179	73	140
14	470	1,620	965	3,830	415	1,050	110	33	17	116	69	1,190
15	1,980	2,370	730	2,200	342	695	83	53	17	64	66	639
16	1,720	3,390	660	1,520	365	525	71	179	24	76	96	360
17	925	2,840	558	1,140	320	442	83	248	33	53	119	252
18	845	1,770	498	925	280	415	71	179	33	53	125	260
19	625	1,370	590	768	240	390	59	116	17	53	102	182
20	660	1,670	845	695	205	280	48	88	17	53	91	182
21	558	1,520	768	1,010	342	240	48	76	17	64	81	188
22	768	1,470	625	2,660	342	240	59	76	17	76	81	169
23	1,570	2,040	558	2,150	280	240	716	53	24	102	96	162
24	2,420	6,820	525	1,770	240	342	415	53	42	308	128	146
25	1,570	3,800	1,370	1,230	188	320	205	53	53	288	119	153
26	1,140	2,320	1,720	1,520	205	280	140	53	53	179	105	150
27	845	1,720	1,670	1,180	205	280	125	53	33	131	96	150
28	695	1,470	1,470	1,420	342	674	96	53	33	116	86	140
29	590	.....	1,180	1,520	300	625	83	53	33	88	81	156
30	498	.....	925	4,690	188	342	205	53	33	76	83	156
31	365	.....	845	.....	205	.....	454	53	.....	53	.....	137

NOTE.—These discharges are based on a rating curve that is well defined below 1,930 second-feet.

Monthly discharge of Blacklick Creek at Blacklick, Pa., for 1909.

[Drainage area, 403 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	2,420	222	824	2.04	2.35	B.
February	6,820	342	1,660	4.12	4.29	B.
March	4,590	498	1,410	3.50	4.04	B.
April	4,690	498	1,450	3.60	4.02	B.
May	5,620	188	913	2.27	2.62	B.
June	3,420	172	667	1.66	1.85	B.
July	716	48	152	.377	.43	A.
August	268	33	89.1	.221	.25	A.
September	53	17	36.2	.090	.10	A.
October	308	17	84.4	.209	.24	A.
November	128	53	88.8	.220	.25	A.
December	1,190	66	195	.484	.56	B.
The year	6,820	17	631	1.57	21.00	

MONONGAHELA RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Monongahela River lies in the States of Pennsylvania, Maryland, and West Virginia. The river is formed in the east-central part of Marion County, W. Va., by the union of Tygart and West Fork rivers—two streams whose headwaters drain the western slopes of the Allegheny Mountains. From this junction point it flows northeastward across the Pennsylvania state line to the mouth of Cheat River, thence northward, and unites with Allegheny River to form the Ohio at Pittsburg, Pa. The river is 125 miles long and its drainage area comprises about 7,350 square miles. It is navigable through its entire length by means of locks and dams.

The Tygart, also called Tygart Valley River, drains the country to the southeast of the head of Monongahela River; the West Fork, the country to the southwest. Tygart River rises in the southern part of Randolph County, W. Va., and flows northerly; the West Fork rises in the western part of Upshur County, W. Va., flows northwestward into Lewis County and thence in a slight northeasterly direction to its junction with the Tygart at Fairmont, W. Va. The Tygart is about 100 miles long (map measurement) and its drainage area above its mouth is about 1,420 square miles; the West Fork is about 70 miles (map measurement) long and drains about 845 square miles.

The sources of the West Fork head at an altitude of 1,500 feet above sea level; those of the Tygart at 3,500 feet. At Fairmont the Monongahela has an elevation of 860 feet, and at the mouth of the river at Pittsburg the elevation is 692 feet above sea level.

The headwater country is mountainous, the slopes of the valleys are steep, and in many places precipitous, and the fall of the streams

is rapid; farther down the country becomes less mountainous, but remains very rolling. The steep slopes and rocky soil of the upper country cause the heavy rains to run off rapidly, producing sudden and intense floods and a low flow in dry periods.

The headwater regions are covered with fine growths of hardwood timber which are being rapidly lumbered. Below Fairmont the slope of the main stream is but little more than 1 foot per mile.

The basin is exceptionally rich in natural resources, as it is underlain by very valuable and extensive coal beds and contains oil and gas in abundance.

The important tributaries of the Monongahela, beginning at the head of the river and following down the east bank, are Cheat and Youghiogheny rivers; on the west bank are Buffalo and Tenmile creeks, neither of which is of much importance.

The country drained by Cheat and Youghiogheny rivers resembles that drained by Tygart and West Fork rivers, being mountainous and rough at the headwaters, losing the mountainous character as the rivers are descended, and continuing rolling and hilly to the junctions with the main stream.

This basin was at one time covered with forests, but the greater part of the timber has been cut off, and though some still remains at the headwaters, the area of timbered land is small when compared to the total area of the basin.

The mean annual rainfall on that portion of the basin in West Viriginia is from 45 to 50 inches; on the portion in Pennsylvania it is 40 to 45 inches. The winters in the southern part of the basin are comparatively mild. The snowfall is light and does not last long, and ice does not form very thick. In the northern part of the basin ice forms about a foot in thickness during severe winters, but in ordinary winters it is not very thick and it causes little trouble in floods.

The tributaries of Monongahela River afford a number of reservoir sites, some of which would store an immense quantity of water.

Fuel is so cheap and abundant in the drainage basin that little water power has been developed, although the main stream and its tributaries afford good opportunities. At the dams on the main stream a fall of about 140 feet is available for use. The low flow during dry spells is unfavorable for water-power development.

TYGART RIVER AT BELINGTON, W. VA.

This station, which is located at the highway bridge at Belington, W. Va., was established June 5, 1907, to obtain data connected with the study of water power, water supply, pollution, flood control, and storage problems.

In general, the winters are mild. The station has not been maintained long enough to determine definitely the ice conditions.

The records are reliable and accurate. The datum of the chain gage attached to the bridge has remained unchanged.

Sufficient data have not yet been obtained to develop a satisfactory rating curve for all stages of flow. Estimates of discharge are withheld for the present.

Discharge measurements of Tygart River at Belington, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 20	A. H. Horton	180	327	3.05	203
November 17	do	186	395	3.44	328
December 4	G. L. Parker	186	342	3.11	208

Daily gage height, in feet, of Tygart River at Belington, W. Va., for 1909.

[S. A. Campbell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	3.7	5.0	4.8	5.7	2.8	3.6	6.4	2.6	2.6	3.2	3.3
2	3.7	3.7	4.7	4.5	5.5	3.1	3.2	4.1	2.5	2.5	3.1	3.2
3	3.6	3.6	4.4	5.1	5.1	3.3	2.9	3.7	2.4	2.5	3.2	3.2
4	3.0	3.5	6.1	5.7	5.3	3.0	2.9	3.3	2.5	2.4	3.1	3.1
5	2.9	3.5	5.5	6.1	5.1	3.0	2.7	3.1	2.5	2.4	2.9	3.1
6	2.9	3.9	5.1	6.3	4.7	5.0	2.5	2.9	2.6	2.3	2.9	3.0
7	3.7	4.1	5.8	5.5	4.5	4.2	2.5	3.0	2.6	2.3	2.9	3.1
8	3.4	4.6	7.8	4.9	4.0	4.8	2.5	2.8	2.5	2.3	2.8	3.1
9	3.3	4.0	6.7	4.3	3.9	7.0	2.5	2.6	2.5	2.3	2.8	3.1
10	3.2	5.8	6.3	4.0	3.7	5.4	2.5	2.6	2.6	2.3	7.5	3.0
11	3.0	7.4	6.0	3.9	4.2	5.8	2.4	2.5	4.2	2.2	6.6	3.0
12	2.9	5.5	5.0	3.7	4.5	5.3	2.3	2.5	3.8	3.3	5.2	3.0
13	3.0	4.7	4.5	3.6	4.1	4.9	2.3	2.4	3.0	4.0	4.4	3.0
14	3.3	4.9	4.6	7.5	3.9	4.3	2.3	2.3	2.7	3.4	4.1	4.5
15	6.4	5.2	4.9	9.9	3.7	4.0	2.5	2.3	2.6	3.1	3.6	5.3
16	7.0	5.3	4.5	6.2	3.5	4.2	2.7	3.7	4.5	3.4	3.5	4.5
17	6.4	6.1	4.3	5.0	3.4	4.2	2.6	4.6	5.9	3.2	3.4	4.0
18	5.8	5.5	4.0	4.5	3.2	7.5	2.5	4.1	3.6	3.4	3.3	3.7
19	4.2	4.9	3.7	4.0	3.0	5.7	2.4	3.5	3.4	4.0	3.2	4.0
20	4.0	4.7	3.8	3.9	3.0	4.9	2.4	3.2	3.0	4.3	3.2	4.7
21	4.0	5.0	3.8	6.1	3.1	3.7	2.4	3.4	2.8	4.5	3.1	4.8
22	3.8	5.5	3.7	8.1	3.3	3.5	2.3	3.3	2.7	3.7	3.1	4.6
23	3.6	5.4	3.7	8.2	3.3	3.2	2.5	3.2	2.6	3.6	3.2	4.4
24	3.5	5.4	3.6	8.9	3.3	3.1	3.0	3.0	3.4	10.2	3.3	4.0
25	3.5	6.7	3.7	7.0	3.2	3.0	3.0	2.8	2.7	6.4	4.0	4.2
26	3.5	6.1	4.2	5.7	3.1	2.9	2.9	2.6	2.9	5.1	3.8	4.1
27	3.4	5.7	5.2	5.7	3.1	2.7	2.7	2.5	3.0	4.1	3.6	4.0
28	3.3	5.4	5.8	5.3	3.2	3.4	2.7	2.5	2.9	4.0	3.5	4.1
29	3.2	.....	6.1	5.4	3.3	3.4	2.6	2.4	2.8	3.7	3.3	4.0
30	3.2	.....	5.5	5.0	3.2	3.1	2.6	2.1	2.7	3.5	3.3	3.8
31	3.4	.....	5.1	.....	3.0	.....	8.1	2.8	.....	3.4	.....	3.5

TYGART RIVER AT FETTERMAN, W. VA.

This station, which is located at the highway bridge at Fetterman, W. Va., was established June 3, 1907, to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

Lost Otter Creek enters from the west about one-half mile below the station.

The winters are mild; ice does not form very thick and does not last long. The records are reliable and accurate; the datum of the gage chain attached to the bridge has not been changed.

Sufficient data have not yet been collected to enable estimates of flow to be made.

Discharge measurements of Tygart River at Fetterman, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 19	A. H. Horton	267	1,470	4.20	722
November 16	do	268	1,580	4.56	1,080
December 5	G. L. Parker	269	1,410	4.11	620

Daily gage height, in feet, of Tygart River at Fetterman, W. Va., for 1909.

[Joseph Gerken, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	4.8	5.85	5.8	7.65	4.0	4.45	5.65	3.5	3.8	4.3	4.3
2	4.2	4.65	5.65	5.65	9.65	3.9	4.3	4.8	3.5	3.8	4.25	4.25
3	4.35	4.55	6.15	5.8	8.7	4.05	4.15	4.65	3.55	3.75	4.15	4.15
4	4.4	4.45	8.0	5.85	6.9	4.05	4.05	4.5	3.65	3.65	4.1	4.1
5	4.45	4.5	7.25	6.7	6.15	4.6	3.9	4.1	3.7	3.6	4.1	4.1
6	4.4	5.05	6.5	7.0	5.75	6.05	3.75	3.9	3.55	3.5	4.05	4.05
7	4.2	5.65	6.5	6.55	5.55	5.1	3.65	3.8	3.5	3.5	4.0	4.05
8	4.45	5.7	7.4	5.8	5.2	5.15	3.5	3.7	3.5	3.4	3.9	4.15
9	4.6	5.65	7.3	5.5	4.85	7.15	3.45	3.65	3.5	3.4	3.9	4.1
10	4.35	7.45	6.85	5.35	4.8	6.55	3.4	3.6	4.75	3.4	5.65	3.95
11	4.4	8.65	6.65	5.05	4.95	8.95	3.4	3.5	5.45	3.4	8.0	3.9
12	4.6	6.8	6.1	4.85	4.9	6.8	3.45	3.5	4.8	3.8	6.2	4.1
13	4.55	6.2	5.65	4.8	4.85	5.95	3.6	3.45	4.45	4.4	5.5	4.2
14	4.5	5.95	5.6	9.3	4.8	5.4	3.55	3.35	4.1	4.35	5.15	5.15
15	7.7	5.95	5.8	11.5	4.7	5.75	3.45	3.35	3.95	4.3	4.9	5.85
16	9.6	9.3	5.7	7.8	4.55	5.8	3.55	3.6	3.85	4.1	4.65	5.75
17	8.9	8.7	5.45	6.45	4.45	5.25	3.7	4.3	6.55	3.9	4.5	5.15
18	7.6	7.35	5.25	5.65	4.2	9.85	3.65	5.05	4.75	4.15	4.4	4.85
19	5.9	6.6	4.95	5.4	3.95	7.3	3.6	4.7	4.5	4.15	4.4	4.6
20	5.65	6.2	4.9	6.1	4.0	5.85	3.45	4.3	4.25	4.85	4.25	4.45
21	5.45	5.95	4.85	8.2	4.05	5.2	3.4	4.2	3.9	5.1	4.15	4.25
22	5.3	6.45	4.7	11.45	4.15	4.65	3.35	4.6	3.8	4.95	4.05	4.2
23	5.15	6.55	4.65	11.05	4.2	4.5	3.3	4.3	3.7	5.8	4.0	4.2
24	5.3	8.5	4.45	9.25	4.2	4.35	3.3	4.1	3.9	12.75	4.3	4.15
25	5.35	10.05	4.55	8.3	4.15	4.25	3.55	3.9	4.7	11.2	4.7	4.1
26	4.8	7.75	4.75	7.6	4.0	4.15	3.9	3.75	4.6	7.85	4.7	.....
27	4.65	6.7	5.6	6.4	4.1	4.1	4.15	3.65	4.2	6.3	4.55	.....
28	4.5	6.15	6.2	6.05	4.5	4.9	3.9	3.5	4.1	5.3	4.4	.....
29	4.55	.....	6.6	5.75	4.35	5.1	3.7	4.65	3.95	4.9	4.35	.....
30	4.65	.....	6.55	6.05	4.15	4.6	4.15	4.25	3.9	4.65	4.3	.....
31	4.8	.....	6.4	.....	4.05	.....	6.2	3.55	.....	4.55	.....	3.5

NOTE.—Ice conditions December 15 to 31. Frozen over December 22. Thickness of ice December 31, 0.3 foot.

BUCKHANNON RIVER AT HALL, W. VA.

This station, which is located at the highway bridge at Hall, W. Va., was established June 7, 1907, to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

Pecks Run is tributary on the left bank about a mile below the station.

A small power plant, used principally for grinding grain, is located a short distance above the station, and the operation of this plant may modify the low-water flow to a slight extent. When this station was established it was thought that the dam and mill at Boulder, a few miles below, had been abandoned, and that backwater effect being constant would not vitiate the gage readings. Some time during the summer of 1908 the dam was repaired, thus raising the water about 1 foot in the pond above the dam. It is believed that the gage readings from the date of establishment until the latter part of November, 1908, are but little modified by backwater effect, but this is not certain, and the records should be used with caution, especially for low stages. During the early part of 1909 it became evident that backwater from the dam extended above the station, and on May 25 observations were discontinued.

Winter conditions are mild and ice causes little trouble.

Except as above indicated the records are reliable and accurate. The datum of the chain gage, attached to the bridge, has remained unchanged during the maintenance of the station.

Daily gage height, in feet, of Buckhannon River at Hall, W. Va., for 1909.

[James Newcomb, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	4.1	4.1	5.2	5.2	6.8	16	8.5	6.8	5.3	6.7	4.1
2	4.1	4.0	4.9	4.9	8.3	17	7.8	8.2	5.1	5.6	4.0
3	3.8	4.0	4.9	5.1	6.9	18	6.9	6.7	4.7	5.0	3.9
4	3.6	4.1	8.1	5.4	6.1	19	5.7	5.7	4.4	4.7	3.8
5	3.5	4.3	6.6	6.2	5.8	20	4.9	5.6	4.3	4.7	3.7
6	3.6	4.9	5.7	6.1	5.4	21	4.6	6.6	4.3	6.7	3.6
7	5.2	5.5	5.8	5.8	5.0	22	4.3	6.2	4.2	8.4	3.7
8	5.1	5.4	6.3	5.2	4.6	23	4.3	6.1	4.1	9.0	3.7
9	3.9	5.1	6.2	4.8	4.4	24	4.2	5.8	4.0	8.6	3.6
10	3.9	7.3	6.0	4.4	4.3	25	4.1	8.2	4.1	6.9	3.5
11	3.8	7.6	6.0	4.5	4.6	26	4.0	7.0	4.9	6.0	.....
12	3.7	6.1	5.4	4.3	4.6	27	3.9	5.9	5.2	5.8	.....
13	3.8	5.4	5.1	4.2	4.5	28	3.9	5.6	5.6	5.5	.....
14	4.0	5.5	5.1	8.2	4.4	29	3.8	.....	6.2	5.6	.....
15	8.3	5.4	5.6	9.7	4.2	30	3.8	.....	5.9	5.3	.....
						31	4.2	.....	5.6	.....	.....

WEST FORK RIVER AT ENTERPRISE, W. VA.

This station, which is located at the highway bridge at Enterprise, W. Va., was established June 2, 1907, to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

Bingamon Creek is tributary from the west about 1 mile below the station.

Winter conditions are mild and ice does not form very thick, if at all.

A small dam is located at Worthington about 3 miles below the station, but backwater does not reach to the section, for, from

December 5 to 12, 1908, when the gates at the dam were opened to let water out of the pond, no effect was produced at the gage. The gage reader states that during the summer of 1908 the only water running in the river was the pumpage from the numerous coal mines along the stream.

The datum of the chain gage, attached to the bridge, has remained unchanged; the records are reliable and accurate.

Sufficient data have not yet been collected to enable estimates of flow to be made.

Discharge measurements of West Fork River at Enterprise, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 18	A. H. Horton	153	292	1.68	128
December 6	G. L. Parker	151	240	1.40	60

Daily gage height, in feet, of West Fork River at Enterprise, W. Va., for 1909.

[C. M. Tetrick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.3	2.9	4.8	3.8	8.9	1.9	2.6	1.6	1.3	1.2	1.6	1.5
2	1.1	2.8	4.4	3.4	7.0	1.8	2.3	1.5	1.2	1.2	1.5	1.5
3	1.6	2.6	3.5	3.0	5.2	1.8	1.9	1.4	1.2	1.1	1.5	1.5
4	1.8	4.8	3.6	3.3	4.5	1.8	1.3	1.3	1.2	1.0	1.5	1.5
5	1.8	4.4	6.2	3.8	3.8	2.4	1.5	1.2	1.2	1.0	1.6	1.5
6	1.9	4.0	4.2	3.4	3.2	2.3	1.5	1.4	1.1	.9	1.5	1.4
7	1.8	3.9	4.0	3.0	2.8	2.5	1.4	1.3	1.1	.9	1.5	1.5
8	1.7	3.8	3.8	2.7	2.5	2.4	1.3	1.2	1.1	1.0	1.4	1.6
9	1.7	4.3	3.7	2.5	2.3	9.1	1.2	1.1	1.1	.9	1.4	1.7
10	1.6	8.3	3.5	2.3	2.2	4.8	1.1	1.0	1.9	.9	1.5	2.0
11	1.5	6.8	4.4	2.2	2.1	5.3	1.1	.9	4.3	.9	4.3	1.8
12	2.3	5.2	3.8	2.1	2.0	4.8	1.0	.8	3.2	1.2	3.3	6.4
13	1.8	4.8	3.6	2.1	1.9	4.5	1.5	.8	2.2	1.5	2.5	4.6
14	1.7	4.3	3.4	6.7	1.9	3.3	1.7	.8	1.8	1.4	2.2	3.5
15	8.5	3.9	2.9	5.6	1.7	4.3	1.8	1.2	1.6	1.4	2.0	3.1
16	6.4	10.9	2.6	4.4	1.7	3.5	2.0	2.0	1.5	1.4	1.9	2.9
17	4.8	8.3	4.3	3.3	1.7	2.8	1.9	2.5	1.4	1.4	1.8	2.8
18	6.4	3.8	4.0	3.0	1.6	7.1	1.7	2.0	1.3	1.5	1.7	2.7
19	4.1	4.3	3.7	2.8	1.5	6.6	1.8	1.9	1.2	1.4	1.6	2.6
20	3.3	4.8	3.2	3.3	1.5	5.5	1.7	1.7	1.2	1.4	1.6	2.5
21	2.8	3.8	2.9	9.4	1.9	3.0	1.5	3.4	1.2	1.4	1.5	.....
22	2.7	5.0	4.4	10.3	2.6	2.6	1.4	2.7	1.1	1.4	1.5	.....
23	2.4	4.3	3.8	9.3	2.2	2.7	1.3	2.3	1.1	1.6	1.5	.....
24	4.3	10.0	3.5	7.1	2.0	2.6	1.2	1.8	1.1	7.2	1.5	.....
25	3.9	7.9	3.2	5.4	1.8	2.6	1.5	1.6	1.5	6.4	1.6	.....
26	3.4	5.9	3.0	4.6	1.7	2.5	1.7	1.4	1.2	3.8	1.8	.....
27	3.0	4.8	2.9	4.0	2.0	4.2	1.6	1.3	1.1	2.8	1.7	2.3
28	2.8	5.3	2.8	3.5	2.5	9.3	1.5	1.2	1.4	2.3	1.6	.....
29	2.8	.....	4.3	3.0	2.3	4.4	1.4	1.1	1.2	2.2	1.6	.....
30	3.3	.....	3.9	2.8	2.2	3.3	1.6	1.3	1.3	1.8	1.6	.....
31	3.0	.....	3.6	.....	2.1	.....	1.7	1.3	.....	1.8	.....	.....

NOTE.—Ice conditions December 18 to 31. Thickness of ice December 27, 0.3 foot.

CHEAT RIVER NEAR MORGANTOWN, W. VA.

This station, which was maintained from July 8 to December 30, 1899, July 1 to December 29, 1900, and August 21, 1902, to December 31, 1905, was reestablished November 18, 1908, by F. W. Scheidenhelm, through whose courtesy the 1908 and 1909 discharge measurements and gage heights have been furnished to the United States Geological Survey for publication.

The data are of value for determining the quantity of water available for power and storage and the effect of Cheat River run-off on floods and pollution of Monongahela River.

The staff gage for this station was originally located about 100 feet above the present location of Ice's ferry bridge at Uneva, W. Va., about 6 miles northeast of Morgantown and 10 miles above the mouth of Cheat River. The 1899 measurement was made from a cable which was located at the gage. During 1900 the cable was moved downstream about 1 mile and all subsequent measurements were made at the new cable location except those stated to have been made at wading sections or at Ice's ferry bridge. The first four measurements made during 1899 to 1901 were referred to the staff gage immediately above the present location of Ice's ferry bridge.

On August 20, 1902, a new inclined and vertical staff gage was installed about 275 feet below the new cable section. The readings were made on the inclined section below 6.5 feet. The new gage was set to read the same as the original gage at 1.8 feet. On September 28, 1904, the inclined portion of this staff gage was found to be 0.35 foot too high and the vertical section 0.15 foot too high. Both sections were accordingly lowered. On September 28, 1904, a chain gage was established on Ice's ferry bridge to read the same as the second staff gage at 1.85 feet. Both gages were maintained from September 28, 1904, to December 31, 1905. The staff gage was maintained from November 18, 1908, to May 8, 1909, and the chain gage has been maintained from January 21, 1909, to date. From these simultaneous gage readings the following gage relation has been determined:

Relation of gages on Cheat River.

Chain gage.	Staff gage.	Chain gage.	Staff gage.
Feet.	*Feet.*	*Feet.*	*Feet.*
1.5	1.52	6.5	7.69
2.0	2.00	7.0	8.28
2.5	2.52	7.5	8.87
3.0	3.11	8.0	9.43
3.5	3.78	8.5	9.98
4.0	4.46	9.0	10.53
4.5	5.15	9.5	11.06
5.0	5.82	10.0	11.59
5.5	6.47	10.5	12.11
6.0	7.09	11.0	12.65

All discharge measurements and gage heights from 1902 to 1909, as published below, are referred to the second staff gage. All gage heights from 1902 to September 28, 1904, have been reduced to the gage zero established September 28, 1904. Gage heights previously published for 1899–1900 are referred to the original staff gage and are correct as originally published.

The original staff gage and the chain gage are located in a deep pool, with large islands about one-fourth mile above and below the station. The second staff gage is also located in a deep pool of somewhat smaller dimensions than at the original location. It is situated nearly one-fourth mile below a large island and a short distance above a small island. Both pools are controlled by permanent rock reefs. Water was diverted around the lower gage for milling prior to 1908. The quantity thus diverted was relatively small (see table of discharge measurements) except at low stages, and has been disregarded in the following computations of discharge, but should, however, be taken into consideration in making use of the tables to determine the run-off in the Cheat River drainage basin. No important tributaries enter Cheat River near the gaging station.

Large ice jams sometimes occur at this station. In January, 1904, the ice piled up from 8 to 10 feet above normal low-water stage, thus greatly affecting the relation of gage height to discharge. For the occurrence of other periods of ice effect, as determined by observer's records and climatological reports, see gage-height table footnotes.

The discharge for these periods has been estimated, and it is assumed that the open-channel rating applies for all other winter periods.

The curves developed are very satisfactory and the daily and monthly discharge values given in the following table are considered very good, with the possible exception of those for 1902–3, for which period there is some doubt about the elevation of the inclined gage. However, as the two measurements made during 1902–3 plot practically on the 1904–1909 discharge curve, when their gage heights are increased 0.35 foot, it is evident either that the inclined gage was set incorrectly at the time of its installation by the amount of the error in the gage (0.35 foot) discovered during 1904 or else that conditions of flow were different in these two years from what they have been since. In either event the correction of all gage heights for 1902–3 in accordance with the discrepancies found September 28, 1904, will yield essentially correct results for these years, and these corrections have accordingly been made.

The discharge for low stages during 1899–1900 is also somewhat open to question. It has been impossible as yet to determine the period when Ice's ferry bridge was erected. The somewhat conflicting statements obtained seem to indicate that the bridge was built

during 1900 or 1901. In any event it is probable that both the measurements made during 1901 were affected by the backwater from the bridge. This backwater effect is, however, very slight at low stages, owing to the deep, wide pool in which the gage is located. The two rating curves probably converge to a common curve at some point above the stage of zero flow. Hence at low stages the 1899–1900 discharges may be too high.

Discharge measurements of Cheat River near Morgantown, W. Va., in 1899–1905, 1908, 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1899.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 8 [a]	E. G. Paul	367	2,160	2.60	1,150
1900.					
June 25 [b]	do	292	1,240	2.80	[c] 1,400
1901.					
July 26 [d]	do	282	1,060	2.30	710
November 5 [e]	do	139	167	1.45	222
1902.					
August 20 [b]	do	275	940	2.10	299
1903.					
September 1 [b]	do	283	1,090	2.65	[f] 672
1904.					
July 6 [b]	Hoyt and Hall	300	1,230	2.95	773
September 16 [g]	R. J. Taylor	275	887	2.00	136
1905.					
March 17 [h]	Grover and Morse	388	2,750	5.56	5,720
Do [b]	do	320	1,950	5.62	5,940
1908.					
November 18 [i]	Scheidenhelm and Custer	83	73.7	1.61	131
December 9 [j]	L. B. Custer	171	141	1.86	223
1909.					
January 21 [k]	Horton and Scheidenhelm	385	2,450	4.16	2,410
April 28 [h]	Scheidenhelm and Hammel	395	2,900	5.16	4,520
June 6 [h]	do	412	3,380	7.26	10,600
June 7 [h]	V. F. Hammel	397	2,880	5.62	6,140
July 12 [l]	do	106	132	2.34	358
August 19 [h]	Scheidenhelm and Hammel	386	2,460	4.06	2,180
Do [h]	do	385	2,390	3.99	1,950

[a] Measurement made at original cable section above the present Ice's ferry bridge.
[b] Measurement made at second cable section about 1 mile below the bridge.
[c] Mill-race discharge of 25 second-feet included in total discharge of the river.
[d] Measurement at second cable section about 1 mile below the bridge. Somewhat affected by new Ice's ferry bridge, which was erected below the original gage during 1900 to 1901. Mill-race discharge of 6 second-feet included in total discharge of the river.
[e] Measurement made at wading section, 700 feet above the second cable location. Somewhat affected by new Ice's ferry bridge, which was erected just below the original gage during 1900 to 1901.
[f] Mill-race discharge of 10 second-feet not included in value of discharge given.
[g] Measurement at second cable section. Considered inaccurate on account of low velocity, and not used in developing the discharge curve.
[h] Measurement made at Ice's ferry bridge. Gage height was read on the chain gage and reduced to the corresponding reading on the staff gage.
[i] Measurement at wading section, three-eighths mile above the bridge.
[j] Measurement at wading section, one-fourth mile below the cable.
[k] Measurement at Ice's ferry bridge.
[l] Measurement at wading section, one-half mile above the bridge. Gage height read on chain gage and reduced to corresponding reading on the staff gage.

NOTE.—Gage heights 1899–1901 refer to original staff gage established July 8, 1899, above the present Ice's ferry bridge. Gage heights 1902–1905 and 1908–9 refer to the staff gage established August 21, 1902, about 1 mile below the bridge, and have been reduced to the present datum. Gage heights of measurements read on the chain gage have been reduced to the corresponding reading on the staff gage. All other gage heights were read directly on the staff gage.

Daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.							1899.						
1	.....	3.0	2.2	2.0	3.7	2.9	16	2.8	2.3	2.8	1.7	2.5	3.8
2	.....	2.8	2.0	2.0	4.0	2.8	17	3.5	2.4	2.7	1.8	2.4	3.4
3	.....	2.7	2.3	1.9	3.8	2.7	18	3.4	2.3	2.3	1.8	2.4	3.2
4	.....	2.5	2.2	1.9	3.5	2.7	19	3.0	2.2	2.2	1.7	2.5	3.0
5	.....	3.4	2.2	1.9	3.3	2.6	20	2.8	2.1	2.0	1.7	3.4	4.8
6	.....	3.3	2.2	1.9	3.1	2.6	21	2.4	2.0	1.9	1.6	3.4	4.4
7	.....	3.0	2.1	1.8	2.1	2.5	22	2.4	2.0	1.9	1.6	3.2	4.1
8	2.6	2.8	2.0	1.8	2.1	2.5	23	2.4	1.9	2.3	1.6	3.0	3.9
9	3.0	2.7	2.0	1.8	2.8	2.5	24	2.3	1.9	2.2	1.6	3.0	5.2
10	2.8	2.6	2.2	1.7	2.7	2.5	25	2.5	1.8	2.2	1.6	3.9	4.4
11	2.7	2.5	4.1	1.7	2.6	2.7	26	2.7	1.8	2.1	1.7	3.7	3.6
12	2.5	2.4	3.8	1.7	2.9	5.5	27	2.8	1.8	2.3	1.7	3.5	3.2
13	2.4	2.3	3.5	1.7	2.7	6.4	28	2.6	2.5	2.4	1.7	3.3	2.9
14	2.5	2.2	3.2	1.7	2.6	4.8	29	2.5	2.4	2.3	1.7	3.1	2.7
15	2.8	2.2	3.0	1.7	2.6	4.2	30	3.5	2.3	2.2	1.7	3.1	2.6
							31	3.6	2.3	.....	1.7	.....	.....
1900.							1900.						
1	3.2	3.2	2.3	2.1	1.6	.....	16	2.6	1.6	1.4	1.4	2.2	3.0
2	2.8	3.1	2.1	2.0	1.6	4.0	17	2.8	1.6	1.4	1.4	2.2	2.9
3	2.7	2.9	2.0	1.9	1.7	4.0	18	2.9	1.5	1.4	1.4	2.1	2.8
4	2.6	2.7	1.9	1.8	1.7	4.3	19	2.9	1.5	1.4	1.5	2.2	2.8
5	2.6	2.6	1.6	1.7	1.6	7.0	20	3.0	1.6	1.4	1.4	3.0	2.7
6	2.4	2.4	1.5	1.6	2.0	7.0	21	3.0	2.0	1.3	1.3	3.3	2.7
7	2.3	2.4	1.4	1.5	2.3	6.0	22	3.0	1.9	1.5	1.3	3.5	2.6
8	3.0	2.3	1.4	1.6	2.5	5.0	23	2.9	1.8	1.5	1.3	3.8	3.0
9	2.9	2.0	1.4	1.7	2.4	4.4	24	3.5	1.8	1.4	2.3	4.0	3.2
10	2.9	2.0	1.4	1.7	2.2	4.7	25	4.8	1.8	1.4	2.3	.....	3.3
11	2.8	2.0	1.4	1.7	2.0	3.4	26	5.1	1.8	1.5	2.2	.....	3.3
12	2.7	1.8	1.4	1.7	1.9	3.4	27	5.2	1.7	1.3	2.1	.....	3.2
13	2.6	1.7	1.3	1.6	1.9	3.2	28	4.9	1.7	1.3	2.0	.....	3.1
14	2.5	1.7	1.3	1.5	1.9	3.0	29	3.7	2.0	1.4	1.8	.....	3.1
15	2.6	1.7	1.3	1.5	2.0	3.0	30	3.4	2.3	1.4	1.7	.....	.....
							31	3.2	2.3	.....	1.6	.....	.....

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						1902.					
1	.....	2.05	3.15	2.85	5.0	16	.....	1.8	3.65	2.55	10.6
2	.....	2.05	5.15	2.55	4.85	17	.....	1.75	3.35	2.55	9.35
3	.....	2.05	4.0	2.55	6.4	18	.....	1.75	3.15	2.55	7.65
4	.....	2.15	3.75	2.55	6.65	19	.....	1.85	3.0	2.35	6.0
5	.....	2.0	3.75	2.4	5.7	20	.....	1.75	2.8	2.35	4.3
6	.....	2.65	3.8	2.25	4.95	21	2.15	1.75	2.8	2.5	4.75
7	.....	2.35	3.4	2.5	4.5	22	2.25	1.65	2.7	2.75	5.55
8	.....	2.2	3.2	2.55	4.45	23	2.95	1.65	2.55	2.7	5.85
9	.....	2.05	2.95	2.75	4.3	24	3.05	1.65	2.55	3.1	5.15
10	.....	2.05	2.7	2.6	3.9	25	2.65	1.65	2.55	4.7	4.65
11	.....	2.05	2.55	2.55	5.95	26	2.4	1.8	2.45	8.15	4.3
12	.....	1.95	5.8	2.55	11.05	27	2.25	2.05	2.55	6.95	3.8
13	.....	1.95	5.3	2.55	10.65	28	2.15	1.95	3.1	5.7	3.55
14	.....	1.85	4.75	2.6	9.1	29	2.05	2.35	2.95	4.9	3.7
15	.....	1.85	4.1	2.55	6.85	30	2.05	2.4	2.95	4.4	5.1
						31	2.05	.....	2.85	.....	4.9

NOTE.—The temperature was low December 25 to 31, 1899, but the discharge was probably not materially affected by ice conditions.

NOTE.—The discharge was probably unaffected by ice conditions during December, 1900.

NOTE.—Discharge unaffected by ice conditions December, 1902.

Daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	4.3	6.5	10.7	4.05	3.5	3.6	6.0	2.6	2.6	1.75	1.85	2.2
2	4.1	6.75	7.1	4.15	3.4	3.3	5.6	3.15	2.55	1.75	1.85	2.2
3	10.25	7.5	5.95	4.15	3.35	3.35	4.45	3.05	2.5	1.75	1.85	2.25
4	9.05	9.35	5.25	4.4	3.65	3.05	4.0	2.85	2.35	1.75	1.85	2.25
5	6.95	8.95	4.9	5.7	3.6	2.85	4.2	2.7	2.15	1.9	1.9	2.15
6	5.85	6.6	4.85	4.95	3.4	2.85	4.95	2.45	2.15	2.2	2.1	2.15
7	5.15	5.7	5.1	4.8	3.25	3.85	4.3	2.65	2.05	2.2	2.25	2.15
8	4.7	5.15	7.25	6.9	3.1	6.0	4.05	2.45	2.05	2.05	2.5	2.1
9	3.95	4.95	8.4	8.5	3.05	5.0	3.55	2.45	2.05	3.4	2.4	2.05
10	3.65	4.45	6.9	6.7	2.9	4.3	3.3	2.35	2.15	3.45	2.25	2.1
11	3.75	4.3	6.05	5.8	2.85	3.95	3.8	2.3	2.15	3.0	2.2	2.15
12	6.2	5.4	5.65	5.4	2.85	5.15	4.3	2.25	2.1	2.6	2.15	2.0
13	5.25	6.1	5.3	5.3	2.7	7.05	5.1	2.25	2.0	2.45	2.1	2.15
14	5.7	5.3	4.95	5.1	2.65	7.15	5.65	2.1	1.95	2.6	2.05	2.6
15	5.95	6.0	4.4	4.95	2.6	7.35	4.75	2.1	1.85	2.45	2.05	2.6
16	4.45	11.25	4.25	5.85	2.8	6.2	4.05	2.05	1.85	2.35	2.05	2.75
17	4.2	8.4	4.15	5.85	2.7	5.1	3.6	2.05	1.85	2.25	2.55	2.55
18	3.9	6.45	3.95	5.85	2.6	4.45	3.6	2.05	1.85	2.25	5.6	2.55
19	3.55	5.2	3.75	5.3	2.55	4.05	3.55	2.15	2.35	2.4	4.5	2.35
20	3.35	5.1	3.6	4.75	2.45	3.85	4.4	2.2	2.9	2.7	3.6	2.45
21	3.75	4.5	4.7	4.4	2.4	5.2	4.65	2.15	2.4	2.55	3.1	4.35
22	4.15	4.35	5.55	4.25	2.3	4.9	3.8	2.85	2.2	2.45	2.9	4.25
23	4.0	3.95	8.1	4.0	2.65	5.0	3.4	2.5	2.05	2.35	2.85	3.8
24	3.75	4.15	9.65	3.8	3.85	5.65	3.1	2.3	2.0	2.25	2.75	3.35
25	3.65	4.2	6.75	3.9	4.6	4.75	2.85	2.1	1.95	2.15	2.6	4.8
26	3.5	4.05	5.7	3.9	5.65	4.05	2.65	2.05	1.85	2.0	2.6	5.7
27	3.55	4.3	4.95	4.4	6.65	3.65	2.55	2.05	1.85	2.05	2.4	4.4
28	6.4	11.45	4.55	4.15	5.4	4.1	2.35	2.1	1.85	2.05	2.4	3.85
29	8.65	.....	4.15	3.9	4.65	8.85	2.45	2.1	1.85	2.05	2.25	3.5
30	8.9	.....	4.05	3.65	4.2	7.7	2.4	2.1	1.75	1.95	2.25	3.5
31	8.3	.....	4.05	.....	3.95	.....	2.35	2.6	.....	1.95	.....	3.2
1904.												
1	3.3	3.6	6.55	6.6	6.25	3.4	3.6	2.15	1.8	1.6	2.0	2.0
2	3.25	3.0	6.8	6.7	5.85	3.45	4.0	2.25	1.85	1.85	2.0	2.05
3	8.75	3.25	7.2	5.95	4.95	3.5	3.65	2.15	1.85	1.9	1.9	2.2
4	11.15	3.15	8.35	5.1	5.0	3.9	3.35	2.35	1.85	1.9	1.9	2.1
5	11.15	3.0	6.55	4.55	4.55	3.85	3.0	2.55	1.85	1.9	1.9	2.1
6	11.15	3.0	5.5	4.3	4.2	4.8	3.0	2.35	1.8	1.85	1.9	2.6
7	11.15	4.9	6.1	4.15	3.95	4.3	3.65	2.25	1.75	1.85	1.82	2.5
8	11.15	8.65	7.45	4.05	3.75	4.1	3.5	2.3	1.75	1.9	1.8	2.5
9	11.15	6.45	6.7	4.05	3.55	3.85	3.4	2.15	1.75	1.8	1.8	2.5
10	11.15	5.35	5.7	4.15	3.75	3.7	3.3	2.05	1.75	1.9	1.8	2.4
11	11.15	4.65	5.15	4.0	3.75	3.5	3.55	2.05	1.75	1.95	1.8	2.35
12	11.15	4.0	5.05	3.85	3.45	3.3	3.5	2.0	1.75	2.0	1.8	2.2
13	11.15	3.6	4.9	3.8	3.3	3.1	3.35	2.05	1.75	2.05	1.8	2.15
14	11.15	3.65	4.55	3.85	3.25	2.9	3.05	2.05	1.85	2.75	1.8	2.05
15	11.15	3.8	5.15	3.7	3.4	2.85	2.8	2.05	1.85	2.3	1.9	2.15
16	11.15	3.4	4.95	3.95	3.7	2.85	2.7	1.95	2.08	2.2	1.95	2.15
17	11.15	2.95	4.4	5.05	3.65	2.75	2.55	1.95	1.95	2.15	1.88	2.1
18	11.15	3.15	4.35	4.65	3.7	2.9	2.55	1.95	2.02	2.05	1.9	2.2
19	11.15	3.0	4.45	4.25	7.2	2.95	2.35	2.0	1.92	2.0	1.9	2.2
20	11.15	3.15	4.45	4.0	6.6	2.7	2.3	1.95	1.85	2.0	1.9	2.2
21	11.15	3.65	5.1	3.8	6.7	3.25	2.75	2.35	2.2	1.9	2.05	2.15
22	21.15	5.7	5.65	3.6	6.55	4.3	3.0	2.1	2.1	2.0	2.1	2.1
23	10.95	5.45	8.15	3.45	6.2	4.75	3.25	2.4	1.9	2.0	2.35	2.0
24	7.5	6.05	7.85	3.35	4.9	3.45	2.8	2.55	1.85	2.1	2.45	2.6
25	5.95	5.4	6.4	3.55	4.45	3.3	2.6	2.55	1.8	2.1	2.4	8.2
26	5.05	4.65	5.85	4.7	4.1	2.95	2.45	2.4	1.75	2.0	2.4	7.2
27	4.4	4.2	6.0	6.75	4.05	2.85	2.55	2.2	1.75	2.0	2.35	7.2
28	3.8	3.95	5.3	7.4	4.15	2.85	2.45	2.05	1.62	2.1	2.05	6.8
29	3.75	5.15	4.65	6.5	3.9	3.05	2.5	1.95	1.6	2.0	2.1	5.4
30	3.65	.....	4.3	6.05	3.7	3.8	2.35	1.85	1.6	2.0	2.0	4.2
31	3.6	.....	4.35	.....	3.55	.....	2.2	1.85	.....	2.0	.....	3.85

NOTE.—Discharge affected by ice conditions from about January 11 to 27 and about December 14 to 19, 1903, as determined by temperature records. The temperature was very low for a few days about February 18 and 19, 1903, but the discharge was probably not greatly affected by ice conditions owing to the flood which immediately preceded this period.

NOTE.—Ice gorge from January 3 to 23, 1904. No ice during December on basis of comparison with chain gage heights.

Daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	3.8	2.95	5.35	4.1	4.4	5.9	3.7	4.05	2.7	2.0	3.55	5.2
2	3.6	2.85	4.55	4.0	4.05	5.25	4.15	3.8	2.65	2.0	3.35	4.7
3	3.6	2.9	4.1	3.85	3.85	4.4	3.8	3.45	2.5	2.0	3.15	8.25
4	3.65	2.85	3.75	3.8	3.7	3.75	3.65	3.05	2.5	2.1	3.1	8.0
5	3.45	2.9	3.7	3.8	3.8	3.55	4.75	2.9	2.45	2.05	3.0	6.15
6	3.4	2.9	4.7	4.2	4.35	3.4	4.15	3.4	2.4	2.1	3.05	5.1
7	3.45	3.1	5.55	4.9	3.95	3.5	3.8	3.2	2.4	2.1	3.4	4.55
8	3.35	3.4	8.2	5.05	3.8	3.65	3.8	3.35	2.35	2.1	3.6	4.2
9	3.2	3.85	11.25	4.85	3.8	3.45	4.05	3.05	2.3	2.1	3.5	4.0
10	3.2	5.95	12.65	4.8	3.55	3.3	3.7	3.15	2.3	2.0	3.45	3.9
11	3.3	4.8	8.75	5.8	3.45	3.15	3.65	3.15	2.85	2.0	3.35	3.6
12	6.45	4.35	7.05	5.75	7.3	3.65	3.6	3.15	4.15	2.3	3.1	3.55
13	9.85	7.4	6.2	4.75	7.45	4.55	3.75	3.0	4.1	3.4	3.0	3.45
14	7.05	6.25	5.8	4.6	5.9	4.25	4.45	3.3	3.6	3.2	3.0	3.4
15	5.45	8.5	5.4	4.4	8.5	3.6	3.85	5.2	3.05	2.9	2.9	3.3
16	4.85	8.3	5.2	4.2	6.75	3.25	3.65	5.6	2.9	2.8	3.0	3.2
17	3.95	8.35	5.75	4.05	6.2	3.0	3.45	5.45	2.7	2.55	3.4	3.15
18	3.85	7.65	6.05	3.8	5.25	3.0	3.1	4.3	2.65	2.4	3.55	3.1
19	3.8	6.7	6.85	3.7	4.8	3.0	2.9	4.0	2.5	2.45	3.4	3.2
20	3.8	6.55	8.2	3.7	4.45	3.0	3.8	3.5	2.45	6.6	3.35	3.2
21	3.8	6.55	10.85	4.6	4.1	3.05	4.3	3.45	2.4	6.0	3.05	5.1
22	3.6	7.0	9.35	5.65	3.85	5.3	3.7	3.05	2.3	5.2	2.8	5.85
23	3.5	8.0	7.25	5.35	3.55	5.25	3.8	2.9	2.3	4.65	2.65	5.95
24	3.4	7.9	6.1	4.65	3.5	4.85	5.5	2.75	2.25	3.25	2.45	6.05
25	3.2	7.5	6.65	4.35	3.3	5.9	4.35	4.35	2.2	3.1	3.3	4.95
26	2.8	7.85	6.55	4.05	3.2	5.0	3.7	5.25	2.1	4.15	3.3	4.15
27	2.95	7.25	6.05	4.35	3.1	6.9	3.55	4.25	2.1	5.25	3.3	4.2
28	2.9	6.3	5.6	5.9	3.0	5.45	3.25	3.75	2.1	4.55	3.3	4.0
29	2.95	.....	5.1	5.4	3.0	4.5	3.2	3.55	2.0	3.9	5.1	4.15
30	3.0	.....	4.85	4.95	2.95	3.9	5.15	2.9	2.0	3.8	7.3	4.25
31	3.15	.....	4.65	.....	3.2	.....	4.6	2.9	.....	3.65	.....	4.15

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1908.			1908.			1908.		
1	.....	1.71	11	.....	2.00	21	1.61	3.40
2	.....	1.71	12	.....	2.32	22	1.61	2.78
3	.....	1.66	13	.....	3.05	23	1.74	2.60
4	.....	1.66	14	.....	2.90	24	1.81	2.57
5	.....	1.66	15	.....	2.65	25	1.81	2.50
6	.....	1.66	16	.....	2.35	26	1.81	2.32
7	.....	1.66	17	.....	2.44	27	1.76	2.35
8	.....	1.86	18	1.61	2.70	28	1.76	2.40
9	.....	1.86	19	1.61	4.65	29	1.71	2.42
10	.....	1.99	20	1.61	4.00	30	1.71	2.40
						31	.....	2.35

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	3.44	3.20	5.00	4.50	5.44	3.14	3.56	5.30	3.12	2.67	3.37	3.16
2	2.98	3.10	4.73	4.39	6.36	5.08	3.50	4.24	2.86	2.60	3.40	3.09
3	2.82	3.20	5.36	5.10	6.57	5.18	3.38	3.75	2.75	2.56	3.21	3.00
4	2.68	3.35	6.68	5.44	5.38	4.49	3.06	3.34	2.80	2.45	3.14	2.91
5	2.70	3.62	5.63	5.71	5.25	5.66	2.87	3.11	2.92	2.43	3.11	2.87
6	2.78	4.95	5.08	6.08	4.84	7.21	2.75	2.97	2.87	2.36	3.01	2.85
7	3.65	5.25	4.90	5.97	4.43	5.82	2.64	2.87	2.91	2.29	3.09	2.80
8	3.56	4.80	5.90	5.38	4.14	5.14	2.54	2.80	2.76	2.26	2.86	3.27
9	3.08	4.30	5.95	4.53	3.98	7.02	2.54	2.70	2.68	2.24	3.03	3.04
10	3.18	5.96	6.92	4.47	3.89	6.20	2.52	2.61	2.65	2.21	3.05	2.87

NOTE.—High gage heights February 13 to about March 3 caused by backwater from ice gorge. Ice conditions probably prevailed from about January 27 to March 3. No ice during December on the basis of comparison with chain gage heights.

NOTE.—Discharge unaffected by ice conditions during December, 1908.

NOTE.—Discharge probably unaffected by ice conditions January to March, 1909. Discharge about December 10 to 13 and 18 to 31, 1909, affected by ice conditions.

Daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	3.10	6.90	6.66	4.20	3.68	7.68	2.43	2.54	6.00	2.24	4.82	2.82
12	3.13	5.45	6.54	4.12	4.11	6.57	2.34	2.50	4.45	2.82	4.32	2.75
13	3.45	5.00	4.98	4.20	3.75	5.29	2.41	2.42	3.70	4.66	3.98	2.94
14	3.47	5.50	4.80	8.28	3.56	5.15	2.49	2.32	3.25	3.72	3.70	5.59
15	8.75	5.50	5.07	8.04	3.40	5.35	2.45	2.52	3.06	3.32	3.53	5.46
16	7.40	7.20	4.56	6.22	3.28	5.11	2.68	3.98	5.43	3.42	3.36	4.57
17	5.75	7.12	4.30	5.33	3.14	4.80	2.50	5.35	5.00	3.53	3.24	3.98
18	4.80	5.94	4.14	4.78	3.03	6.94	2.39	4.57	4.06	3.38	3.19	3.95
19	4.05	5.16	3.94	4.40	2.99	6.13	2.36	3.95	3.45	3.36	3.20	3.74
20	4.00	5.20	4.12	4.36	2.89	5.07	2.31	3.61	3.11	4.09	3.11	3.65
21	4.13	5.73	4.18	7.09	2.86	4.38	2.28	4.16	2.92	3.92	3.01	3.23
22	4.37	5.40	4.02	9.06	3.06	4.00	2.26	3.37	2.82	3.71	3.01	2.91
23	4.58	5.47	3.83	7.84	4.19	3.86	2.34	3.19	2.73	4.00	3.04	2.65
24	5.80	7.95	3.68	7.50	3.60	3.72	2.41	2.99	2.87	9.16	3.11	.....
25	5.40	7.58	3.86	6.32	3.40	3.45	3.41	2.83	4.16	6.59	.....	2.77
26	4.80	6.30	4.58	5.71	3.24	3.29	3.11	2.68	3.64	5.37	3.53	2.65
27	4.40	5.64	5.27	5.46	3.38	3.16	2.77	2.63	3.21	4.71	3.37	2.87
28	3.85	5.34	5.18	5.18	3.98	3.49	2.63	2.54	3.07	4.24	3.19	2.83
29	3.60	.....	5.48	5.00	4.00	4.19	2.58	2.68	2.87	3.88	3.11	2.68
30	3.80	.....	5.07	4.90	3.56	3.95	2.63	3.70	2.77	3.72	3.06	2.61
31	3.45	.....	4.78	.....	3.34	.....	8.53	3.51	.....	3.49	.....	2.45

NOTE.—Discharge probably unaffected by ice conditions January to March, 1909. Discharge about December 10 to 13 and 18 to 31, 1909, affected by ice conditions.

Rating tables for Cheat River near Morgantown, W. Va.

1899 AND 1900. (Referred to first staff gage.)

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	165	2.50	970	3.70	3,500	4.90	7,790
1.40	200	2.60	1,100	3.80	3,820	5.00	8,180
1.50	240	2.70	1,240	3.90	4,150	5.20	8,970
1.60	280	2.80	1,400	4.00	4,490	5.40	9,770
1.70	325	2.90	1,570	4.10	4,830	5.60	10,570
1.80	375	3.00	1,750	4.20	5,180	5.80	11,380
1.90	430	3.10	1,940	4.30	5,540	6.00	12,200
2.00	495	3.20	2,150	4.40	5,900	6.20	13,020
2.10	570	3.30	2,380	4.50	6,270	6.40	13,840
2.20	655	3.40	2,630	4.60	6,640	6.60	14,670
2.30	750	3.50	2,900	4.70	7,020	6.80	15,510
2.40	855	3.60	3,190	4.80	7,400	7.00	16,350

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made 1899–1901 and is fairly well defined. Above gage height 3.0 feet the rating curve is based on the form of the rating referred to the chain gage at Ice's ferry bridge and should be accurate. This table applies to original gage located about 100 feet above the present Ice's ferry bridge.

1902 TO 1909. (Referred to second staff gage.)

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	110	2.90	735	4.30	2,670	6.40	8,210
1.60	135	3.00	815	4.40	2,880	6.60	8,830
1.70	160	3.10	905	4.50	3,090	6.80	9,450
1.80	190	3.20	1,005	4.60	3,310	7.00	10,080
1.90	220	3.30	1,110	4.70	3,530	7.20	10,720
2.00	255	3.40	1,220	4.80	3,760	7.40	11,370
2.10	290	3.50	1,340	4.90	4,000	7.60	12,030
2.20	330	3.60	1,470	5.00	4,250	7.80	12,690
2.30	375	3.70	1,610	5.20	4,760	8.00	13,370
2.40	420	3.80	1,760	5.40	5,300	9.00	16,830
2.50	470	3.90	1,920	5.60	5,860	10.00	20,430
2.60	525	4.00	2,090	5.80	6,430	11.00	24,180
2.70	590	4.10	2,280	6.00	7,010	12.00	27,980
2.80	660	4.20	2,470	6.20	7,610	13.00	31,880

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on thirteen discharge measurements made during 1902 to 1909 and is well defined between gage heights 1.6 feet and 8.0 feet.

Daily discharge, in second-feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.							1899.						
1		1,750	655	495	3,500	1,570	16	1,400	750	1,400	325	970	3,820
2		1,400	495	495	4,490	1,400	17	2,900	855	1,240	375	855	2,630
3		1,240	750	430	3,820	1,240	18	2,630	750	750	375	855	2,150
4		970	655	430	2,900	1,240	19	1,750	655	655	325	970	1,750
5		2,630	655	430	2,380	1,100	20	1,400	570	495	325	2,630	7,400
6		2,380	655	430	1,940	1,100	21	855	495	430	280	2,630	5,900
7		1,750	570	375	570	970	22	855	495	430	280	2,150	4,830
8	1,100	1,400	495	375	570	970	23	855	430	750	280	1,750	4,150
9	1,750	1,240	495	375	1,400	970	24	750	430	655	280	1,750	8,970
10	1,400	1,100	655	325	1,240	970	25	970	375	655	280	4,150	5,900
11	1,240	970	4,830	325	1,100	1,240	26	1,240	375	570	325	3,500	3,190
12	970	855	3,820	325	1,570	10,200	27	1,400	375	750	325	2,900	2,150
13	855	750	2,900	325	1,240	13,800	28	1,100	970	855	325	2,380	1,570
14	970	655	2,150	325	1,100	7,400	29	970	855	750	325	1,940	1,240
15	1,400	655	1,750	325	1,100	5,180	30	2,900	750	655	325	1,940	1,100
							31	3,190	750	.....	325	.....	970

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.							1900.						
1	2,150	2,150	750	570	280	6,270	16	1,100	280	200	200	655	1,750
2	1,400	1,940	570	495	280	4,490	17	1,400	280	200	200	655	1,570
3	1,240	1,570	495	430	325	4,490	18	1,570	240	200	200	570	1,400
4	1,100	1,240	430	375	325	5,540	19	1,570	240	200	240	655	1,400
5	1,100	1,100	280	325	280	16,400	20	1,750	280	200	200	1,750	1,240
6	855	855	240	280	495	16,400	21	1,750	495	165	165	2,380	1,240
7	750	855	200	240	750	12,200	22	1,750	430	240	165	2,900	1,100
8	1,750	750	200	280	970	8,180	23	1,570	375	240	165	3,820	1,750
9	1,570	495	200	325	855	5,900	24	2,900	375	200	750	4,490	2,150
10	1,570	495	200	325	655	7,020	25	7,400	375	200	750	8,180	2,380
11	1,400	495	200	325	495	2,630	26	8,570	375	240	655	14,000	2,380
12	1,240	375	200	325	430	2,630	27	8,970	325	165	570	20,000	2,150
13	1,100	325	165	280	430	2,150	28	7,790	325	165	495	13,800	1,940
14	970	325	165	240	430	1,750	29	3,500	495	200	375	9,770	1,940
15	1,100	325	165	240	495	1,750	30	2,630	750	200	325	8,180	2,900
							31	2,150	750	.....	280	.....	2,900

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						1902.					
1		272	955	698	4,250	16		190	1,540	498	22,700
2		272	4,630	498	3,880	17		175	1,160	498	18,100
3		272	2,090	498	8,210	18		175	955	498	12,200
4		310	1,680	498	8,980	19		205	815	398	7,010
5		255	1,680	420	6,140	20		175	660	398	2,670
6		558	1,760	352	4,120	21	310	175	660	470	3,640
7		398	1,220	470	3,090	22	352	148	590	625	5,720
8		330	1,000	498	2,980	23	775	148	498	590	6,580
9		272	775	625	2,670	24	860	148	498	905	4,630
10		272	590	525	1,920	25	558	148	498	3,530	3,420
11		272	498	498	6,860	26	420	190	445	13,900	2,670
12		238	6,430	498	24,400	27	352	272	498	9,920	1,760
13		238	5,030	498	22,800	28	310	238	905	6,140	1,400
14		205	3,640	525	17,200	29	272	398	775	4,000	1,610
15		205	2,280	498	9,600	30	272	420	775	2,880	4,500
						31	272	.....	698	.....	4,000

NOTE.—Discharge estimated December 31, 1899.

NOTE.—Discharges November 25 to December 1 and December 30 and 31, 1900, estimated by a hydrograph comparison with Youghiogheny River at Friendsville, Md.

Daily discharge, in second-feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	2,670	8,520	23,000	2,180	1,340	1,470	7,010	525	525	175	205	330
2	2,280	9,300	10,400	2,380	1,220	1,110	5,860	955	498	175	205	330
3	21,400	11,700	6,860	2,380	1,160	1,160	2,980	860	470	175	205	352
4	17,000	18,100	4,900	2,880	1,540	860	2,090	698	398	175	205	352
5	9,920	16,700	4,000	6,140	1,470	698	2,470	590	310	220	220	310
6	6,580	8,830	3,880	4,120	1,220	698	4,120	445	310	330	290	310
7	4,630	6,140	4,500	3,760	1,060	1,840	2,670	558	272	330	352	310
8	3,530	4,630	10,900	9,760	905	7,010	2,180	445	272	272	470	290
9	2,000	4,120	14,700	15,100	860	4,250	1,400	445	272	1,220	420	272
10	1,540	2,980	9,760	9,140	735	2,670	1,110	398	310	1,280	352	290
11	1,200	2,670	7,160	6,430	698	2,000	1,760	375	310	815	330	310
12	1,000	5,300	6,000	5,300	698	4,630	2,670	352	290	525	310	255
13	700	7,310	5,030	5,030	590	10,200	4,500	352	255	445	290	310
14	500	5,030	4,120	4,500	558	10,600	6,000	290	238	525	272	250
15	400	7,010	2,880	4,120	525	11,200	3,640	290	205	445	272	250
16	500	25,100	2,570	6,580	660	7,610	2,180	272	205	398	272	200
17	700	14,700	2,380	6,580	590	4,500	1,470	272	205	352	498	200
18	700	8,360	2,000	6,580	525	2,980	1,470	272	205	352	5,860	200
19	500	4,760	1,680	5,030	498	2,180	1,400	310	398	420	3,090	250
20	700	4,500	1,470	3,640	445	1,840	2,880	330	735	590	1,470	445
21	800	3,090	3,530	2,880	420	4,760	3,420	310	420	498	905	2,780
22	700	2,780	5,720	2,570	375	4,000	1,760	698	330	445	735	2,570
23	700	2,000	13,700	2,090	558	4,250	1,220	470	272	398	698	1,760
24	600	2,380	19,200	1,760	1,840	6,000	905	375	255	352	625	1,160
25	700	2,470	9,300	1,920	3,310	3,640	698	290	238	310	525	3,760
26	800	2,180	6,140	1,920	6,000	2,180	558	272	205	255	525	6,140
27	1,000	2,670	4,120	2,880	8,980	1,540	498	272	205	272	420	2,880
28	8,210	25,900	3,200	2,380	5,300	2,280	398	290	205	272	420	1,840
29	15,600	.....	2,380	1,920	3,420	16,300	445	290	205	272	352	1,340
30	16,500	.....	2,180	1,540	2,470	12,400	420	290	175	238	352	1,340
31	14,400	.....	2,180	.....	2,000	.....	398	525	.....	238	.....	1,000
1904.												
1	1,110	1,470	8,680	8,830	7,760	1,220	1,470	310	190	135	255	225
2	1,060	815	9,450	9,140	6,580	1,280	2,090	352	205	205	255	272
3	4,000	1,060	10,700	6,860	4,120	1,340	1,540	310	205	220	220	330
4	1,800	955	14,600	4,500	4,250	1,920	1,160	398	205	220	220	290
5	1,400	815	8,680	3,200	3,200	1,840	815	498	205	220	220	290
6	1,000	815	5,580	2,670	2,470	3,760	815	398	190	205	220	525
7	900	4,000	7,310	2,380	2,000	2,670	1,540	352	175	205	196	470
8	800	15,600	11,500	2,180	1,680	2,280	1,340	375	175	220	190	470
9	800	8,360	9,140	2,180	1,400	1,840	1,220	310	175	190	190	470
10	800	5,160	6,140	2,380	1,680	1,610	1,110	272	175	220	190	420
11	800	3,420	4,630	2,090	1,680	1,340	1,400	272	175	238	190	398
12	800	2,090	4,380	1,840	1,280	1,110	1,340	255	175	255	190	330
13	800	1,470	4,000	1,760	1,110	905	1,160	272	175	272	190	310
14	800	1,540	3,200	1,840	1,060	735	860	272	205	625	190	272
15	800	1,760	4,630	1,610	1,220	698	660	272	205	375	220	310
16	800	1,220	4,120	2,000	1,610	698	590	238	283	330	238	310
17	800	775	2,880	4,380	1,540	625	498	238	238	310	214	290
18	900	955	2,780	3,420	1,610	735	498	238	262	272	220	330
19	1,200	815	2,980	2,570	10,700	775	398	255	227	255	220	330
20	4,000	955	2,980	2,090	8,830	590	375	238	205	255	220	330
21	9,600	1,540	4,500	1,760	9,140	1,060	625	398	330	220	272	310
22	15,000	6,140	6,000	1,470	8,680	2,670	815	290	290	255	290	290
23	21,000	5,440	13,900	1,280	7,610	3,640	1,060	420	220	255	398	255
24	11,700	7,160	12,900	1,160	4,000	1,280	660	498	205	290	445	525
25	6,860	5,300	8,210	1,400	2,980	1,110	525	498	190	290	420	14,000
26	4,380	3,420	6,580	3,530	2,280	775	445	420	175	255	420	10,700
27	2,880	2,470	7,010	9,300	2,180	698	498	330	175	255	398	10,700
28	1,760	2,000	5,030	11,400	2,380	698	445	272	140	290	272	9,450
29	1,680	4,630	3,420	8,520	1,920	860	470	238	135	255	290	5,300
30	1,540	.....	2,670	7,160	1,610	1,760	398	205	135	255	255	2,470
31	1,470	.....	2,780	.....	1,400	.....	330	205	.....	255	.....	1,840

NOTE.—Discharges January 11 to 27 and December 14 to 19, 1903, estimated on the basis of climatological reports on temperature and precipitation.

NOTE.—Discharge estimated for ice period, January 3 to 23, 1904, on the basis of climatological reports and a thorough study of run-off conditions during the period.

Daily discharge, in second-feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	1,760	450	1,500	2,280	2,880	6,720	1,610	2,180	590	255	1,400	4,760
2	1,470	450	1,500	2,090	2,180	4,900	2,380	1,760	558	255	1,160	3,530
3	1,470	450	1,500	1,840	1,840	2,880	1,760	1,280	470	255	955	14,200
4	1,540	450	1,680	1,760	1,610	1,680	1,540	860	470	290	905	13,400
5	1,280	450	1,610	1,760	1,760	1,400	3,640	735	445	272	815	7,460
6	1,220	500	3,530	2,470	2,780	1,220	2,380	1,220	420	290	860	4,500
7	1,280	700	5,720	4,000	2,000	1,340	1,760	1,000	420	290	1,220	3,200
8	1,160	1,000	14,000	4,380	1,760	1,540	1,760	1,160	398	290	1,470	2,470
9	1,000	1,200	25,100	3,880	1,760	1,280	2,180	860	375	290	1,340	2,090
10	1,000	4,500	30,400	3,760	1,400	1,110	1,610	955	375	255	1,280	1,920
11	1,110	2,500	16,000	6,430	1,280	955	1,540	955	698	255	1,160	1,470
12	8,360	1,500	10,200	6,280	11,000	1,540	1,470	955	2,380	375	905	1,400
13	19,900	2,500	7,610	3,640	11,500	3,200	1,680	815	2,280	1,220	815	1,280
14	10,200	1,500	6,430	3,310	6,720	2,570	2,980	1,110	1,470	1,000	815	1,220
15	5,440	1,000	5,300	2,880	15,100	1,470	1,840	4,760	860	735	735	1,110
16	3,880	700	4,760	2,470	9,300	1,060	1,540	5,860	735	660	815	1,000
17	2,000	600	6,280	2,180	7,610	815	1,280	5,440	590	498	1,220	955
18	1,840	500	7,160	1,760	4,900	815	905	2,670	558	420	1,400	905
19	1,760	500	9,600	1,610	3,760	815	735	2,090	470	445	1,220	1,000
20	1,760	600	14,000	1,610	2,980	815	1,760	1,340	445	8,830	1,160	1,000
21	1,760	700	23,600	3,310	2,280	860	2,670	1,280	420	7,010	860	4,500
22	1,470	700	18,100	6,000	1,840	5,030	1,610	860	375	4,760	660	6,580
23	1,340	800	10,900	5,160	1,400	4,900	1,760	735	375	3,420	558	6,860
24	1,220	800	7,310	3,420	1,340	3,880	5,580	625	352	1,060	445	7,160
25	1,000	800	8,980	2,780	1,110	6,720	2,780	2,780	330	905	1,110	4,120
26	660	1,800	8,680	2,180	1,000	4,250	1,610	4,900	290	2,380	1,110	2,380
27	600	1,500	7,160	2,780	905	9,760	1,400	2,570	290	4,900	1,110	2,470
28	550	1,500	5,860	6,720	815	5,440	1,060	1,680	290	3,200	1,110	2,090
29	500	.....	4,500	5,300	815	3,090	1,000	1,400	255	1,920	4,500	2,380
30	500	.....	3,880	4,120	775	1,920	4,630	735	255	1,760	11,000	2,570
31	450	.....	3,420	.....	1,000	.....	3,310	735	.....	1,540	.....	2,380

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1908.			1908.			1908.		
1	.....	163	11	.....	255	21	138	1,220
2	.....	163	12	.....	384	22	138	646
3	.....	150	13	.....	860	23	172	525
4	.....	150	14	.....	735	24	193	508
5	.....	150	15	.....	558	25	193	470
6	.....	150	16	.....	398	26	193	384
7	.....	150	17	.....	440	27	178	398
8	.....	208	18	138	590	28	178	420
9	.....	208	19	138	3,420	29	163	430
10	.....	252	20	138	2,090	30	163	420
						31	.....	398

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	1,270	1,000	4,250	3,090	5,410	945	1,420	5,030	925	570	1,190	965
2	799	905	3,600	2,860	8,090	4,450	1,340	2,550	705	525	1,220	896
3	675	1,000	5,190	4,500	8,740	4,710	1,200	1,680	625	503	1,020	815
4	577	1,160	9,080	5,410	5,250	3,070	869	1,150	660	445	945	743
5	590	1,500	5,940	6,170	4,900	6,030	712	915	751	435	915	712
6	646	4,120	4,450	7,250	3,860	10,800	625	791	712	402	824	698
7	1,540	4,900	4,000	6,920	2,940	6,490	551	712	743	370	896	660
8	1,420	3,760	6,720	5,250	2,360	4,600	492	660	632	357	705	1,080
9	887	2,670	6,860	3,160	2,060	10,100	492	590	577	348	842	851
10	985	6,890	9,820	3,030	1,900	7,610	481	532	558	334	860	650
11	905	9,760	9,020	2,470	1,580	12,300	435	492	7,010	348	3,810	600
12	935	5,440	5,690	2,320	2,300	8,740	393	470	2,980	675	2,710	550
13	1,280	4,250	4,200	2,470	1,680	5,000	425	430	1,610	3,440	2,060	700
14	1,300	5,580	3,760	14,300	1,420	4,630	465	384	1,060	1,640	1,610	5,830
15	16,000	5,580	4,420	13,500	1,220	5,160	445	481	869	1,130	1,380	5,470

NOTE.—Discharges January 27 to March 3, 1905, estimated on basis of climatological reports.
NOTE.—Discharge December 10 to 13 and 18 to 31, 1909, estimated on the basis of climatological data.

Daily discharge, in second-feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
16	11,400	10,700	3,220	7,670	1,090	4,530	577	2,060	5,380	1,240	1,180	3,240
17	6,280	10,500	2,670	5,110	945	3,760	470	5,160	4,250	1,380	1,050	2,060
18	3,760	6,840	2,360	3,710	842	9,890	416	3,240	2,200	1,200	995	1,500
19	2,180	4,660	1,990	2,880	807	7,400	402	2,000	1,280	1,180	1,000	1,200
20	2,090	4,760	2,320	2,800	728	4,420	380	1,480	915	2,260	915	1,000
21	2,340	6,230	2,430	10,400	705	2,840	366	2,390	751	1,950	824	800
22	2,820	5,300	2,130	17,000	869	2,090	357	1,190	675	1,620	824	500
23	3,270	5,500	1,810	12,800	2,450	1,860	393	995	611	2,090	851	450
24	6,430	13,200	1,580	11,700	1,470	1,640	425	807	712	17,400	915	450
25	5,300	12,000	1,860	7,970	1,220	1,280	1,230	682	2,390	8,800	1,140	450
26	3,760	7,910	3,270	6,170	1,050	1,100	915	577	1,530	5,220	1,380	400
27	2,880	5,970	4,950	5,470	1,200	965	639	544	1,020	3,550	1,190	450
28	1,840	5,140	4,710	4,710	2,060	1,330	544	492	878	2,550	995	400
29	1,470	.....	5,520	4,250	2,090	2,450	514	577	712	1,890	915	350
30	1,760	.....	4,420	4,000	1,420	2,000	544	1,610	639	1,640	869	300
31	1,280	.....	3,710	.....	1,150	.....	15,200	1,350	.....	1,330	.....	250

NOTE.—Discharge December 10 to 13 and 18 to 31, 1909, estimated on the basis of climatological data.

Monthly discharge of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909.

[Drainage area, 1,380 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1899.						
July 8–31	3,190	750	1,450	1.05	0.94	A.
August	2,630	375	940	.681	.79	B.
September	4,830	430	1,090	.790	.88	B.
October	495	280	350	.254	.29	B.
November	4,490	570	2,010	1.46	1.63	A.
December	13,800	970	3,420	2.48	2.86	A.
1900.						
July	8,970	750	2,440	1.77	2.04	A.
August	2,150	240	635	.460	.53	B.
September	750	165	249	.180	.20	B.
October	750	165	348	.252	.29	B.
November	[a] 20,000	280	3,310	2.40	2.68	B.
December	16,400	1,100	4,130	2.99	3.45	A.
1902.						
August 21–31	860	272	432	.313	.13	A.
September	558	148	252	.183	.20	A.
October	6,430	445	1,490	1.08	1.24	A.
November	13,900	352	1,760	1.28	1.43	A.
December	24,400	1,400	7,410	5.37	6.19	A.
1903.						
January [b]	21,400	400	4,470	3.24	3.74	C.
February	25,900	2,000	7,830	5.67	5.90	A.
March	23,000	1,470	6,450	4.67	5.38	A.
April	15,100	1,540	4,450	3.22	3.59	A.
May	8,980	375	1,680	1.22	1.41	A.
June	16,300	698	4,560	3.30	3.68	A.
July	7,010	398	2,280	1.65	1.90	A.
August	955	272	423	.307	.35	A.
September	735	175	306	.222	.25	A.
October	1,280	175	412	.299	.34	A.
November	5,860	205	705	.511	.57	A.
December [b]	6,140	200	1,040	.753	.87	A.
The year	25,900	175	2,880	2.09	27.98	

[a] Estimated from hydrograph comparison of this station with Youghiogheny River at Friendsville, Md.
[b] Ice conditions January 11 to 27, and December 14 to 19, 1903; discharge estimated.

Monthly discharge of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1904.						
January [a]	21,000	800	3,330	2.41	2.78	C.
February	15,600	775	3,180	2.30	2.48	A.
March	14,600	2,670	6,500	4.71	5.43	A.
April	11,400	1,160	3,830	2.78	3.10	A.
May	10,700	1,060	3,550	2.57	2.96	A.
June	3,760	590	1,420	1.03	1.15	A.
July	2,090	330	876	.635	.73	A.
August	498	205	319	.231	.27	A.
September	330	135	202	.146	.16	A.
October	625	135	261	.189	.22	A.
November	445	190	257	.186	.21	A.
December	14,000	255	2,030	1.47	1.70	A.
The year	21,000	135	2,150	1.55	21.19	
1905.						
January [a]	19,900	450	2,560	1.86	2.14	A.
February [a]	4,500	450	1,090	.790	.82	D.
March [a]	30,400	1,500	8,910	6.46	7.45	A.
April	6,720	1,610	3,410	2.47	2.76	A.
May	15,100	775	3,460	2.51	2.89	A.
June	9,760	815	2,800	2.03	2.26	A.
July	5,580	735	2,060	1.49	1.72	A.
August	5,860	625	1,820	1.32	1.52	A.
September	2,380	255	608	.441	.49	A.
October	8,830	255	1,610	1.17	1.35	A.
November	11,000	445	1,470	1.07	1.19	A.
December	14,200	905	3,620	2.62	3.02	A.
The year	30,400	255	2,780	2.02	27.61	
1908.						
November 18–30	193	138	163	.118	.06	A.
December	3,420	150	558	.404	.47	A.
1909.						
January	16,000	577	2,860	2.07	2.39	A.
February	13,200	905	5,620	4.07	4.24	A.
March	9,820	1,580	4,390	3.18	3.67	A.
April	17,000	2,320	6,310	4.57	5.10	A.
May	8,740	705	2,380	1.72	1.98	A.
June	12,300	945	4,740	3.43	3.83	A.
July	15,200	357	1,090	.790	.91	A.
August	5,160	384	1,360	.986	1.14	A.
September	7,010	558	1,480	1.07	1.19	A.
October	17,400	334	2,160	1.57	1.81	A.
November	3,810	705	1,200	.870	.97	A.
December [b]	5,830	.....	1,130	.819	.94	C.
The year	17,400	.....	2,890	2.10	28.17	

[a] Ice conditions January 3 to 23, 1904, and January 27 to March 3, 1905; discharge estimated.
[b] Ice conditions December 10 to 13 and 18 to 31, 1909; discharge estimated.

YOUGHIOGHENY RIVER AT CONFLUENCE, PA.

The Youghiogheny rises in Garrett County, Md., and flows in a northwesterly direction into Pennsylvania, emptying into Monongahela River about 15 miles above Pittsburg. Its source is on the western slope of the Allegheny Mountains at an elevation of about 2,900 feet. For 19 miles above its mouth the average fall of the stream is about 2 feet per mile, but above that point it soon increases to an average fall of nearly 5 feet per mile. The average width of the river from its mouth to West Newton, Pa., is about 546 feet.

The gaging station which was established by the United States Geological Survey September 15, 1904, to obtain comparative and statistical data regarding the discharge of the Youghiogheny for use in the determination of methods of flood prevention and for storage, navigation, and power problems, is located at a highway bridge about one-half mile from the railroad station at Confluence, Pa. It is now maintained by the Water Supply Commission of Pennsylvania, by which the records of gage heights and discharge measurements are furnished.

No important tributaries enter above the station. Casselman River, having approximately the same drainage area as Youghiogheny River, enters from the right about one-half mile below the station, and a short distance below Casselman River Laurel Hill Creek enters also from the right. This creek has about one-fourth the drainage area of the Youghiogheny above Confluence. The joining of these three tributaries to the main Youghiogheny River, together with the inadequate flood channel capacity of the main stream, causes gorging and backwater at high stages to a greater or less extent in all of them. No measurements have yet been obtained which show backwater at the Youghiogheny station, but from general conditions it is believed to occur occasionally, particularly at very high stages, although much less than at the Casselman and Laurel Hill stations. A tangent has been adopted for the rating curve at high stages and applied directly without correction throughout 1907, 1908, and 1909. It may give excessive discharge occasionally, but in general and from daily comparisons with other stations the results are believed to be essentially correct.[a]

Conditions of flow are probably permanent, although somewhat disturbed by a low rock dam under the bridge. The low-water rating curve is fairly well defined. The discharge is occasionally affected by ice conditions. The datum of the chain gage attached to the bridge has remained constant since the establishment of the station.

The following discharge measurement was made by F. W. Scheidenhelm:

June 12, 1909: Width, 232 feet; area, 679 square feet; gage height, 4.34 feet; discharge, 2,250 second-feet.

[a] See also Casselman River and Laurel Hill Creek at Confluence, Pa.

Daily gage height, in feet, of Youghiogheny River at Confluence, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.75	2.25	3.6	3.0	3.8	2.7	2.2	1.6	1.75	1.55	2.0	1.9
2	2.0	2.5	3.9	3.0	3.7	3.0	2.1	1.6	1.7	1.55	2.0	1.85
3	2.05	2.5	4.6	3.2	3.5	3.35	2.05	1.6	1.7	1.5	1.95	1.85
4	1.8	2.4	4.6	3.9	3.6	3.2	2.0	1.6	1.7	1.5	1.95	1.85
5	1.8	2.5	4.4	3.85	3.4	5.0	2.0	1.6	1.8	1.5	1.9	1.85
6	1.9	3.6	3.8	3.75	3.0	5.35	1.9	1.6	1.9	1.5	1.85	1.8
7	1.9	3.35	3.4	3.45	2.8	4.1	1.8	1.55	1.8	1.45	1.8	1.9
8	1.85	2.9	4.2	3.2	2.7	4.05	1.75	1.55	1.75	1.45	1.8	2.4
9	1.8	2.8	4.2	3.0	2.65	3.75	1.7	1.5	1.7	1.45	2.0	2.4
10	2.0	3.0	4.5	2.9	2.6	3.9	1.65	1.45	1.65	1.4	2.1	2.2
11	1.9	3.9	3.9	2.85	2.5	5.3	1.65	1.45	1.7	1.55	2.0	2.1
12	2.0	3.75	3.4	2.8	2.4	4.3	1.65	1.4	2.15	2.25	2.0	2.1
13	2.1	3.6	3.25	2.75	2.3	3.6	1.65	1.4	2.05	2.15	2.0	2.4
14	2.3	4.0	3.15	6.05	2.25	3.7	1.65	1.4	1.9	1.9	1.95	3.4
15	4.85	3.9	3.0	4.85	2.2	3.6	1.65	1.45	1.8	1.9	1.95	2.6
16	4.0	6.0	2.9	4.0	2.15	3.6	1.6	3.05	1.7	1.85	1.95	2.5
17	3.35	4.5	2.8	3.5	2.2	3.95	1.6	3.5	2.5	1.8	1.95	2.35
18	2.85	3.9	2.8	3.15	2.1	3.25	1.6	2.9	2.1	1.75	1.95	2.25
19	2.5	3.6	2.75	3.1	2.0	3.05	1.6	2.6	2.0	1.75	1.95	2.15
20	2.7	3.85	3.1	3.65	2.0	2.9	1.6	2.35	1.9	1.75	1.95	2.05
21	2.6	3.5	2.9	5.85	2.05	2.8	1.55	3.2	1.8	1.75	1.95	2.0
22	2.8	3.25	2.8	7.2	2.3	2.7	1.5	2.4	1.8	1.9	1.95	2.0
23	3.6	3.65	2.65	5.95	2.2	2.65	1.5	2.1	1.75	2.1	1.95	1.9
24	4.7	8.1	2.55	5.05	2.05	2.6	1.65	1.9	1.75	5.0	1.9	1.9
25	3.9	6.5	2.75	4.2	2.0	2.4	1.7	1.8	1.75	3.5	1.9	2.0
26	3.7	5.0	3.1	4.05	2.0	2.25	1.7	1.7	1.75	2.9	1.9	2.1
27	2.9	4.45	3.3	3.6	2.3	2.15	1.65	1.7	1.7	2.4	1.9	2.1
28	2.8	4.15	3.5	3.4	3.15	2.0	1.65	1.7	1.65	2.4	1.85	2.1
29	2.7	.....	3.4	3.2	2.9	2.0	1.65	1.85	1.65	2.3	1.9	2.1
30	2.25	.....	3.3	3.3	2.6	2.0	1.65	1.85	1.6	2.2	1.9	2.1
31	1.75	.....	3.1	.....	2.5	.....	1.65	1.85	.....	2.1	.....	2.1

NOTE.—No information available regarding ice conditions, 1909; discharge probably not affected during the year.

Daily discharge, in second-feet, of Youghiogheny River at Confluence, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	148	432	1,500	974	1,700	746	399	93	148	80	271	217
2	271	603	1,800	974	1,600	974	334	93	127	80	271	192
3	302	603	2,580	1,140	1,410	1,270	302	93	127	67	244	192
4	168	533	2,580	1,800	1,500	1,140	271	93	127	67	244	192
5	168	603	2,350	1,750	1,320	3,080	271	93	168	67	217	192
6	217	1,500	1,700	1,650	974	3,540	217	93	217	67	192	168
7	217	1,270	1,320	1,360	820	2,020	168	80	168	57	168	217
8	192	896	2,120	1,140	746	1,960	148	80	148	57	168	533
9	168	820	2,120	974	710	1,650	127	67	127	57	271	533
10	271	974	2,470	896	674	1,800	110	57	110	47	334	399
11	217	1,800	1,800	858	603	3,470	110	57	127	80	271	334
12	271	1,650	1,320	820	533	2,240	110	47	366	432	271	334
13	334	1,500	1,180	783	465	1,500	110	47	302	366	271	533
14	465	1,910	1,100	3,540	432	1,600	110	47	217	217	244	1,320
15	2,890	1,800	974	2,890	399	1,500	110	57	168	217	244	674
16	1,910	4,460	896	1,910	366	1,500	93	1,010	127	192	244	603
17	1,270	2,470	820	1,410	399	1,860	93	1,410	603	168	244	499
18	858	1,800	820	1,100	334	1,180	93	896	334	148	244	432
19	603	1,500	783	1,060	271	1,010	93	674	271	148	244	366
20	746	1,750	1,060	1,550	271	896	93	499	217	148	244	302
21	674	1,410	896	4,240	302	820	80	1,140	168	148	244	271
22	820	1,180	820	6,260	465	746	67	533	168	217	244	271
23	1,500	1,550	710	4,390	399	710	67	334	148	334	244	217
24	2,700	7,610	638	3,140	302	674	110	217	148	3,080	217	217
25	1,800	5,210	783	2,120	271	533	127	168	148	1,410	217	271
26	1,600	3,080	1,060	1,960	271	432	127	127	148	896	217	334
27	896	2,410	1,230	1,500	465	366	110	127	127	533	217	334
28	820	2,070	1,410	1,320	1,100	271	110	127	110	533	192	334
29	746	.....	1,320	1,140	896	271	110	192	110	465	217	334
30	432	.....	1,230	1,230	674	271	110	192	93	399	217	334
31	148	.....	1,060	.....	603	.....	110	192	.....	334	.....	334

NOTE.—These discharges are based on a rating curve that is well defined below 10,500 second-feet. Above 4,460 second-feet the rating curve is a tangent, the difference being 150 per tenth.

Wm. A. Lamb.

Monthly discharge of Youghiogheny River at Confluence, Pa., for 1909.

[Drainage area, 435 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	2,890	148	768	1.77	2.04	A.
February	7,610	432	1,910	4.39	4.57	A.
March	2,580	638	1,370	3.15	3.63	A.
April	6,260	783	1,860	4.28	4.78	A.
May	1,700	271	686	1.58	1.82	A.
June	3,540	271	1,330	3.06	3.41	A.
July	399	67	145	.333	.38	A.
August	1,410	47	288	.662	.76	A.
September	603	93	186	.428	.48	A.
October	3,080	47	358	.823	.95	A.
November	334	168	238	.547	.61	A.
December	1,320	168	370	.851	.98	A.
The year	7,610	47	792	1.82	24.41	

CASSELMAN RIVER AT CONFLUENCE, PA.

This station, which is located at Confluence, Pa., at a highway bridge about 500 yards from the railroad station, was established by the United States Geological Survey September 15, 1904, to obtain data for the determination of methods of flood prevention, and for studies of storage, navigation, and power problems. It is now maintained by the Water Supply Commission of Pennsylvania, by which the records of gage heights and discharge measurements are furnished.

No important tributary enters near the station, but it is located only a few hundred yards above the junction of Casselman and Youghiogheny rivers, and as a result backwater usually occurs at high stages. The measurements indicate that as a rule backwater does not occur below gage height 4 feet, and below this stage a good rating curve has been developed under permanent channel conditions. Above 4 feet a double reversed rating curve has been used which shows about 1 to 2 feet backwater. From daily comparisons of discharge of the three streams at Confluence, this seems to be a fair average of backwater conditions which, of course, vary with each flood.[a]

The discharge is more or less affected by ice during the winter periods. The datum of the chain gage attached to the bridge has remained the same since the installation of the station. The bridge was moved a little by the flood of March 14, 1907, but gage heights were not materially affected thereby nor by the repairs to the bridge later.

[a] See also Youghiogheny River and Laurel Hill Creek at Confluence, Pa.

The following discharge measurement was made by F. W. Scheidenhelm:

June 12, 1909: Width, 232 feet; area, 508 square feet; gage height, 3.39 feet; discharge, 1,290 second-feet.

Daily gage height, in feet, of Casselman River at Confluence, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.83	2.0	3.3	2.85	3.5	2.15	2.0	1.63	1.78	1.53	1.93	1.83
2	1.73	2.4	4.1	2.8	3.3	2.35	2.05	1.58	1.73	1.53	1.93	1.78
3	1.93	2.3	4.5	3.0	3.1	2.5	2.05	1.53	1.73	1.48	1.88	1.78
4	1.83	2.4	4.55	3.5	3.1	2.35	1.98	1.48	1.73	1.48	1.88	1.78
5	1.78	2.6	4.1	3.45	3.0	3.25	1.98	1.48	1.88	1.48	1.88	1.78
6	1.88	2.85	3.5	3.35	2.75	4.1	1.88	1.43	1.83	1.48	1.83	1.78
7	1.83	2.65	3.6	3.05	2.55	3.1	1.83	1.43	1.73	1.43	1.73	1.93
8	1.78	2.4	4.0	3.0	2.55	3.05	1.78	1.43	1.68	1.43	1.83	2.45
9	1.98	2.4	3.75	2.8	2.55	3.05	1.73	1.43	1.68	1.43	1.78	2.3
10	1.98	2.65	3.9	2.8	2.6	3.05	1.68	1.38	1.63	1.38	1.78	2.15
11	1.88	3.6	3.4	2.75	2.5	4.15	1.68	1.38	1.63	1.58	1.78	2.1
12	1.98	3.6	3.1	2.65	2.3	3.25	1.68	1.38	1.68	2.35	1.78	2.0
13	2.1	3.5	2.9	2.8	2.35	2.9	1.68	1.38	1.68	2.15	1.78	2.2
14	2.05	3.35	2.95	6.3	2.3	2.85	1.73	1.38	1.68	1.83	1.78	3.5
15	3.5	3.3	2.85	4.5	2.25	2.65	1.73	1.48	1.63	1.83	1.88	2.65
16	3.25	5.4	2.75	3.9	2.2	2.55	1.68	3.65	1.58	1.78	1.88	2.55
17	2.35	4.1	2.65	3.25	2.1	2.6	1.68	3.05	1.58	1.73	1.88	2.3
18	2.35	3.35	2.55	3.05	2.1	2.35	1.68	2.8	1.53	1.68	1.88	2.3
19	2.15	3.25	2.65	3.0	2.05	2.35	1.68	2.6	1.53	1.83	1.88	2.2
20	2.4	3.35	3.0	3.7	2.05	2.3	1.68	2.3	1.53	1.83	1.83	2.0
21	2.4	3.0	2.8	5.3	2.2	2.2	1.63	3.55	1.53	1.78	1.83	2.05
22	2.6	2.85	2.8	6.8	2.2	2.3	1.63	2.55	1.53	1.78	1.83	1.98
23	3.5	3.25	2.5	5.45	2.2	2.25	1.68	2.3	1.58	2.0	1.83	1.88
24	4.6	7.9	2.5	4.5	2.15	2.25	2.15	2.0	1.68	3.5	1.83	1.88
25	3.5	5.7	2.6	3.75	2.1	2.25	2.05	1.98	1.68	3.0	1.83	2.05
26	3.3	4.1	2.9	3.7	2.05	2.2	1.98	1.88	1.68	2.3	1.78	2.15
27	2.55	3.9	3.0	3.1	2.1	2.6	1.88	1.88	1.68	2.1	1.78	2.2
28	2.4	3.8	3.0	3.2	2.4	2.45	1.78	1.83	1.63	2.1	1.78	2.2
29	2.2	.....	3.05	3.3	2.2	2.3	1.68	1.93	1.63	2.1	1.83	2.15
30	2.05	.....	3.0	3.4	2.1	2.2	1.68	1.93	1.58	2.05	1.83	2.25
31	1.95	.....	2.9	.....	2.1	.....	1.63	1.88	.....	1.98	.....	2.25

NOTE.—No information is available regarding ice conditions during the year; it is probable, however, that there was little or no effect due to ice.

Daily discharge, in second-feet, of Casselman River at Confluence, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	158	260	1,500	1,020	1,720	370	260	71	132	44	215	158
2	109	579	2,320	967	1,500	535	296	56	109	44	215	132
3	215	491	2,600	1,180	1,280	671	296	44	109	33	185	132
4	158	579	2,630	1,720	1,280	535	247	33	109	33	185	132
5	132	767	2,320	1,660	1,180	1,440	247	33	185	33	185	132
6	185	1,020	1,720	1,550	916	2,320	185	24	158	33	158	132
7	158	816	1,840	1,230	719	1,280	158	24	109	24	109	215
8	132	579	2,240	1,180	719	1,230	132	24	88	24	158	625
9	247	579	2,000	967	719	1,230	109	24	88	24	132	491
10	247	816	2,140	967	767	1,230	88	17	71	17	132	370
11	185	1,840	1,610	916	671	2,350	88	17	71	56	132	331
12	247	1,840	1,280	816	491	1,440	88	17	88	535	132	260
13	331	1,720	1,070	967	535	1,070	88	17	88	370	132	408
14	296	1,550	1,120	4,010	491	1,020	109	17	88	158	132	1,720
15	1,720	1,500	1,020	2,600	450	816	109	33	71	158	185	816
16	1,440	3,220	916	2,140	408	719	88	1,890	56	132	185	719
17	535	2,320	816	1,440	331	767	88	1,230	56	109	185	491
18	535	1,550	719	1,230	331	535	88	967	44	88	185	491
19	370	1,440	816	1,180	296	535	88	767	44	158	185	408
20	579	1,550	1,180	1,940	296	491	88	491	44	158	158	260

Daily discharge, in second-feet, of Casselman River at Confluence, Pa., for 1909—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	579	1,180	967	3,140	408	408	71	1,780	44	132	158	296
22	767	1,020	967	4,510	408	491	71	719	44	132	158	247
23	1,720	1,440	671	3,260	408	450	88	491	56	260	158	185
24	2,660	5,760	671	2,600	370	450	370	260	88	1,720	158	185
25	1,720	3,460	767	2,000	331	450	296	247	88	1,180	158	296
26	1,500	2,320	1,070	1,940	296	408	247	185	88	491	132	370
27	719	2,140	1,180	1,280	331	767	185	185	88	331	132	408
28	579	2,050	1,180	1,390	579	625	132	158	71	331	132	408
29	408	.....	1,230	1,500	408	491	88	215	71	331	158	370
30	296	.....	1,180	1,610	331	408	88	215	56	296	158	450
31	228	.....	1,070	.....	331	.....	71	185	.....	247	.....	450

NOTE.—These discharges are based on a rating curve that is well defined below 2,200 second-feet. There is a double reversal in the rating curve between discharges 1,800 and 8,600 second-feet on account of backwater effect. See description.

Monthly discharge of Casselman River at Confluence, Pa., for 1909.

[Drainage area, 450 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	2,660	109	618	1.37	1.58	A.
February	5,760	260	1,580	3.51	3.66	B.
March	2,630	671	1,380	3.07	3.54	B.
April	4,510	816	1,760	3.91	4.36	B.
May	1,720	296	623	1.38	1.59	B.
June	2,350	370	851	1.89	2.11	C.
July	370	71	150	.333	.38	A.
August	1,890	17	337	.749	.86	A.
September	185	44	83.4	.185	.21	B.
October	1,720	17	248	.551	.64	A.
November	215	109	160	.356	.40	A.
December	1,720	132	390	.867	1.00	A.
The year	5,760	17	682	1.51	20.33	

LAUREL HILL CREEK AT CONFLUENCE, PA.

This station, which is located at Confluence, Pa., at a highway bridge about one-fourth mile from the railroad station, was established by the United States Geological Survey September 15, 1904, to obtain data for use in determining methods of preventing floods and water pollution and for studies of storage and power problems. It is now maintained by the Water Supply Commission of Pennsylvania, by whom the records of gage heights and discharge measurements are furnished.

No important tributary enters near the station. It is located, however, only a few hundred yards above the junction of the creek with Youghiogheny River, and as a result backwater almost invariably occurs at high stages. The measurements indicate that as a rule backwater does not occur below gage height 3 feet. At low stages, however, conditions of flow are changeable owing to the fact

that refuse dumped into the creek from a tannery a few feet above the station settles under one end of the bridge. As a result, the records of flow at this station are not so good as those at the other two Confluence stations. For high stages a reversed curve followed by a tangent has been used, the backwater effect increasing with the stage. This curve seems to give fair average results for flood stages and the records of daily discharges compare favorably with those of Casselman and Youghiogheny rivers. Backwater conditions vary with each flood.[a]

The discharge is affected by ice during the winter periods. The datum of the chain gage attached to the bridge has remained constant during the period of maintenance of the station.

The following discharge measurement was made by F. W. Scheidenhelm:

June 12, 1909: Width, 102 feet; area, 249 square feet; gage height, 3.40 feet; discharge, 733 second-feet.

Daily gage height, in feet, of Laurel Hill Creek at Confluence, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.95	2.3	2.9	2.7	3.3	2.2	2.1	1.65	1.85	1.55	1.9	1.8
2	1.95	2.4	3.6	2.7	3.1	2.25	2.05	1.6	1.8	1.55	1.85	1.8
3	2.1	2.3	4.4	2.75	3.0	2.1	2.0	1.6	1.75	1.5	1.85	1.8
4	2.1	2.5	4.0	2.95	3.1	2.2	1.95	1.6	1.75	1.5	1.85	1.75
5	2.0	2.8	3.65	2.9	2.9	2.75	1.9	1.6	2.0	1.5	1.8	1.75
6	2.5	3.1	3.3	2.8	2.7	3.4	1.85	1.6	1.8	1.5	1.8	1.75
7	2.3	2.8	3.5	2.9	2.6	2.8	1.85	1.6	1.7	1.5	1.8	1.9
8	2.1	2.65	3.8	2.8	2.5	2.7	1.8	1.6	1.7	1.5	1.8	2.25
9	2.3	2.4	3.7	2.7	2.5	2.6	1.8	1.6	1.7	1.5	1.85	2.2
10	2.2	2.6	3.75	2.6	2.5	5.85	1.7	1.55	1.7	1.5	1.85	2.1
11	2.2	3.8	3.15	2.55	2.5	4.0	1.7	1.55	1.7	1.75	1.85	2.05
12	2.2	3.65	2.9	2.55	2.4	3.4	1.7	1.55	1.75	2.15	1.85	2.05
13	2.15	3.55	2.8	2.65	2.35	2.9	1.7	1.55	1.75	1.9	1.8	2.8
14	2.1	3.15	2.7	4.3	2.3	2.9	1.65	1.55	1.7	1.8	1.9	4.0
15	3.5	3.15	2.55	3.5	2.25	2.75	1.65	1.75	1.7	1.8	1.9	2.8
16	3.05	4.5	2.5	3.1	2.2	2.6	1.65	3.7	1.7	1.8	1.85	2.6
17	2.65	3.5	2.4	2.85	2.15	2.5	1.65	2.9	1.65	1.75	1.85	2.4
18	2.55	3.05	2.4	2.7	2.05	2.4	1.65	2.7	1.65	1.7	1.85	2.3
19	2.25	2.95	2.5	2.7	2.05	2.4	1.65	2.45	1.6	1.85	1.8	2.2
20	2.5	3.05	2.85	3.7	2.05	2.35	1.65	2.35	1.6	1.85	1.8	2.1
21	2.45	2.85	2.65	4.1	2.15	2.35	1.6	2.5	1.6	1.85	1.8	2.0
22	2.6	2.75	2.6	4.85	2.15	2.35	1.6	2.25	1.6	1.9	1.8	1.95
23	3.45	3.3	2.5	4.05	2.1	2.3	1.6	2.15	1.6	2.25	1.8	1.9
24	3.8	6.1	2.5	3.55	2.05	2.3	1.75	2.1	1.75	2.25	1.8	1.9
25	3.2	4.1	2.7	3.1	2.0	2.3	1.75	2.0	1.75	2.4	1.85	2.1
26	2.8	3.35	2.75	3.05	1.95	2.25	1.7	1.9	1.75	2.1	1.85	2.2
27	2.65	3.3	2.9	2.8	2.3	2.35	1.7	1.9	1.7	2.1	1.85	2.2
28	2.6	3.2	3.0	2.7	2.45	2.3	1.7	1.85	1.65	2.0	1.85	2.2
29	2.5	.....	2.95	2.75	2.2	2.25	1.65	1.95	1.65	2.0	1.8	2.2
30	2.3	.....	2.9	3.1	2.05	2.15	1.65	1.95	1.6	1.95	1.8	2.2
31	2.2	.....	2.8	.....	2.1	.....	1.65	1.9	.....	1.9	.....	2.2

[a] See Casselman River and Youghiogheny River at Confluence, Pa.

NOTE.—No information available regarding ice conditions during 1909. It is probable that there was no great effect from ice.

Daily discharge, in second-feet, of Laurel Hill Creek at Confluence, Pa., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	64	185	522	395	742	142	106	20	44	14	52	35
2	64	233	885	395	636	164	91	16	35	14	44	35
3	106	185	1,210	426	581	106	76	16	29	11	44	35
4	106	284	1,060	552	636	142	64	16	29	11	44	29
5	76	456	908	522	522	426	52	16	76	11	35	29
6	284	636	742	456	395	790	44	16	35	11	35	29
7	185	456	840	522	338	456	44	16	23	11	35	52
8	106	366	975	456	284	395	35	16	23	11	35	164
9	185	233	930	395	284	338	35	16	23	11	44	142
10	142	338	952	338	284	1,680	23	14	23	11	44	106
11	142	975	663	311	284	1,060	23	14	23	29	44	91
12	142	908	522	311	233	790	23	14	29	124	44	91
13	124	862	456	366	209	522	23	14	29	52	35	456
14	106	663	395	1,170	185	522	20	14	23	35	52	1,060
15	848	663	311	840	164	426	20	29	23	35	52	456
16	608	1,240	284	636	142	338	20	930	23	35	44	338
17	366	840	233	489	124	284	20	522	20	29	44	233
18	311	608	233	395	91	233	20	395	20	23	44	185
19	164	552	284	395	91	233	20	258	16	44	35	142
20	284	608	489	930	91	209	20	209	16	44	35	106
21	258	489	366	1,100	124	209	16	284	16	44	35	76
22	338	426	338	1,360	124	209	16	164	16	52	35	64
23	715	742	284	1,080	106	185	16	124	16	164	35	52
24	975	1,750	284	862	91	185	29	106	29	164	35	52
25	690	1,100	395	636	76	185	29	76	29	233	44	106
26	456	766	426	608	64	164	23	52	29	106	44	142
27	366	742	522	456	185	209	23	52	23	106	44	142
28	338	690	581	395	258	185	23	44	20	76	44	142
29	284	.....	552	426	142	164	20	64	20	76	35	142
30	185	.....	522	636	91	124	20	64	16	64	35	142
31	142	.....	456	.....	106	.....	20	52	.....	52	.....	142

NOTE.—These discharges are based on a rating curve that is fairly well defined between 16 and 580 second-feet.

Monthly discharge of Laurel Hill Creek at Confluence, Pa., for 1909.

[Drainage area, 118 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	975	64	295	2.50	2.88	B.
February	1,750	185	643	5.45	5.68	B.
March	1,210	233	568	4.81	5.54	B.
April	1,360	311	595	5.04	5.62	B.
May	742	64	248	2.10	2.42	B.
June	1,680	106	369	3.13	3.49	B.
July	106	16	32.7	.277	.32	C.
August	930	14	118	1.00	1.15	B.
September	76	16	25.9	.219	.24	C.
October	233	11	54.9	.465	.54	C.
November	52	35	40.9	.347	.39	C.
December	1,060	29	162	1.37	1.58	B.
The year	1,750	11	263	2.23	29.85	

MUSKINGUM RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Muskingum River lies in the eastern part of the State of Ohio.

The river is formed by the junction of Mohican and Tuscarawas rivers at Coshocton, near the central part of Coshocton County, from which it flows in a slightly southwesterly direction to Zanesville, thence southeastward to its junction with Ohio River at Marietta, Ohio. In the southeastern part of Morgan County the river forms a large bend and flows due north for several miles. The length of the river below the junction of the Mohican and Tuscarawas is about 100 miles (map measurement), and its drainage area comprises about 8,000 square miles.

Mohican River rises in the northwestern part of Richland County, flows in a general southerly direction to the northeastern part of Tuscarawas County and thence southwestward to its junction with the Mohican. The important tributaries of the Mohican are Walhonding and Killbuck creeks; of the Tuscarawas, Chippewa and Sugar creeks on the west bank and Sandy and Big Stillwater creeks on the east bank.

Muskingum River has only two important tributaries—Licking River from the west near Zanesville and Wills Creek from the east near the southern line of Coshocton County.

The drainage basin is regular in shape, being about 100 miles wide and 125 miles long. Only the headwaters of Licking, Mohican, and Tuscarawas rivers lie within the glaciated area, the remainder of the basin being unglaciated. In the central and southern part of the basin the soil has resulted from the disintegration of native rocks and the country is poorly watered. Its surface is extremely rough and irregular, cut in every direction by valleys between which rise high hills. To the north the surface becomes less broken though it is still undulating; the soil has been derived from drift materials and is sandy and gravelly. At the headwaters of Mohican and Tuscarawas rivers it is naturally marshy. This characteristic has been much modified by cultivation and drainage, but swampy areas still exist. Springs are common in the glaciated region.

The elevation of the sources of the Mohican and Tuscarawas rivers is about 1,100 feet; the elevation at Coshocton is about 730 feet; at Zanesville about 688 feet; at the mouth of the river at Marietta the elevation is 570 feet.

There are no large forested areas in this drainage basin. This region has been long settled and the timber left standing is in groves or wood lots, generally of small size.

The mean annual rainfall is about 40 inches, being less at the headwaters and greater at the mouth of the river. The winters in the northern part are comparatively severe. Ice forms about 1 foot thick on the streams. In the lower part of the basin the winters are milder, but ice generally forms on the river.

The basin affords sites for storage reservoirs at the headwaters of the tributaries, and reservoirs constructed in 1830 to store water for feeding the Ohio Canal are in existence at the present time. The cost of overflowed land would undoubtedly now prohibit reservoir construction.

Both the main stream and tributaries present favorable sites for the development of water power.

The Muskingum is navigable from Zanesville down. In this stretch of the river there are 10 locks and dams with a total fall of 118 feet. The surplus water is available for water power, but only at one or two places is all the power at these dams utilized.

The Ohio Canal, which runs from Cleveland to Portsmouth, Ohio, crosses this drainage basin. At the headwaters of Tuscarawas and Licking rivers are the reservoirs for feeding the canal both ways from the summits; thus some water is diverted from the Muskingum basin. The surplus water from the canal between the two summits is discharged into Muskingum River near Dresden. About the only use made of the canal at the present time is to furnish water for the power plants situated along its banks.

MUSKINGUM RIVER AT ZANESVILLE, OHIO.

This station is located at the Sixth Street Bridge at Zanesville, about 1,000 feet above Lock No. 10. The gage, which belongs to the United States Engineer Corps, is located at the lock. The United States Weather Bureau furnishes the daily gage heights. The gage was established June 4, 1887. On March 11, 1905, discharge measurements were begun at this station to obtain data for the study of water power, water supply, pollution, and navigation problems.

Licking River enters from the west about one-half mile above the station. The drainage area above the section is about 5,830 square miles.

The winter conditions are comparatively severe, and ice generally causes some trouble. Several power plants located above the station may modify the flow in low water to some extent.

The datum of the gage has remained unchanged.

The station has not been visited since June, 1906, and nothing is known about the present conditions. The low-water gage heights for 1908 and probably also for 1907 and 1909, when based on the 1906 rating curve, give results which are far too great.

Daily gage height, in feet, of Muskingum River at Zanesville, Ohio, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.0	9.7	17.0	10.6	16.7	9.5	10.8	9.1	8.3	7.9	7.9	8.1
2	8.0	9.4	16.6	10.2	17.3	10.0	9.9	8.8	8.1	7.9	7.9	8.1
3	8.0	9.5	16.3	10.0	17.6	11.3	9.3	8.4	8.0	7.9	7.9	8.1
4	8.0	9.5	16.6	9.9	17.2	13.3	9.0	8.2	8.3	7.8	7.9	8.0
5	8.0	9.5	16.0	9.9	16.6	14.0	8.9	8.2	8.2	7.8	7.9	8.0
6	8.0	10.2	15.1	9.8	15.1	13.1	8.7	8.8	8.2	7.7	7.9	8.0
7	8.2	11.8	14.1	17.5	13.6	12.3	8.6	8.2	8.1	7.8	7.9	8.0
8	8.5	11.8	13.0	18.7	12.0	11.9	8.5	8.2	8.0	7.6	7.9	8.0
9	8.4	10.9	12.4	17.0	11.0	12.7	8.3	8.1	8.0	7.8	7.9	8.0
10	8.4	11.5	17.9	15.2	11.0	12.0	8.3	8.0	8.0	7.8	7.9	7.9
11	8.4	12.1	18.0	13.0	14.0	13.0	8.3	8.0	7.9	7.8	7.9	7.9
12	8.2	12.1	17.0	11.9	13.8	12.6	8.3	8.0	7.9	7.8	7.9	8.0
13	8.0	11.7	15.7	11.1	12.3	11.9	8.4	7.8	7.9	7.8	8.0	8.1
14	7.9	12.9	13.6	10.7	12.1	11.1	8.8	7.9	7.8	7.8	7.9	11.5
15	8.2	15.4	12.3	10.5	11.4	10.3	8.9	9.5	8.0	7.8	7.9	11.9
16	8.3	17.7	11.5	10.5	11.3	9.5	9.1	15.7	8.0	7.8	7.9	11.0
17	8.3	16.8	11.0	10.1	11.3	9.4	9.5	13.6	8.0	7.8	7.9	9.8
18	9.0	15.5	10.7	9.8	10.5	9.2	9.2	11.6	7.9	7.8	8.0	9.3
19	9.0	15.2	10.3	9.6	9.9	9.0	8.9	10.1	7.9	7.8	8.1	8.8
20	9.2	16.8	10.3	9.4	9.5	9.0	8.6	9.3	7.9	7.7	8.2	8.5
21	8.8	17.8	10.6	9.4	13.8	8.9	8.4	8.7	7.9	7.8	8.2	8.4
22	8.8	17.0	10.6	10.3	19.1	9.0	8.3	8.6	7.9	7.7	8.2	8.4
23	9.5	15.8	10.2	11.7	15.1	9.2	8.3	8.4	7.8	7.9	8.0	8.2
24	13.9	22.9	9.8	12.1	13.4	9.1	8.2	8.3	7.8	8.0	8.8	8.1
25	14.6	26.0	9.9	11.1	12.4	10.6	8.2	8.2	7.8	8.1	9.0	8.0
26	14.4	25.1	10.5	11.0	11.6	14.7	8.2	8.1	7.8	8.0	8.9	8.0
27	13.9	24.0	12.8	10.4	10.3	11.0	8.2	8.1	7.9	8.0	8.7	8.0
28	12.0	22.2	12.9	10.6	10.2	12.2	8.1	8.1	7.9	8.0	8.5	8.0
29	10.2	.....	12.3	10.3	10.1	14.0	8.1	8.4	7.9	7.9	8.3	8.0
30	9.8	.....	11.4	10.2	10.0	12.0	8.8	8.8	7.9	7.9	8.2	8.0
31	9.8	.....	11.0	.....	9.9	.....	8.8	8.6	.....	7.9	.....	8.0

NOTE.—No information available concerning ice conditions or probable backwater effects therefrom during 1909.

KANAWHA RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of the Kanawha comprises about one-third of the State of West Virginia, part of western Virginia, and the counties of Alleghany, Ashe, and part of Watauga County in the extreme northwestern part of North Carolina. The lower part of the river, below the mouth of the Gauley, is called the Kanawha; above this point it is called the New.

New River is formed by the union of the North Fork and South Fork a few miles south of the northern boundary of North Carolina. Considering the South Fork as the main stream, as it is the larger, the river rises in the central part of Watauga County near Boone, N. C., whence it flows northeastward across the State line into Virginia. At Radford, Va., the river turns abruptly and flows northwestward across West Virginia, and empties into Ohio River at Point Pleasant, W. Va. The total length of the river is 427 miles. The lower 90 miles have been made navigable by means of locks and dams. The total drainage area as determined and adjusted from topographic maps, comprises 12,197 square miles.

NEW RIVER NEAR GAULEY, W. VA.

Beginning at the headwaters and following down the right or eastern bank the important tributaries are Big Reed Island Creek and Little River in Virginia; Greenbrier River, Gauley River, Elk River, and Pocotaligo River in West Virginia; those on the left or western bank are Cripple Creek, Reed Creek, Walker Creek, and Wolf Creek in Virginia; East River, Bluestone River, and Coal River, in West Virginia.

The drainage area is irregular in outline. Its length, following the general course of the river, is about 240 miles; its width at the widest point is about 140 miles. The sources of the New lie in the Appalachian Mountains among the high ridges that separate this basin from the basins of Great Pedee and Santee rivers, which drain into the Atlantic Ocean; and from the basin of Tennessee River, which drains into the Ohio. The basins of the tributaries in North Carolina and in the southern part of Virginia are more or less regular in outline and circular in shape. The main river crosses the Allegheny Front just below Pearisburg, Va., near the Virginia and West Virginia line. Along this section the basins of the tributaries are long and narrow. Below the state line to the mouth of the river the valley of the Kanawha proper is very narrow.

As all the tributaries except those in the lower part of the basin drain the steep slopes and precipitous sides of mountainous country, the beds of the streams are rough and rocky and there are many falls and rapids. Along the section traversed by the Chesapeake & Ohio Railway, from the West Virginia line to Charleston, W. Va., and especially from Hinton to the mouth of Gauley River the scenery is exceptionally fine, for through this section the river is confined to a narrow canyon with mountains on both sides. (See Pl. IV.)

The sources of the river are about 3,660 feet above sea level; at its mouth the elevation is 510 feet. The total fall is therefore about 3,100 feet, or an average fall of over 7 feet to the mile. The following table gives some idea of the slope of the river:

Slope of Kanawha River.

Locality.	Elevation.	Distance.	Fall between points.	Distance between points.	Average fall per mile.
	Feet.	*Miles.*	*Feet.*	*Miles.*	*Feet.*
Sources	3,600	0			
Junction of North and South forks	2,500	86	1,100	86	12.8
Radford, Va	1,760	192	740	106	7.0
Virginia-West Virginia State line	1,500	246	260	54	4.8
Hinton, W. Va	1,340	270	160	24	6.7
Gauley River	650	331	690	61	11.3
Upper Pool, Lock No. 2	600	343	50	12	4.2
Mouth	510	427	90	84	1.1

Probably from 10 to 20 per cent of the drainage area is forested. Lumbering is being carried on extensively along many of the tributaries, especially at the headquarters of the Gauley and Greenbrier

where there are large areas of virgin timber. The mean annual rainfall at the sources of the river in North Carolina is about 55 inches; on that part of the drainage basin in Virginia the rainfall is from 45 to 50 inches; in West Virginia the rainfall is 45 inches.

In general, the winters throughout the basin are mild. Ice does not form very thick, and the snowfall is light and does not last long. During the winter of 1908 and 1909 ice formed about 2 inches thick at a few of the stations in the basin and lasted only a few days.

The basin affords many opportunities for storage reservoirs, there being suitable foundation sites for large dams and readily accessible material for their construction. Reservoirs would be of use for flood control, as an aid to navigation, and for waterpower development. At the present time the basin affords abundant supplies of coal, oil, and gas, but as these supplies diminish and the cost of fuel increases the numerous opportunities for power development afforded by the river and its tributaries will be very extensively utilized. The lower part of the river has been made navigable by means of 10 locks and dams, the lift ranging from about 6 feet to 14 feet. The lock farthest upstream is located at Montgomery, W. Va., about 84 miles above the mouth; the lowest lock is near Point Pleasant, about 1 mile above the mouth of the river. The river is used principally for transporting the coal mined from the extensive coal fields along the river above Charleston.

At ordinary stages the water of the tributaries is clear, and some of the larger streams afford excellent trout and bass fishing. The water of the main stream is rarely, if ever, clear, being of a reddish-brown color due to the hydraulic mining of iron ore carried on in Virginia.

SOUTH FORK OF NEW RIVER NEAR CRUMPLER, N. C.

This station, which was established August 12, 1908, to obtain data for use in studying water power, pollution, flood control, and storage problems, is located about 1½ miles above the confluence of the North and South Forks of New River, about 4 miles from Crumpler, N. C.

The drainage area above the section is about 325 square miles.

Discharge measurements are made by means of a boat or by wading.

The chain gage is attached to a tree on the left bank about one-half mile above the measuring section. The datum of the gage has remained unchanged; the records are reliable and accurate.

Sufficient data have not been obtained to enable estimates of the flow to be made.

The following discharge measurement was made by H. J. Jackson:

June 18, 1909: Width, 178 feet; area, 541 square feet; gage height, 2.02 feet; discharge, 1,060 second-feet.

Daily gage height, in feet, of South Fork of New River near Crumpler, N. C., for 1909.

[John J. Garvey, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.12	1.55	1.89	1.82	2.50	2.08	2.12	1.80	1.31	1.30	1.29	1.18
2	1.93	2.02	1.84	1.74	2.12	2.00	2.12	1.92	1.29	1.30	1.28	1.18
3	1.83	1.91	1.85	1.81	1.82	2.22	1.86	1.97	1.26	1.30	1.28	1.21
4	1.82	1.80	1.88	1.74	1.76	3.92	1.82	1.78	1.32	1.32	1.27	1.21
5	2.42	1.73	1.80	1.72	1.73	2.92	1.78	1.72	1.40	1.32	1.27	1.21
6	2.49	1.80	1.87	1.66	1.70	2.64	1.75	1.69	1.39	1.34	1.27	1.20
7	2.05	1.67	2.05	1.68	1.66	2.28	2.06	1.61	1.32	1.30	1.27	1.53
8	1.95	1.60	1.95	1.70	1.66	2.15	1.96	1.59	1.30	1.30	1.27	1.74
9	1.87	1.65	1.87	1.74	1.64	2.38	1.86	1.52	1.34	1.30	1.27	1.56
10	1.83	2.29	2.06	1.67	3.61	2.15	1.84	1.50	1.45	1.28	1.50	1.39
11	1.78	2.17	2.07	1.60	2.87	2.04	1.77	1.50	1.40	2.33	1.45	1.32
12	1.76	1.87	1.91	1.55	2.36	2.42	1.72	1.58	1.34	2.57	1.35	1.46
13	1.72	1.77	1.87	2.57	2.04	2.04	1.70	1.52	1.30	1.76	1.30	2.02
14	1.71	1.71	1.87	3.34	1.95	2.02	1.69	1.48	1.26	1.60	1.28	2.42
15	1.77	1.78	1.86	2.42	1.82	1.96	1.67	1.65	1.25	1.66	1.27	1.75
16	1.97	2.43	1.77	2.12	1.76	1.92	1.60	2.08	1.47	1.68	1.27	1.66
17	2.25	2.31	1.72	1.96	1.80	2.35	1.56	1.86	1.60	1.51	1.29	1.68
18	2.01	2.01	1.72	1.88	1.77	2.06	1.52	1.68	1.62	1.48	1.28	1.44
19	1.89	2.01	1.69	1.86	1.68	1.92	1.52	1.60	1.46	1.42	1.26	1.39
20	1.81	2.83	1.67	1.79	2.40	1.87	1.50	1.49	1.43	1.38	1.23	1.38
21	1.77	2.19	1.78	1.76	6.54	1.86	1.48	1.46	1.42	1.38	1.23	1.36
22	1.73	2.09	1.90	1.75	3.88	1.84	1.50	1.43	1.72	1.37	1.22	1.41
23	1.69	2.05	1.73	1.76	2.94	1.88	1.51	1.41	1.96	1.37	1.34	1.30
24	1.67	2.19	1.70	1.74	2.62	1.88	1.54	1.38	1.72	1.38	1.28	1.31
25	1.67	2.38	2.11	1.69	2.48	1.89	1.47	1.36	1.66	1.40	1.25	1.51
26	1.72	2.17	2.16	1.68	2.44	1.94	1.47	1.34	1.47	1.33	1.24	1.51
27	1.77	2.03	1.94	1.66	2.78	1.97	1.68	1.36	1.44	1.32	1.20	1.28
28	1.65	1.94	2.14	1.66	2.34	1.84	1.90	1.34	1.34	1.30	1.18	1.54
29	1.67	.....	2.26	1.70	2.22	2.10	1.84	1.32	1.33	1.32	1.18	2.26
30	1.65	.....	1.96	1.81	2.15	2.00	1.56	1.33	1.33	1.32	1.18	2.10
31	1.65	.....	1.90	.....	2.08	.....	1.64	1.32	.....	1.30	.....	1.96

NOTE.—Ice conditions December 10 to 31. Ice about 0.75 foot thick on December 31.

NEW RIVER NEAR GRAYSON, VA.

This station, which is located at the Norfolk & Western Railway bridge at Fries Junction, about 1 mile from Grayson, Va., was established August 7, 1908, to obtain data for use in studying water power, pollution, flood control, and storage problems.

Chestnut Creek enters immediately below the section. The drainage area above the station is about 1,160 square miles.

The datum of the chain gage attached to the railroad bridge has remained unchanged; the records are reliable and accurate. Sufficient data have not yet been obtained to enable estimates of the flow to be made.

Discharge measurements of New River near Grayson, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 14	H. J. Jackson	639	1,710	4.74	3,110
June 21	do	631	1,500	4.45	2,390

Daily gage height, in feet, of New River near Grayson, Va., for 1909.

[Wm. J. Matkins and Oscar Williams, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.32	4.07	4.64	4.64	5.27	4.67	4.74	4.40	3.80	3.75	3.45	3.78
2	5.47	4.35	4.54	4.58	5.25	4.55	4.62	4.66	3.76	3.74	3.80	3.79
3	4.81	4.57	4.46	4.48	4.80	4.63	4.54	4.62	3.76	3.70	3.79	3.79
4	4.65	4.51	4.52	4.46	4.65	6.55	4.40	4.46	3.78	3.74	3.79	3.74
5	5.32	4.37	4.52	4.42	4.55	6.43	4.30	4.35	3.82	3.80	3.79	3.68
6	6.15	4.47	4.54	4.34	4.49	5.47	4.30	4.26	3.88	3.76	3.79	3.67
7	5.37	4.39	4.84	4.26	4.41	5.11	4.39	5.30	3.88	3.79	3.78	3.75
8	4.99	4.32	4.88	4.26	4.34	4.85	4.98	4.10	3.85	3.78	3.79	4.12
9	4.87	4.27	4.80	4.31	4.25	4.80	4.69	4.06	3.86	3.75	3.45	4.15
10	4.69	5.29	4.76	4.28	5.00	5.00	4.52	4.00	3.85	3.72	3.85	3.88
11	4.63	5.61	4.76	4.23	5.65	4.73	4.42	3.98	3.85	4.24	3.90	3.68
12	4.55	4.92	4.72	4.20	4.93	4.60	4.30	4.01	3.80	5.55	3.91	3.79
13	4.45	4.65	4.70	4.70	4.60	4.67	4.30	4.00	3.78	4.55	3.80	4.25
14	4.42	4.54	4.66	6.47	4.47	4.85	4.30	4.05	3.78	4.09	3.79	4.91
15	4.43	4.47	4.58	5.50	4.41	4.65	4.26	4.30	3.76	4.08	3.78	4.60
16	4.55	4.82	4.50	4.95	4.36	4.56	4.17	4.68	3.75	4.26	3.79	4.18
17	5.39	5.01	4.46	4.75	4.31	4.40	4.12	4.69	4.04	4.18	3.81	3.98
18	5.15	4.78	4.43	4.60	4.25	4.38	4.10	4.36	4.04	4.06	3.73	3.91
19	4.95	4.70	4.37	4.47	4.23	4.59	4.06	4.14	4.01	3.96	3.70	3.90
20	4.75	4.98	4.34	4.45	4.30	4.51	4.02	4.05	3.85	3.92	3.74	3.93
21	4.61	4.86	4.40	4.44	9.10	4.44	3.98	3.99	3.86	3.95	3.72	3.74
22	4.55	4.91	4.51	4.40	7.63	4.35	3.96	3.94	3.91	3.92	3.73	3.68
23	4.47	5.06	4.47	4.37	5.87	4.32	4.01	3.89	4.18	3.96	3.75	3.68
24	4.45	5.11	4.42	4.31	4.40	4.42	4.03	3.88	4.28	3.98	3.78	3.75
25	4.42	5.34	4.58	4.26	5.15	4.49	4.02	3.87	4.12	3.95	3.82	3.88
26	4.42	5.16	4.91	4.25	5.15	4.48	4.10	3.85	4.01	3.89	3.79	3.94
27	4.41	4.94	4.80	4.25	5.23	4.54	4.48	3.85	3.95	3.88	3.78	3.76
28	4.37	4.74	4.98	4.25	5.05	4.48	4.30	3.82	3.84	3.83	3.76	3.84
29	4.36	.....	5.58	4.23	4.83	4.52	4.22	3.80	3.80	3.83	3.71	3.89
30	4.33	.....	5.08	4.30	4.73	4.62	4.18	3.78	3.80	3.89	3.72	3.84
31	4.05	.....	4.84	.....	4.70	.....	4.16	3.81	.....	3.90	.....	3.92

NOTE.—Ice conditions December 9 to 31. Gage is at swift water, and river does not freeze over. On December 31 ice extended one-third of the distance across from both sides of the river. Gage heights probably affected during this period.

NEW RIVER AT RADFORD, VA.

This station, which is located at the toll highway bridge about 1½ miles below the Norfolk & Western Railway bridge, near the Norfolk & Western Railway station at Radford, Va., was established August 1, 1898, discontinued July 15, 1906, and reestablished May 6, 1907. It is maintained to obtain data for use in studying water supply, pollution, water power, flood control, and storage problems.

No important tributaries enter in the immediate vicinity of this station. Little River enters from the right about 6 miles above the station.

The United States Weather Bureau gage was originally used at this point, but owing to its inaccessibility it was replaced by a wire gage referred to the same datum February 23, 1900. On December 1, 1903, the wire gage was replaced by a chain gage and the datum lowered 3.41 feet to avoid negative readings. Many errors entered into the gage readings prior to the installation of the chain gage, and estimates of discharge based on them are not very reliable. All

estimates at this station were revised in 1905, but it was impossible to eliminate all the gage errors.

Conditions of flow are constant and the discharge is only occasionally affected by backwater from ice conditions. A good low-water rating curve has been developed from recent measurements and two recomputed measurements made in 1900 and 1901. At high stages the rating curve is only approximate. The tubular piers of the bridge interfere somewhat with the discharge measurements, and errors have occurred in some measurements due to not considering the area and velocity immediately above them.

Revised data for this station prior to 1906 have been published in Bulletin 3 of the Geological Survey of Virginia.

Discharge measurements of New River at Radford, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 10	H. J. Jackson	548	2,580	5.15	7,300
June 22	do	547	2,030	4.36	4,050
December 7	A. H. Horton	540	1,620	3.50	1,830

Daily gage height, in feet, of New River at Radford, Va., for 1909.

[C. L. Gillespie, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.0	4.5	4.8	4.9	5.9	4.7	4.7	4.1	3.4	3.4	3.4	3.3
2	5.6	3.8	4.6	4.6	5.5	4.6	4.6	5.2	3.4	3.5	3.4	3.3
3	5.1	3.9	4.6	4.4	5.4	4.5	4.5	4.9	3.3	3.5	3.4	3.3
4	4.8	3.8	4.3	4.2	4.9	4.9	4.4	4.4	3.3	3.4	3.4	3.3
5	5.0	3.6	4.3	4.2	4.5	7.9	4.1	4.0	3.3	3.3	3.4	3.3
6	7.5	3.7	4.3	4.1	4.4	6.1	4.0	4.1	3.2	3.3	3.4	3.3
7	6.2	4.0	4.2	4.1	4.4	5.6	4.3	4.1	3.2	3.3	3.4	3.5
8	5.6	3.8	5.1	4.1	4.3	5.0	4.5	4.1	3.2	3.3	3.5	3.7
9	4.9	3.8	5.2	4.0	4.2	5.7	4.9	3.9	3.5	3.3	3.4	3.8
10	4.7	5.4	5.0	4.2	4.2	5.2	4.5	3.7	4.2	3.5	3.4	3.7
11	4.5	6.3	4.8	4.1	6.1	5.0	4.2	3.5	4.0	3.5	3.6	3.4
12	4.7	5.2	4.9	4.0	5.8	4.7	4.2	3.6	3.8	6.0	3.6	3.5
13	4.6	4.0	4.8	4.0	5.0	4.6	4.0	3.4	3.5	5.1	3.6	3.7
14	4.5	4.6	4.6	8.2	4.6	5.2	4.1	3.4	3.6	4.6	3.6	5.4
15	4.5	4.5	4.4	6.8	4.4	4.9	4.0	3.4	3.5	3.8	3.5	4.5
16	4.9	4.6	4.2	5.4	4.3	4.7	4.0	3.9	3.5	3.7	3.4	4.1
17	5.4	5.3	4.4	5.2	4.2	4.5	3.9	4.3	4.0	3.6	3.3	3.7
18	6.0	5.0	4.4	5.0	4.2	4.3	3.9	4.1	3.9	3.8	3.3	3.7
19	5.4	4.7	4.2	4.7	4.1	4.8	3.7	3.8	3.8	3.6	3.3	3.7
20	5.5	4.9	4.2	4.5	4.0	4.4	3.7	3.6	3.8	3.6	3.3	3.7
21	5.3	4.7	4.3	4.4	8.9	4.3	3.6	3.6	3.6	3.7	3.3	3.6
22	4.8	4.7	4.3	4.4	11.8	4.3	3.6	3.5	3.5	3.6	3.3	3.6
23	4.7	4.8	4.6	4.3	7.4	4.3	3.7	3.4	3.6	3.6	3.3	3.5
24	4.6	5.5	4.5	4.3	6.1	4.6	3.6	3.1	3.7	3.6	3.3	3.2
25	4.6	5.7	4.3	4.3	5.5	4.5	3.8	3.9	4.0	3.6	3.3	3.4
26	4.4	5.5	5.2	4.1	5.4	4.4	3.8	3.8	3.8	3.6	3.3	3.8
27	4.3	5.4	5.2	4.1	6.1	4.3	3.7	3.8	3.7	3.6	3.3	3.5
28	4.2	5.2	5.0	4.0	5.6	4.3	3.7	3.7	3.6	3.6	3.3	3.4
29	4.2	.....	5.6	4.0	5.1	4.8	4.3	3.5	3.5	3.5	3.3	3.3
30	4.0	.....	5.4	4.0	4.9	4.6	4.1	3.4	3.4	3.5	3.3	3.3
31	4.6	.....	5.3	.....	4.8	.....	4.0	3.4	.....	3.5	.....	3.3

Daily discharge, in second-feet, of New River at Radford, Va., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10,800	4,900	6,000	6,380	10,400	5,630	5,630	3,590	1,640	1,640	1,640	1,390
2	9,140	2,710	5,260	5,260	8,740	5,260	5,260	7,550	1,640	1,900	1,640	1,390
3	7,160	3,000	5,260	4,550	8,340	4,900	4,900	6,380	1,390	1,900	1,640	1,390
4	6,000	2,710	4,220	3,900	6,380	6,380	4,550	4,550	1,390	1,640	1,640	1,390
5	6,770	2,160	4,220	3,900	4,900	19,400	3,590	3,290	1,390	1,390	1,640	1,390
6	17,400	2,430	4,220	3,590	4,550	11,200	3,290	3,590	1,150	1,390	1,640	1,390
7	11,600	3,290	3,900	3,590	4,550	9,140	4,220	3,590	1,150	1,390	1,640	1,900
8	9,140	2,710	7,160	3,590	4,220	6,770	4,900	3,590	1,150	1,390	1,900	2,430
9	6,380	2,710	7,550	3,290	3,900	9,540	6,380	3,000	1,900	1,390	1,640	2,710
10	5,630	8,340	6,770	3,900	3,900	7,550	4,900	2,430	3,900	1,900	1,640	2,430
11	4,900	12,000	6,000	3,590	11,200	6,770	3,900	1,900	3,290	1,900	2,160	1,640
12	5,630	7,550	6,380	3,290	9,950	5,630	3,900	1,900	2,710	10,800	2,160	1,900
13	5,260	3,290	6,000	3,290	6,770	5,260	3,290	1,640	1,900	7,160	2,160	2,430
14	4,900	5,260	5,260	21,000	5,260	7,550	3,590	1,640	2,160	5,260	2,160	8,340
15	4,900	4,900	4,550	14,200	4,550	6,380	3,290	1,640	1,900	2,710	1,900	4,900
16	6,380	5,260	3,900	8,340	4,220	5,630	3,290	3,000	1,900	2,430	1,640	3,590
17	8,340	7,940	4,550	7,550	3,900	4,900	3,000	4,220	3,290	2,160	1,390	2,430
18	10,800	6,770	4,550	6,770	3,900	4,220	3,000	3,590	3,000	2,710	1,390	2,430
19	8,340	5,630	3,900	5,630	3,590	6,000	2,430	2,710	2,710	2,160	1,390	2,430
20	8,740	6,380	3,900	4,900	3,290	4,550	2,430	2,160	2,710	2,160	1,390	2,430
21	7,940	5,630	4,220	4,550	25,000	4,220	2,160	2,160	2,160	2,430	1,390	2,160
22	6,000	5,630	4,220	4,550	43,500	4,220	2,160	1,900	1,900	2,160	1,390	2,160
23	5,630	6,000	5,260	4,220	17,000	4,220	2,430	1,640	2,160	2,160	1,390	1,900
24	5,260	8,740	4,900	4,220	11,200	5,260	2,160	920	2,430	2,160	1,390	1,150
25	5,260	9,540	4,220	4,220	8,740	4,900	2,710	3,000	3,290	2,160	1,390	1,640
26	4,550	8,740	7,550	3,590	8,340	4,550	2,710	2,710	2,710	2,160	1,390	2,710
27	4,220	8,340	7,550	3,590	11,200	4,220	2,430	2,710	2,430	2,160	1,390	1,900
28	3,900	7,550	6,770	3,290	9,140	4,220	2,430	2,430	2,160	2,160	1,390	1,640
29	3,900	.....	9,140	3,290	7,160	6,000	4,220	1,900	1,900	1,900	1,390	1,390
30	3,290	.....	8,340	3,290	6,380	5,260	3,590	1,640	1,640	1,900	1,390	1,390
31	5,260	.....	7,940	.....	6,000	.....	3,290	1,640	.....	1,900	.....	1,390

NOTE.—These discharges are based on a rating curve that is well defined between 700 and 17,400 second-feet. Above this the curve is based on the extension of the area and velocity curves and is only approximate.

Monthly discharge of New River at Radford, Va., for 1909.

[Drainage area, 2,720 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	17,400	3,290	6,880	2.53	2.92	A.
February	12,000	2,160	5,720	2.10	2.19	A.
March	9,140	3,900	5,600	2.06	2.38	A.
April	21,000	3,290	5,310	1.95	2.18	A.
May	43,500	3,290	8,720	3.21	3.70	A.
June	19,400	4,220	6,320	2.32	2.59	A.
July	6,380	2,160	3,550	1.31	1.51	A.
August	7,550	920	2,860	1.05	1.21	A.
September	3,900	1,150	2,170	.798	.89	A.
October	10,800	1,390	2,540	.934	1.08	A.
November	2,160	1,390	1,610	.592	.66	A.
December	8,340	1,150	2,250	.827	.95	A.
The year	43,500	920	4,460	1.64	22.26	

NEW RIVER AT FAYETTE, W. VA.

This station, which is located at the highway bridge connecting Fayette with South Fayette, W. Va., was established July 29, 1895; discontinued May 22, 1901; reestablished August 11, 1902; discontinued December 31, 1904; and reestablished July 16, 1908. Its records furnish data for water power, flood control, and storage problems.

Wolf Creek enters on the left bank about 850 feet below the station; the drainage area above the section is about 6,800 square miles.

The bed of the river here is rock, with large bowlders on the bottom which cause eddies and boils at high stages. The bottom has been carefully sounded, and by using standard soundings and care in making measurements the discharge can be determined with accuracy.

The datum of the gage has remained constant during the maintenance of the station, but errors have entered into many of the gage readings prior to 1908, particularly before the chain gage was installed, November 20, 1903, the original wire gage being frequently many tenths in error. Owing to this cause and to the difficulty of making accurate measurements at Fayette, all estimates of discharge heretofore published are only fair.

Estimates of the discharge are withheld until sufficient recent measurements have been made to develop a complete curve.

Discharge measurements of New River at Fayette, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 2	H. J. Jackson	239	3,750	6.94	13,000
Apr. 14	do	258	4,070	[a] 8.11	17,100
June 26	do	207	3,110	4.24	6,820
Nov. 20	A. H. Horton	173	2,540	1.30	2,660
Do	do	173	2,540	1.30	2,680
Dec. 1	G. L. Parker	172	2,500	1.10	2,390

[a] Gage height rose 0.72 foot during measurement.

Daily gage height, in feet, of New River at Fayette, W. Va., for 1909.

[John R. Durrett and A. E. Pierson, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	12.32	4.28	7.36	7.62	13.32	6.40	5.42	3.66	0.58	1.39	1.38	1.10
2	9.86	3.15	6.76	7.04	13.62	6.24	5.96	3.68	.68	1.17	1.29	1.12
3	8.18	2.98	7.32	7.54	10.98	5.42	5.92	5.21	.84	1.11	1.22	1.02
4	7.14	3.52	8.25	6.12	9.16	4.99	5.45	5.32	1.03	1.06	1.17	1.02
5	6.94	4.50	8.46	5.76	7.28	8.72	4.12	4.10	1.10	.89	1.14	.98
6	12.81	4.60	8.38	5.64	6.63	9.61	10.62	3.93	1.10	.93	1.12	.95
7	12.85	4.59	10.30	5.78	6.08	7.40	12.95	3.52	1.12	.95	1.12	1.15
8	9.75	4.20	11.05	5.25	5.66	6.18	8.20	3.08	1.17	.87	1.00	1.10
9	8.19	4.69	12.45	4.50	5.42	6.55	6.40	3.43	1.45	.96	1.00	1.35
10	6.76	6.52	12.20	4.68	7.01	7.65	5.70	3.16	3.01	.97	.90	1.80
11	6.05	11.55	11.24	4.39	10.02	7.55	4.95	2.31	3.33	1.95	.90	2.30
12	5.16	11.60	10.38	4.20	10.38	7.26	4.25	2.03	2.91	4.27	.90	1.95
13	5.07	8.65	8.55	4.12	8.76	6.06	4.05	1.90	2.35	7.82	2.20	2.05
14	5.88	7.49	7.92	6.78	7.16	5.89	3.92	1.83	2.06	5.65	1.83	3.65
15	6.10	7.16	7.60	16.62	6.10	5.88	3.60	2.34	1.27	4.12	1.78	9.68
16	6.74	7.00	7.09	11.72	5.45	5.48	3.50	3.06	1.47	3.91	1.74	7.25
17	12.19	8.08	6.58	8.76	4.98	5.10	3.26	3.53	1.79	3.10	1.69	5.50
18	10.94	9.26	6.10	7.58	4.57	5.26	3.09	4.02	3.15	3.08	1.58	4.25
19	10.19	8.85	5.50	6.70	4.14	5.22	2.79	4.02	5.25	2.82	1.54	3.25
20	9.28	7.74	5.19	6.12	3.95	5.20	2.69	3.30	5.76	2.52	1.16	2.65
21	8.54	8.10	5.58	5.91	4.12	4.78	2.38	2.40	5.29	2.18	1.21	2.00
22	8.02	8.20	6.36	6.55	10.45	4.22	2.14	1.92	4.99	2.12	1.20	1.80
23	7.75	9.20	6.59	7.48	12.14	3.85	2.02	1.80	3.13	2.10	1.40	1.15
24	7.36	9.20	7.02	8.54	8.54	3.58	2.08	1.73	2.05	2.30	1.35	.75
25	7.22	10.70	8.28	8.91	7.98	4.56	2.19	1.58	3.03	2.24	1.50	1.10
26	7.10	11.20	12.22	7.68	7.82	4.34	2.09	1.53	2.88	2.05	1.30	1.85
27	6.58	9.20	11.20	6.36	11.66	4.02	2.05	1.39	2.85	1.88	1.45	1.30
28	6.12	8.32	10.75	6.10	11.14	4.79	2.18	1.28	2.18	1.74	1.40	1.35
29	5.68	.....	10.90	7.70	8.86	4.84	2.19	1.08	1.86	1.66	1.60	1.35
30	5.20	.....	10.85	6.25	7.20	5.26	2.79	1.08	1.47	1.58	1.20	1.30
31	4.90	.....	9.20	.....	6.66	.....	3.32	.97	.....	1.47	.....	.70

NORTH FORK OF NEW RIVER NEAR CRUMPLER, N. C.

This station is located at a ford about 1 mile above the confluence of the North and South Forks of New River, about 2½ miles north of Crumpler, N. C. It was established August 13, 1908, to obtain data for use in studying water power, pollution, flood control, and storage problems.

The drainage area above the section is about 279 square miles.

Discharge measurements are made by means of a boat at the ford, or by wading. The chain gage is attached to posts on the right bank about one-fourth mile below the ford. The datum of the gage has remained unchanged. The records are accurate and reliable. Sufficient data have not been obtained to enable estimates of the discharge to be made.

The following discharge measurement was made by H. J. Jackson:

June 18, 1909: Width, 207 feet; area, 428 square feet; gage height, 2.88 feet; discharge, 786 second-feet.

Daily gage height, in feet, of North Fork of New River near Crumpler, N. C., for 1909.

[John J. Garvey, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.66	2.25	2.80	2.92	3.94	2.56	2.57	2.26	1.63	1.52	1.70	1.53
2	3.21	2.56	2.70	2.76	3.40	2.48	2.68	2.64	1.59	1.50	1.69	1.53
3	3.02	2.55	2.77	2.75	2.96	3.37	2.35	2.40	1.55	1.50	1.66	1.54
4	2.90	2.52	2.86	2.68	2.77	5.86	2.54	2.19	1.63	1.50	1.62	1.56
5	4.84	2.49	2.64	2.55	2.62	4.30	2.18	2.23	1.96	1.55	1.62	1.53
6	4.27	2.62	2.90	2.46	2.54	3.56	2.16	2.10	1.71	1.62	1.62	1.52
7	3.63	2.41	3.40	2.46	2.43	3.16	3.28	2.04	1.64	1.62	1.62	1.72
8	3.23	2.32	3.31	2.50	2.39	2.89	3.04	1.92	1.69	1.54	1.63	2.27
9	3.02	2.40	3.14	2.59	2.32	3.18	2.89	1.87	1.68	1.50	1.64	1.67
10	2.86	4.78	3.42	2.44	3.52	2.88	2.64	1.90	2.10	1.50	1.88	1.84
11	2.74	3.61	3.20	2.38	2.86	2.66	2.52	2.00	1.86	3.58	1.75	2.04
12	2.68	3.15	3.06	2.33	2.60	2.86	2.40	1.92	1.71	2.70	1.66	1.84
13	2.60	2.94	2.96	3.20	2.44	2.90	2.40	1.82	1.65	2.06	1.63	2.57
14	2.50	2.76	3.00	3.47	2.40	2.68	2.46	1.86	1.56	1.94	1.61	2.58
15	2.52	2.70	3.88	3.04	2.34	2.65	2.31	2.85	1.56	2.70	1.61	2.08
16	3.04	3.54	3.76	2.78	2.32	2.52	2.22	2.56	1.68	2.36	1.60	1.87
17	3.56	3.03	2.72	2.69	2.23	2.90	2.19	2.46	2.26	2.10	1.57	1.70
18	3.27	2.88	2.59	2.58	2.16	2.88	2.08	2.17	1.92	2.00	1.60	1.96
19	3.08	3.00	2.55	2.48	2.20	2.62	2.00	2.07	1.67	1.92	1.57	1.64
20	2.96	3.06	2.53	2.44	2.82	2.54	1.96	1.94	1.66	1.88	1.54	1.66
21	2.80	2.83	2.68	2.40	5.63	2.44	1.94	1.88	1.68	1.82	1.53	1.46
22	2.68	3.39	2.72	2.39	4.30	2.37	1.92	1.82	1.97	1.79	1.52	2.00
23	2.60	3.32	2.52	2.41	3.51	2.48	2.05	1.79	1.96	1.78	1.64	1.76
24	2.56	3.43	2.48	2.46	3.07	2.48	2.08	1.76	2.04	2.18	1.86	2.10
25	2.50	3.62	3.26	2.32	2.96	2.44	1.88	1.72	1.86	1.89	1.66	2.06
26	2.60	3.35	3.14	2.29	2.88	2.30	1.84	1.70	1.73	1.82	1.58	2.11
27	2.58	3.10	2.96	2.26	2.98	2.34	2.10	1.67	1.67	1.78	1.54	2.22
28	2.44	2.99	4.56	2.30	2.85	2.69	2.39	1.66	1.62	1.74	1.53	2.42
29	2.44	.....	4.06	2.22	2.79	2.52	2.00	1.64	1.60	1.71	1.53	2.46
30	2.40	.....	3.50	2.61	2.56	2.69	1.92	1.66	1.58	1.70	1.53	2.57
31	1.88	.....	3.10	.....	2.83	.....	1.88	1.62	.....	1.70	.....	2.56

NOTE.—Ice conditions December 10 to 31. Ice 0.75 foot thick on December 31.

REED CREEK AT GRAHAMS FORGE, VA.

This station, which is located at the highway bridge at Grahams Forge, Va., was established July 29, 1908, to obtain data for solving water power, flood control, and storage problems.

The drainage area above the station is about 247 square miles.

There is a dam and grist mill just above the station. The storage is small, and the miller states that water flows over the dam at all times, so that the flow is modified little, if any, by the dam. The datum of the chain gage attached to the bridge has remained unchanged, and the records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the discharge to be made.

Discharge measurements of Reed Creek at Grahams Forge, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 16	H. J. Jackson	124	266	2.80	383
December 9	A. H. Horton	125	208	2.34	152

Daily gage height, in feet, of Reed Creek at Grahams Forge, Va., for 1909.

[Robert Runion, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.62	2.59	2.80	2.90	4.46	2.45	2.66	2.28	2.19	2.17	2.18	2.10
2	3.27	2.61	2.76	2.82	3.57	2.52	2.68	2.68	2.13	2.20	2.19	2.06
3	3.31	2.66	2.76	2.76	3.19	2.61	2.62	2.54	2.16	2.11	2.19	2.08
4	3.47	2.57	2.86	2.71	2.95	3.28	2.72	2.42	2.15	2.14	2.20	2.11
5	4.59	2.56	2.78	2.68	2.83	3.16	2.68	2.41	2.18	2.19	2.20	2.15
6	4.09	3.55	2.78	2.65	2.77	2.85	2.49	2.38	2.16	2.17	2.20	2.09
7	3.43	2.57	3.26	2.60	2.63	2.74	2.70	2.28	2.18	2.14	2.21	2.20
8	3.22	2.57	3.40	2.59	2.55	2.63	2.96	2.28	2.19	2.14	2.12	2.40
9	3.09	2.61	3.28	2.58	2.57	3.10	2.76	2.26	2.31	2.18	2.20	2.35
10	2.99	3.28	3.27	2.54	3.33	2.89	2.62	2.21	2.38	2.15	2.21	2.00
11	2.93	3.35	3.22	2.50	3.27	2.74	2.53	2.22	2.25	2.82	2.23	2.20
12	2.87	3.08	3.04	2.52	3.00	2.67	2.48	2.24	2.20	3.10	2.14	2.26
13	2.81	2.85	2.98	2.76	2.85	3.74	2.45	2.23	2.16	2.56	2.20	2.40
14	2.76	2.79	3.01	3.38	2.73	3.17	2.50	2.28	2.19	2.48	2.24	2.58
15	2.77	2.72	2.90	2.94	2.65	2.91	2.39	2.34	2.20	2.54	2.11	2.42
16	3.17	2.84	2.84	2.85	2.59	2.82	2.36	2.59	3.02	2.59	2.12	2.35
17	3.92	2.90	2.77	2.79	2.56	3.02	2.32	2.64	2.61	2.46	2.20	2.34
18	3.67	2.78	2.72	2.66	2.54	2.86	2.32	2.52	2.66	2.40	2.18	2.28
19	3.40	2.78	2.66	2.65	2.51	2.72	2.32	2.37	2.49	2.44	2.17	2.26
20	3.29	2.86	2.66	2.64	2.57	2.63	2.30	2.30	2.36	2.36	2.16	2.19
21	3.15	2.84	2.76	2.67	3.53	2.60	2.28	2.26	2.36	2.31	2.19	2.15
22	3.05	2.94	3.21	2.67	3.70	2.67	2.26	2.25	2.30	2.32	1.90	1.71
23	2.97	3.34	3.00	2.69	3.13	2.58	2.26	2.16	2.26	2.36	2.11	1.70
24	2.91	3.16	2.88	2.67	2.91	2.53	2.25	2.15	2.55	2.34	2.15	2.16
25	2.87	3.16	3.36	2.64	2.84	2.55	2.21	2.20	2.40	2.32	2.15	2.14
26	2.85	3.10	3.37	2.62	2.85	2.55	2.24	2.20	2.32	2.28	2.00	2.17
27	2.82	2.98	3.10	2.57	2.85	2.60	2.25	2.18	2.26	2.26	2.12	2.16
28	2.77	2.88	3.91	2.54	2.74	2.58	2.29	2.16	2.20	2.25	2.11	2.17
29	2.75	.....	3.68	2.52	2.65	2.72	2.34	2.19	2.20	2.20	2.06	2.18
30	2.70	.....	3.16	3.51	2.59	2.66	2.25	2.16	2.16	2.20	2.06	2.14
31	2.57	.....	3.04	.....	2.52	.....	2.28	2.18	.....	2.25	.....	2.15

NOTE.—December 10 to 31, slush ice and ice along shore. The stream did not freeze across.

BIG REED ISLAND CREEK NEAR ALLISONIA, VA.

This station, which is located at J. P. Thomas's farm about 1½ miles from Allisonia, Va., was established July 31, 1908, to obtain data for use in studying water power, flood control, and storage problems.

The drainage area above the section is about 291 square miles. Little Reed Island Creek is tributary on the left bank a short distance below the station.

Discharge measurements are made from a suspension footbridge at Thomas's farm. A vertical staff gage is fastened to a tree on the left bank about 1,200 feet above the bridge. The datum of the gage has remained unchanged.

The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

The following discharge measurement was made by H. J. Jackson:

June 12, 1909: Width, 205 feet; area, 358 square feet; gage height, 1.05 feet; discharge, 588 second-feet.

Daily gage height, in feet, of Big Reed Island Creek near Allisonia, Va., for 1909.

[J. P. Thomas, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.8	0.9	0.8	2.05	1.0	1.15	1.15	0.6	0.5	0.6	0.5
2	.....	1.15	.9	.8	1.45	.95	1.1	2.05	.5	.5	.6	.5
3	0.8	1.2	.9	.8	1.1	.95	.9	1.15	.5	.6	.6	.5
4	.8	.95	.95	.8	.95	2.15	.9	1.0	.7	.6	.6	.5
5	1.5	.9	.85	.8	.9	1.35	.8	.9	.65	.6	.5	.5
6	1.4	.8	.85	.7	.9	1.05	.9	1.0	.65	.6	.5	.5
7	1.05	.8	1.05	.7	.9	1.0	1.1	.9	.65	.6	.5	.55
8	.95	.7	1.0	.75	.8	.9	1.15	.8	.6	.5	.5	1.0
9	.9	.7	1.0	.85	.8	1.45	.9	.8	.8	.5	.5	.6
10	.85	1.05	1.0	.8	1.65	1.2	.9	.8	1.0	.6	.5	.6
11	.8	1.15	.95	.7	1.2	1.4	.8	.7	.8	1.9	.6	.55
12	.8	.9	.9	.7	1.0	1.1	.8	.7	.7	1.6	.6	.75
13	.8	.8	.9	.8	.9	1.55	.9	.8	.6	.9	.6	1.3
14	.8	.85	.9	3.35	.8	1.4	.9	.9	.6	.8	.5	1.4
15	.8	.85	.9	1.7	.8	1.5	.8	.85	.6	.7	.5	.85
16	.8	1.1	.8	1.35	.8	1.15	.8	.9	.6	.7	.5	.65
17	1.1	1.0	.8	1.15	.8	1.85	.8	.85	.9	.6	.55	.7
18	1.2	.9	.8	1.0	.8	1.75	.8	.7	.9	.6	.5	.7
19	1.0	.9	.8	1.0	.8	1.15	.7	.7	.6	.6	.5	.7
20	.9	1.25	.8	.95	1.1	1.0	.7	.7	.65	.6	.5	.6
21	.9	.95	.8	.9	2.65	1.0	.7	.6	.8	.6	.5	.7
22	.9	1.1	.9	.9	1.8	1.0	.7	.6	.7	.6	.5	.9
23	.85	1.2	.8	.9	1.25	1.0	.95	.6	.6	.6	.6	.6
24	.8	1.75	.8	.95	1.1	1.3	.8	.6	.65	.7	.5	.6
25	.8	1.75	1.25	.8	1.1	1.05	.7	.6	.6	.6	.5	.8
26	.8	1.25	1.1	.8	1.35	1.0	.7	.6	.6	.6	.5	.65
27	.8	1.05	.95	.8	1.5	1.25	.9	.6	.6	.6	.5	.75
28	.8	1.0	.....	.8	1.2	1.0	1.05	.6	.5	.6	.5	.75
29	.7	.....	.....	.8	1.05	1.15	.9	.6	.5	.6	.5	.7
30	.7	.....	.....	.9	1.0	1.35	.8	.6	.5	.6	.5	.6
31	.7	.....	.....	.....	.9	.....	.8	.6	.....	.6	.....	.65

NOTE.—Slight ice conditions December 10 to 31; slush ice and frozen along shore. Stream did not freeze across.

LITTLE RIVER NEAR COPPER VALLEY, VA.

This station, which is located at the highway bridge about 5 miles south of Childress and 1 mile north of Copper Valley, Va., was established July 28, 1908, to obtain data for use in studying water-supply, water-power, flood-control, and storage problems.

Indian Creek enters about 600 feet below the station. The drainage area above the section is about 195 square miles.

The datum of the chain gage, attached to the bridge, has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

Discharge measurements of Little River near Copper Valley, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 11	H. J. Jackson	157	415	4.17	538
December 8	A. H. Horton	156	351	3.82	337

Daily gage height, in feet, of Little River near Copper Valley, Va., for 1909.

[Thos. A. De Hart, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.26	3.72	3.82	3.63	4.63	3.94	4.06	4.35	3.42	3.34	3.35	3.35
2	4.25	3.85	3.83	3.61	4.22	3.97	4.01	5.52	3.38	3.31	3.35	3.35
3	3.94	3.80	3.82	3.61	3.93	3.97	3.76	4.32	3.30	3.32	3.44	3.38
4	3.98	3.90	3.92	3.61	3.81	4.93	3.65	3.98	3.42	3.29	3.38	3.35
5	4.64	3.80	3.76	3.58	3.78	4.31	3.68	3.80	3.49	3.31	3.35	3.34
6	4.57	3.85	3.82	3.58	3.73	4.07	3.85	4.12	3.41	3.34	3.32	3.30
7	4.16	3.75	4.00	3.57	3.72	3.98	4.12	3.95	3.41	3.35	3.39	3.38
8	4.00	3.68	3.93	3.55	3.71	3.94	4.05	3.66	3.51	3.32	3.39	3.60
9	3.96	3.75	3.92	3.58	3.68	4.08	3.78	3.60	3.62	3.32	3.40	3.42
10	3.91	4.30	3.86	3.55	4.14	4.03	3.76	3.55	4.22	3.30	3.41	3.40
11	3.87	3.95	3.82	3.53	3.90	4.03	3.72	3.54	3.70	4.56	3.44	3.40
12	3.81	3.78	3.75	3.53	3.74	3.98	3.68	3.58	3.56	4.44	3.41	3.51
13	3.70	3.78	3.74	3.71	3.72	4.04	3.70	3.55	3.50	3.58	3.39	3.58
14	3.75	3.75	3.80	7.03	3.70	3.95	3.78	3.56	3.46	3.45	3.36	4.48
15	3.85	3.72	3.66	4.83	3.67	3.91	3.68	3.70	3.46	3.52	3.38	3.68
16	3.95	3.92	3.66	4.35	3.64	3.90	3.64	3.92	3.49	3.49	3.40	3.50
17	4.30	3.85	3.65	4.11	3.63	4.01	3.66	3.68	3.70	3.48	3.39	3.36
18	4.35	3.75	3.63	4.01	3.62	4.18	3.60	3.55	3.55	3.44	3.35	3.48
19	4.25	3.72	3.62	3.91	3.58	3.91	3.59	3.55	3.55	3.44	3.35	3.38
20	4.20	4.08	3.63	3.91	3.74	3.86	3.52	3.49	3.49	3.42	3.32	3.50
21	4.05	3.82	3.63	3.85	7.13	3.80	3.51	3.45	3.45	3.40	3.32	3.55
22	4.00	3.92	3.70	3.83	5.38	3.79	3.52	3.45	3.60	3.42	3.35	3.38
23	3.95	4.05	3.60	3.85	4.56	3.82	3.60	3.41	3.58	3.40	3.42	3.35
24	3.95	4.15	3.60	3.95	4.26	3.88	3.58	3.44	3.50	3.45	3.40	3.45
25	3.90	4.38	3.94	3.75	4.22	3.84	3.52	3.40	3.45	3.41	3.35	3.52
26	3.88	4.10	3.82	3.78	4.64	3.79	3.49	3.45	3.40	3.40	3.35	3.48
27	3.85	3.95	3.69	3.77	4.82	3.81	3.64	3.46	3.39	3.40	3.35	3.49
28	3.78	3.88	3.88	3.75	4.31	3.75	3.73	3.44	3.36	3.36	3.35	3.53
29	3.75	.....	3.80	3.74	4.13	3.90	3.68	3.41	3.36	3.35	3.36	3.45
30	3.75	.....	3.70	3.77	4.02	4.02	3.80	3.46	3.35	3.40	3.35	3.45
31	3.50	.....	3.66	.....	4.00	.....	3.66	3.42	.....	3.41	.....	3.45

NOTE.—Ice conditions December 10 to 31; frozen over December 23. December 26, thickness of ice 0.25 foot.

WALKER CREEK AT STAFFORDSVILLE, VA.

This station, which is located at the highway bridge at Staffordsville, Va., was established July 24, 1908, to obtain data for use in studying water-power, flood-control, and storage problems.

Whitley Creek enters a short distance above the station. The drainage area above the section is about 277 square miles. A dam and power plant about 250 feet above the station may modify the flow in extreme low water.

The datum of the chain gage attached to the bridge has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

Discharge measurements of Walker Creek at Staffordsville, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 9	H. J. Jackson	135	398	5.75	1,480
June 23	do	102	154	3.66	256
December 6	A. H. Horton	68	79	2.94	72

Daily gage height, in feet, of Walker Creek at Staffordsville, Va., for 1909.

[J. D. Worley and W. E. Durham, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.10	3.75	4.30	4.50	6.90	4.20	3.68	3.44	2.88	3.42	3.31	3.02
2	5.35	3.78	4.10	4.35	5.92	3.98	4.02	3.78	2.87	3.38	3.28	3.02
3	5.00	3.80	4.00	4.28	5.22	4.05	3.70	3.48	2.88	3.34	3.25	3.09
4	4.75	3.78	4.20	4.08	4.85	4.92	3.42	3.36	2.83	3.34	3.23	3.09
5	6.82	3.75	4.15	3.98	4.55	5.00	3.36	3.30	3.04	3.30	3.20	3.06
6	6.45	3.75	4.28	3.88	4.32	4.65	3.45	3.28	3.00	3.30	3.21	3.00
7	6.55	.....	4.85	3.78	4.10	4.28	4.05	3.31	2.97	3.28	3.25	3.14
8	5.05	3.65	5.50	3.68	4.00	4.12	4.70	3.32	2.91	3.24	3.23	3.37
9	4.80	3.72	5.52	3.64	3.90	5.00	4.27	3.28	3.14	3.20	3.23	3.36
10	4.58	6.12	5.45	3.60	5.32	5.15	3.94	3.22	4.06	3.20	3.29	3.22
11	4.40	5.68	5.22	3.55	5.72	4.52	3.72	3.14	3.75	5.00	3.25	3.22
12	4.30	4.98	4.90	3.45	4.92	4.20	3.62	3.03	3.42	5.92	3.21	3.21
13	4.12	4.72	4.66	3.45	4.52	4.25	3.58	3.05	3.20	4.72	3.23	3.45
14	4.05	4.50	4.55	6.70	4.30	4.50	3.56	3.16	3.14	4.26	3.20	3.26
15	4.08	4.30	4.32	5.72	4.12	4.48	3.49	3.26	3.10	4.21	3.21	4.05
16	4.68	4.38	4.20	5.02	4.02	4.15	3.40	3.46	4.57	4.05	3.17	3.82
17	5.58	4.52	4.08	4.70	3.75	4.80	3.40	3.46	5.44	3.89	3.16	3.64
18	5.38	4.38	3.98	4.42	3.70	4.40	3.33	3.34	7.03	3.79	3.13	3.56
19	5.22	4.38	3.90	4.28	3.65	4.05	3.27	3.23	4.99	3.73	3.11	3.49
20	5.10	4.90	3.70	4.15	3.70	3.88	3.22	3.16	4.32	3.63	3.11	3.30
21	5.05	4.70	3.70	4.15	5.18	3.75	3.20	3.08	4.03	3.63	3.11	3.12
22	4.90	4.60	4.10	4.18	6.02	3.65	3.14	3.04	3.83	3.57	3.12	3.16
23	4.75	4.38	4.35	4.25	5.16	3.58	3.19	3.04	3.70	3.55	3.18	3.16
24	4.62	4.45	4.25	4.18	4.70	3.55	3.32	2.96	5.15	3.56	3.15	3.21
25	4.45	4.75	5.48	4.02	4.42	3.55	3.24	2.93	4.50	3.51	3.11	3.38
26	4.38	4.65	5.72	3.98	5.22	3.48	3.16	2.94	4.12	3.47	3.07	3.24
27	4.25	4.50	5.15	3.92	7.95	3.55	3.14	3.06	3.87	3.41	3.12	3.17
28	4.12	4.35	5.60	3.90	5.70	3.45	3.20	2.92	3.72	3.32	3.09	3.26
29	4.05	.....	5.65	3.78	5.10	3.68	3.26	3.10	3.60	3.33	3.07	3.14
30	4.05	.....	5.12	4.90	4.75	3.75	3.22	2.92	3.52	3.31	3.07	2.96
31	3.72	.....	4.78	.....	4.45	.....	3.15	2.89	.....	3.31	.....	3.07

WOLF CREEK NEAR NARROWS, VA.

This station is located at a highway bridge about 3 miles above Narrows, Va. It was established July 22, 1908, to obtain data for use in studying water-supply, water-power, flood-control, and storage problems.

The drainage area above the station is about 223 square miles.

The datum of the chain gage attached to the highway bridge has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

Discharge measurements of Wolf Creek near Narrows, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 8	H. J. Jackson	78	168	3.33	230
June 24	do	79	144	3.12	160

Daily gage height, in feet, of Wolf Creek near Narrows, Va., for 1909.

[J. A. Hale, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.38	3.28	3.88	4.14	7.32	3.55	3.22	3.18	2.64	2.72	2.70	2.60
2	4.69	3.34	3.84	3.98	5.82	3.42	3.14	3.28	2.62	2.69	2.70	2.58
3	4.34	3.28	3.80	3.88	4.99	3.39	3.07	3.18	2.60	2.69	2.70	2.58
4	4.11	3.25	4.10	3.78	4.52	3.71	2.98	3.08	2.65	2.66	2.68	2.57
5	4.66	3.28	4.00	3.65	4.25	3.76	2.92	3.01	2.82	2.64	2.68	2.56
6	4.88	3.42	4.04	3.54	4.03	3.67	3.00	2.94	2.72	2.64	2.66	2.56
7	4.41	3.48	4.76	3.50	3.84	3.51	4.04	3.42	2.70	2.59	2.66	2.62
8	4.14	3.44	4.99	3.44	3.70	3.38	4.32	3.44	2.72	2.62	2.66	2.92
9	3.94	3.46	5.05	3.37	3.65	4.20	3.85	3.16	2.80	2.62	2.66	2.95
10	3.82	5.14	5.33	3.34	4.90	3.81	3.62	3.02	3.59	2.60	2.72	2.70
11	3.69	4.88	5.10	3.29	5.00	3.64	3.39	2.94	3.15	3.17	2.66	2.84
12	3.62	4.35	4.68	3.24	4.49	3.51	3.26	2.88	2.95	3.60	2.66	2.78
13	3.50	4.11	4.40	3.44	4.19	3.61	3.21	2.86	2.82	3.16	2.65	2.85
14	3.42	3.94	4.29	4.44	3.96	4.10	3.40	2.93	2.76	2.98	2.66	3.54
15	3.52	3.78	4.10	4.08	3.82	3.64	3.20	3.26	2.70	2.98	2.64	3.32
16	4.25	4.19	4.00	3.84	3.68	3.74	3.10	3.35	3.40	3.05	2.60	3.24
17	5.08	4.38	3.89	3.71	3.57	4.08	3.15	3.58	3.80	3.00	2.64	3.04
18	4.66	4.14	3.74	3.60	3.46	3.72	3.04	3.60	3.50	2.90	2.62	3.00
19	4.54	4.02	3.66	3.52	3.39	3.48	2.96	3.32	3.25	2.88	2.62	2.96
20	4.44	4.20	3.58	3.50	3.36	3.34	2.92	3.16	3.08	2.86	2.61	2.84
21	4.32	4.08	3.80	3.58	3.70	3.24	2.87	3.06	3.00	2.84	2.61	2.80
22	4.18	4.03	4.26	3.65	4.09	3.18	2.84	2.95	2.94	2.80	2.61	2.83
23	4.05	4.02	4.10	3.88	3.88	3.14	2.84	2.88	2.84	2.78	2.58	2.76
24	3.98	4.10	3.99	3.82	3.69	3.12	3.12	2.79	3.05	2.82	2.68	2.73
25	3.86	4.46	5.02	3.73	3.58	3.16	2.92	2.76	3.01	2.81	2.64	2.80
26	3.76	4.38	5.24	3.68	3.83	3.08	2.84	2.76	2.88	2.78	2.62	2.80
27	3.72	4.26	4.75	3.60	4.94	3.04	2.83	2.72	2.82	2.76	2.60	2.76
28	3.66	4.08	5.44	3.59	4.47	3.08	2.86	2.72	2.78	2.76	2.60	2.82
29	3.59	.....	5.34	3.48	4.13	3.22	2.92	2.72	2.76	2.74	2.60	2.74
30	3.54	.....	4.84	4.46	3.88	3.24	2.84	2.70	2.73	2.73	2.58	2.70
31	3.28	.....	4.44	.....	3.71	.....	2.89	2.66	.....	2.71	.....	2.76

BLUESTONE RIVER AT LILLY, W. VA.

This station, which is located about 2,000 feet below the mouth of Little Bluestone River at Lilly, W. Va., was established August 22, 1908, to obtain data for use in studying water-power, flood-control, and storage problems.

The drainage area above the station is about 454 square miles.

Discharge measurements are made by means of a boat or by wading. A staff gage in two sections is fastened to trees on the left bank below the measuring section.

The gage datum has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

The following discharge measurement was made by H. J. Jackson:

April 16, 1909: Width, 160 feet; area, 442 square feet; gage height, 2.12 feet; discharge, 340 second-feet.

Daily gage height, in feet, of Bluestone River at Lilly, W. Va., for 1909.

[E. M. Lilly, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.70	1.80	2.72	2.80	5.78	1.99	2.90	2.07	1.03	1.28	1.30	1.12
2	3.54	2.20	2.56	2.73	4.80	1.89	3.30	1.94	1.02	1.22	1.25	1.10
3	3.16	2.08	2.43	2.60	3.65	1.84	2.52	2.22	.98	1.19	1.25	1.14
4	3.08	2.05	4.00	2.50	3.17	2.05	2.15	1.96	1.00	1.14	1.32	1.11
5	3.18	2.15	4.26	2.39	2.88	2.30	1.80	1.64	1.05	1.13	1.26	1.12
6	3.78	2.16	3.44	2.19	2.65	2.15	4.80	1.48	1.28	1.18	1.22	1.12
7	3.10	2.30	4.95	2.14	2.44	2.39	5.50	1.40	1.29	1.18	1.20	1.14
8	2.70	2.27	4.80	2.08	3.34	1.94	5.05	1.68	1.20	1.14	1.28	1.17
9	2.45	2.30	5.10	2.00	2.26	2.12	3.39	1.54	2.10	1.09	1.29	1.16
10	2.48	2.17	4.42	1.98	3.00	2.28	2.70	1.39	3.80	1.25	1.30	1.00
11	2.28	3.94	4.48	1.95	3.70	2.34	2.30	1.29	2.70	1.40	1.30	1.11
12	2.08	3.32	3.62	1.86	3.58	2.27	2.16	1.22	2.20	1.72	1.27	1.21
13	2.08	2.85	3.20	1.86	2.78	2.60	2.07	1.20	1.76	1.92	1.26	1.68
14	2.00	2.60	3.25	2.35	2.52	2.32	2.05	1.22	1.55	1.62	1.28	2.32
15	2.35	2.50	3.22	2.34	2.36	2.45	1.93	1.34	1.35	1.75	1.21	2.18
16	4.36	3.37	3.05	2.12	2.12	1.96	1.88	1.64	1.58	2.15	1.18	2.02
17	5.00	3.80	2.90	2.03	2.08	1.94	1.84	2.10	2.68	1.78	1.20	1.74
18	3.90	3.19	2.58	1.97	1.98	2.12	1.78	2.62	2.50	1.66	1.19	1.60
19	3.58	3.42	2.48	1.90	1.91	1.88	1.68	1.98	1.93	1.58	1.21	1.55
20	3.43	3.12	2.42	1.90	1.85	1.75	1.58	1.70	1.65	1.47	1.18	1.40
21	3.18	3.49	2.70	2.02	1.92	1.62	1.42	1.55	1.48	1.43	1.17	1.35
22	3.25	3.65	3.36	2.42	1.94	1.58	1.36	1.39	1.32	1.39	1.14	1.25
23	2.88	3.70	3.27	2.74	1.91	1.46	1.40	1.32	1.40	1.62	1.18	1.20
24	2.67	3.72	2.92	2.72	1.77	1.56	1.38	1.18	1.93	1.98	1.19	1.20
25	2.47	4.52	4.40	2.51	1.82	1.60	1.42	1.22	2.25	1.88	1.22	1.15
26	2.49	4.11	4.75	2.40	2.90	1.70	1.32	1.19	1.80	1.82	1.24	1.20
27	2.46	3.43	3.95	2.32	3.35	1.60	1.26	1.12	1.50	1.88	1.14	1.22
28	2.46	3.00	4.30	2.19	2.95	4.88	1.30	1.10	1.46	1.68	1.12	1.25
29	2.43	.....	4.32	2.14	2.55	3.30	1.30	1.08	1.36	1.48	1.13	1.15
30	2.40	.....	3.67	3.20	2.24	2.78	1.76	1.04	1.30	1.39	1.10	1.18
31	1.90	.....	3.30	.....	2.13	.....	2.12	1.04	.....	1.31	.....	.76

NOTE.—Ice conditions the latter part of December. On December 31 ice 0.4 foot thick, river entire frozen across. Up to this date the ice conditions were probably slight.

GREENBRIER RIVER NEAR MARLINTON, W. VA.

This station, which is located at the Chesapeake & Ohio Railway bridge on the switch that runs to Campbell's lumber mill near Marlinton, W. Va., was established July 9, 1908, to obtain data for use in studying water-supply, pollution, water-power, flood-control, and storage problems.

Stoney Creek enters immediately above the station. The drainage area above the section is about 408 square miles.

The datum of the chain gage attached to the railroad bridge has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

Discharge measurements of Greenbrier River near Marlinton, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	H. J. Jackson	230	618	5.02	1,300
April 19	do	228	516	4.54	788
November 18	A. H. Horton	175	294	3.73	291
December 2	G. L. Parker	168	261	3.55	136

Daily gage height, in feet, of Greenbrier River near Marlinton, W. Va., for 1909.

[Paris G. Johnson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.92	3.36	4.64	4.46	5.18	3.91	4.52	4.74	3.34	3.27	3.49	3.58
2	3.98	3.31	4.51	4.79	5.04	3.90	4.35	4.29	3.32	3.26	3.47	3.62
3	4.12	3.27	4.37	4.71	4.90	4.00	4.16	4.00	3.28	3.25	3.47	3.62
4	4.62	3.21	4.72	4.63	4.73	4.06	3.82	3.82	3.26	3.23	3.42	3.61
5	5.68	3.15	4.66	4.59	4.56	4.33	3.63	3.68	3.36	3.23	3.37	3.60
6	5.44	3.10	4.60	4.63	4.44	4.24	3.72	3.59	3.48	3.21	3.42	3.58
7	5.02	3.07	4.54	4.67	4.32	4.10	3.77	3.55	3.40	3.21	3.39	3.57
8	4.69	3.89	4.47	4.40	4.21	4.02	3.70	3.52	3.33	3.20	3.40	3.56
9	4.38	6.20	4.50	4.54	4.14	4.10	3.60	3.49	3.32	3.19	3.95	3.55
10	4.28	6.29	4.92	4.37	4.92	4.05	3.51	3.45	3.35	3.18	4.89	3.53
11	4.26	6.14	5.47	4.19	4.97	3.98	3.46	3.42	3.33	3.59	4.72	3.49
12	4.22	5.95	5.70	4.13	4.78	3.87	3.46	3.39	3.33	4.53	4.38	3.45
13	4.24	5.68	6.07	5.71	4.62	3.81	3.56	3.36	3.36	4.09	4.22	4.93
14	4.59	5.56	5.86	8.27	4.44	3.78	3.54	3.34	3.32	3.85	4.11	6.79
15	5.66	5.81	5.50	6.53	4.28	3.87	3.55	3.43	3.28	3.75	3.87	5.34
16	5.90	6.41	5.15	5.49	4.17	4.33	3.50	3.98	3.29	3.69	3.77	4.39
17	5.83	6.55	4.80	4.99	4.08	4.10	3.44	3.98	3.37	3.65	3.75	4.40
18	5.74	6.38	4.55	4.74	3.97	4.58	3.38	3.76	3.35	3.63	3.73	4.30
19	5.66	6.05	4.43	4.54	3.88	4.50	3.40	3.66	3.33	3.60	3.67	4.21
20	5.58	5.71	4.29	4.36	3.88	4.28	3.36	3.60	3.31	3.56	3.62	4.11
21	5.50	5.54	4.15	4.63	4.45	4.12	3.34	3.56	3.31	3.53	3.62	4.00
22	5.40	5.44	4.04	5.22	5.78	3.94	3.33	3.53	3.29	3.52	3.63	3.94
23	5.27	5.32	3.91	6.12	5.14	3.89	3.34	3.49	3.28	3.51	3.65	3.89
24	5.19	5.22	3.81	6.14	4.70	3.88	3.32	3.45	3.27	3.87	3.78	3.82
25	5.09	5.10	3.70	5.50	4.46	3.78	3.29	3.40	3.27	3.92	3.78	3.75
26	5.00	4.98	3.61	5.10	4.52	3.72	3.38	3.38	3.25	3.77	3.70	.....
27	4.91	4.86	3.49	4.86	4.56	3.70	3.40	3.36	3.29	3.72	3.67	.....
28	4.83	4.78	5.86	4.67	4.34	3.67	3.38	3.34	3.32	3.66	3.65	.....
29	4.69	.....	6.29	4.91	4.18	3.66	3.32	3.31	3.29	3.60	3.62	.....
30	4.50	.....	6.04	5.38	4.06	4.18	3.50	3.38	3.27	3.53	3.59	.....
31	3.41	.....	4.77	.....	3.96	.....	5.36	3.36	.....	3.51	.....	3.89

NOTE.—Ice conditions December 22 to 31. December 31, thickness of ice 0.3 foot.

GREENBRIER RIVER AT ALDERSON, W. VA.

This station is located at the highway bridge at Alderson, W. Va. It was established August 1, 1895, was discontinued July 15, 1906, and was reestablished May 10, 1907. It is maintained to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

Muddy Creek, the only important tributary in the immediate vicinity of this station, enters from the right about one-half mile below the bridge.

The records are little affected by ice. The datum of the chain gage attached to the bridge has remained the same since the installation of the station. Conditions of flow are nearly permanent and a good rating curve has been developed.

Discharge measurements of Greenbrier River at Alderson, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 19...	A. H. Horton	282	384	2.12	413
December 1....	G. L. Parker	313	375	2.00	334

Daily gage height, in feet, of Greenbrier River at Alderson, W. Va., for 1909.

[W. J. Hancock, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.4	2.7	3.6	3.5	4.95	2.85	2.6	3.3	1.7	1.7	2.0	2.0
2	3.6	2.45	3.4	3.3	5.0	2.75	2.8	2.7	1.6	1.7	1.95	1.95
3	3.2	2.45	3.25	3.2	4.4	2.7	3.6	2.45	1.6	1.7	1.9	1.9
4	3.0	2.7	4.3	3.2	3.9	2.7	2.9	2.3	1.8	1.65	1.9	1.9
5	3.5	2.7	4.2	3.15	3.6	2.9	2.6	2.2	1.75	1.6	1.85	1.9
6	6.5	2.7	3.8	3.6	3.35	3.0	2.5	2.1	1.7	1.6	1.8	1.9
7	5.25	2.7	3.8	3.6	3.1	2.8	3.8	2.1	1.7	1.6	1.8	1.9
8	4.2	2.7	4.8	3.4	3.05	2.65	3.2	2.0	1.8	1.6	1.8	2.0
9	3.5	2.6	5.1	3.2	3.0	2.75	2.8	2.0	1.8	1.55	1.85	2.1
10	3.2	4.95	5.0	3.0	3.35	2.9	2.5	1.8	1.8	1.55	1.9	2.2
11	3.0	6.78	5.5	2.9	4.6	3.2	2.4	1.9	1.85	2.0	2.4	1.9
12	2.9	5.1	4.6	2.8	4.2	2.9	2.3	1.9	1.8	2.5	3.0	2.1
13	2.8	4.1	4.0	2.7	3.65	2.7	2.2	1.85	1.8	2.9	2.75	2.1
14	2.75	4.1	4.0	5.95	3.3	2.6	2.1	1.8	1.8	2.65	2.5	6.0
15	2.9	4.4	3.75	7.6	3.1	2.5	2.1	1.9	1.8	2.35	2.4	4.8
16	5.6	4.65	3.5	5.1	3.0	2.4	2.1	2.1	1.9	2.2	2.3	3.8
17	6.2	5.4	3.3	4.2	2.85	2.4	2.05	2.3	2.25	2.1	2.2	3.25
18	4.9	4.6	3.15	3.7	2.7	2.6	2.0	2.4	2.0	2.1	2.15	2.9
19	4.1	4.0	3.0	3.4	2.65	2.7	2.0	2.25	1.9	2.1	2.1	2.7
20	3.8	3.8	2.9	3.2	2.55	2.8	1.9	2.1	1.9	2.0	2.1	2.9
21	3.8	4.0	2.9	3.1	2.5	2.6	1.9	2.05	1.8	1.9	2.1	2.6
22	4.0	4.2	3.0	3.2	4.38	2.5	1.85	1.9	1.8	1.9	2.0	2.6
23	4.0	4.3	3.15	4.3	4.5	2.35	1.9	1.9	1.75	1.85	2.0	2.4
24	4.2	4.3	3.5	5.65	3.7	2.35	1.9	1.8	1.8	2.3	2.0	2.3
25	4.3	4.8	3.9	4.9	3.3	2.45	1.8	1.85	1.75	2.3	2.1	2.25
26	4.0	4.7	6.3	4.2	4.0	2.4	1.8	1.8	1.75	2.2	2.1	2.2
27	3.6	4.2	4.9	3.75	5.08	2.3	1.8	1.8	1.8	2.3	2.1	2.2
28	3.3	3.9	4.4	3.5	4.5	2.2	1.8	1.8	1.75	2.2	2.05	2.15
29	3.1	.....	3.7	3.5	3.8	2.4	1.8	1.75	1.7	2.1	2.0	2.1
30	3.1	.....	4.25	3.58	3.3	2.6	1.9	1.7	1.7	2.1	2.0	2.1
31	2.9	.....	3.9	.....	3.0	.....	1.9	1.7	.....	2.0	.....	2.3

Daily discharge, in second-feet, of Greenbrier River at Alderson, W. Va., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,030	1,210	3,030	2,800	6,540	1,480	1,040	2,360	143	143	330	330
2	3,030	818	2,580	2,360	6,680	1,300	1,390	1,210	103	143	294	294
3	2,150	818	2,260	2,150	5,030	1,210	3,030	818	103	143	258	258
4	1,760	1,210	4,760	2,150	3,750	1,210	1,570	623	195	123	258	258
5	2,800	1,210	4,500	2,050	3,030	1,570	1,040	511	169	103	226	258
6	11,400	1,210	3,500	3,030	2,470	1,760	888	414	143	103	195	258
7	7,390	1,210	3,500	3,030	1,950	1,390	3,500	414	143	103	195	258
8	4,500	1,210	6,120	2,580	1,860	1,130	2,150	330	195	103	195	330
9	2,800	1,040	6,960	2,150	1,760	1,300	1,390	330	195	89	226	414
10	2,150	6,540	6,680	1,760	2,470	1,570	888	195	195	89	258	511
11	1,760	12,400	8,110	1,570	5,570	2,150	748	258	226	330	748	258
12	1,570	6,960	5,570	1,390	4,500	1,570	623	258	195	888	1,760	414
13	1,390	4,250	4,000	1,210	3,150	1,210	511	226	195	1,570	1,300	414
14	1,300	4,250	4,000	9,510	2,360	1,040	414	195	195	1,130	888	9,680
15	1,570	5,030	3,380	15,400	1,950	888	414	258	195	685	748	6,120
16	8,410	5,710	2,800	6,960	1,760	748	414	414	258	511	623	3,500
17	10,300	7,820	2,360	4,500	1,480	748	372	623	567	414	511	2,260
18	6,400	5,570	2,050	3,260	1,210	1,040	330	748	330	414	462	1,570
19	4,250	4,000	1,760	2,580	1,130	1,210	330	567	258	414	414	1,210
20	3,500	3,500	1,570	2,150	966	1,390	258	414	258	330	414	1,570
21	3,500	4,000	1,570	1,950	888	1,040	258	372	195	258	414	1,040
22	4,000	4,500	1,760	2,150	4,980	888	226	258	195	258	330	1,040
23	4,000	4,760	2,050	4,760	5,300	685	258	258	169	226	330	748
24	4,500	4,760	2,800	8,560	3,260	685	258	195	195	623	330	623
25	4,760	6,120	3,750	6,400	2,360	818	195	226	169	623	414	567
26	4,000	5,840	10,700	4,500	4,000	748	195	195	169	511	414	511
27	3,030	4,500	6,400	3,380	6,900	623	195	195	195	623	414	511
28	2,360	3,750	5,030	2,800	5,300	511	195	195	169	511	372	462
29	1,950	.....	3,260	2,800	3,500	748	195	169	143	414	330	414
30	1,950	.....	4,640	2,980	2,360	1,040	258	143	143	414	330	414
31	1,570	.....	3,750	.....	1,760	.....	258	143	.....	330	.....	623

NOTE.—These discharges are based on a well-defined rating curve.

Monthly discharge of Greenbrier River at Alderson, W. Va., for 1909.

[Drainage area, 1,340 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	11,400	1,300	3,840	2.87	3.31	A.
February	12,400	818	4,080	3.04	3.17	A.
March	10,700	1,570	4,040	3.01	3.47	A.
April	15,400	1,210	3,760	2.81	3.14	A.
May	6,900	888	3,230	2.41	2.78	A.
June	2,150	511	1,120	.836	.93	A.
July	3,500	195	767	.572	.66	A.
August	2,360	143	436	.325	.37	A.
September	567	103	200	.149	.17	A.
October	1,570	89	407	.304	.35	A.
November	1,760	195	466	.348	.39	A.
December	9,680	258	1,200	.896	1.03	A.
The year	15,400	89	1,960	1.46	19.77	

GAULEY RIVER AT ALLINGDALE, W. VA.

This station, which is located at the Baltimore & Ohio Railroad bridge about one-fourth mile south of the depot at Allingdale, W. Va., was established July 3, 1908, to obtain data for use in studying water supply, water power, flood control, and storage problems.

Rock Creek enters immediately above the station. The drainage area above the section is about 248 square miles.

The section at this station is located at a bridge on a curve. The bottom of the stream is rough, but with care accurate measurements can be made. Sufficient data have not been obtained to enable estimates of the flow to be made.

The datum of the chain gage, attached to the railroad bridge, has remained unchanged. The records are reliable and accurate.

Discharge measurements of Gauley River at Allingdale, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	H. J. Jackson	169	914	6.75	1,220
November 12	A. H. Horton	166	728	5.96	663

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for 1909.

[J. L. Cogar, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.19	5.25	5.98	6.05	7.20	4.99	5.96	4.95	4.12	4.56	5.11	5.05
2	5.85	5.35	5.90	6.10	7.10	4.93	5.47	4.79	4.07	4.50	5.07	5.05
3	5.65	5.33	5.85	6.11	6.63	5.05	5.28	4.76	4.07	4.47	5.08	5.04
4	5.47	5.34	6.40	6.23	6.44	5.01	5.03	4.59	4.06	4.41	5.11	5.05
5	5.51	5.49	6.18	6.49	6.20	5.47	5.00	4.49	4.24	4.36	5.01	5.03
6	6.99	6.10	6.10	7.20	5.98	5.37	4.96	4.44	4.31	4.35	4.97	5.00
7	6.61	6.42	6.11	6.89	5.75	5.38	5.47	4.37	4.52	4.28	4.96	4.96
8	6.05	6.08	7.32	6.34	7.03	5.43	5.18	4.33	4.37	4.26	4.96	5.05
9	5.82	5.93	6.79	6.01	6.18	5.56	5.00	4.44	4.28	4.21	5.71	5.15
10	5.63	7.14	8.62	5.83	6.15	5.59	4.83	4.37	4.36	4.18	7.07	5.05
11	5.56	7.18	7.58	5.53	7.20	5.88	4.78	4.32	4.92	4.28	6.55	4.90
12	5.60	6.44	6.70	5.52	6.55	5.68	4.68	4.28	4.90	6.61	6.06	5.10
13	5.65	6.27	6.35	5.50	6.20	5.65	4.78	4.25	4.62	5.28	5.75	5.15
14	5.45	6.92	6.80	10.72	5.90	5.39	5.05	4.17	4.48	6.31	5.30	7.55
15	8.60	7.14	6.55	7.92	5.70	5.40	5.25	4.42	4.39	5.17	5.36	6.40
16	7.90	8.47	6.26	6.87	5.50	6.46	5.04	5.59	7.77	5.16	5.30	5.95
17	7.36	7.56	6.10	6.38	5.51	5.83	4.90	5.21	5.92	5.08	5.26	5.85
18	6.64	6.90	5.80	6.05	5.50	5.99	4.85	5.07	5.26	5.01	5.20	6.20
19	6.22	6.45	5.73	5.85	5.20	5.88	4.73	4.87	5.01	5.08	5.00	5.20
20	6.08	7.29	5.63	5.81	5.12	5.58	4.74	4.72	4.86	5.45	4.90	4.98
21	5.96	6.80	5.65	6.75	5.10	5.38	4.68	4.59	4.66	5.25	4.85	4.92
22	5.90	7.35	6.69	7.94	5.97	5.23	4.53	4.48	4.64	5.21	4.80	4.90
23	5.91	6.90	6.26	7.70	5.45	5.14	4.77	4.46	4.56	5.16	5.05	5.01
24	6.11	6.65	6.24	7.75	5.27	5.15	4.82	4.37	5.51	6.61	5.49	4.95
25	5.95	7.27	6.28	6.85	5.12	5.88	5.07	4.32	5.44	6.11	5.35	4.90
26	5.80	6.65	7.12	6.47	5.15	5.07	4.89	4.27	5.48	5.87	5.25	4.80
27	5.62	6.45	6.94	6.25	5.47	5.04	4.69	4.25	4.94	5.72	5.15	4.84
28	5.58	6.44	7.36	7.01	5.50	5.00	4.65	4.22	4.81	5.56	5.13	4.86
29	5.50	.....	7.05	6.69	5.48	5.03	4.67	4.19	4.71	5.41	5.17	4.80
30	5.49	.....	6.61	6.40	5.28	5.15	4.69	4.17	4.68	5.31	5.15	4.82
31	5.48	.....	6.26	.....	5.08	.....	4.62	4.09	.....	5.26	.....	4.80

GAULEY RIVER NEAR SUMMERSVILLE, W. VA.

This station, which is located at the highway bridge, known as Brock's bridge, about 2½ miles southeast of Summersville, W. Va., was established July 6, 1908, to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

Muddlety Creek enters about one-eighth mile above the station. The drainage area above the section is about 686 square miles.

The datum of the chain gage attached to the bridge has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

Discharge measurements of Gauley River near Summersville, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	H. J. Jackson	231	1,470	9.04	4,120
April 7	do	225	1,360	8.55	3,380
April 8	do	205	1,120	7.63	2,260
April 9	do	203	1,020	7.06	1,730
April 10	do	202	938	6.71	1,440
April 11	do	200	860	6.27	1,120
April 12	do	200	809	6.11	990

Daily gage height, in feet, of Gauley River near Summersville, W. Va., for 1909.

[Adam Chapman and Mrs. Icie Hypes, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.63	5.96	7.24	7.23	9.58	5.28	7.80	4.77	3.65	4.20	5.18	5.23
2	6.70	6.01	6.96	7.50	9.72	5.12	8.60	4.80	3.60	4.12	5.05	5.12
3	6.34	5.99	7.00	7.22	8.68	5.12	6.98	4.63	3.57	4.00	5.23	5.10
4	6.17	5.86	7.70	7.52	7.92	5.21	6.15	4.36	3.61	3.94	5.14	5.10
5	7.10	6.02	7.54	8.26	7.42	5.60	5.63	4.20	4.42	3.84	4.96	5.02
6	9.18	7.10	8.03	8.80	7.00	5.86	6.06	4.04	4.67	3.83	4.89	4.88
7	8.50	8.30	8.05	8.40	6.60	5.64	7.22	3.97	4.35	3.82	4.82	4.89
8	7.43	7.35	9.66	7.60	7.19	5.28	6.58	3.84	4.16	3.79	4.85	5.15
9	6.84	7.02	10.03	7.03	7.28	5.58	5.96	3.75	3.99	3.66	6.00	5.26
10	6.48	9.62	10.72	6.69	8.22	6.58	5.54	3.99	4.33	3.64	8.46	5.10
11	6.26	9.25	9.12	6.30	9.31	7.48	5.22	3.99	5.09	6.55	8.12	5.00
12	6.40	8.24	8.14	6.18	8.28	7.02	4.96	3.86	5.10	8.02	7.22	5.22
13	6.38	7.70	8.45	6.04	7.48	6.26	5.09	3.77	4.62	5.98	6.56	5.32
14	6.22	8.38	8.78	13.18	6.97	6.07	5.55	3.75	4.36	5.26	6.20	9.58
15	10.82	9.15	8.42	10.14	6.53	6.32	5.46	3.91	4.12	5.02	5.91	7.72
16	10.68	10.76	7.74	8.66	6.18	7.55	5.32	5.30	5.96	5.16	5.64	6.80
17	9.75	10.60	7.28	7.72	5.88	6.69	5.14	5.55	6.32	5.14	5.52	6.33
18	8.61	8.95	7.22	7.14	5.62	7.55	4.82	5.30	5.50	5.04	5.43	6.09
19	7.65	8.06	6.52	6.72	5.40	7.10	4.64	4.98	4.98	5.20	.....	5.46
20	7.21	8.88	6.33	6.79	5.30	6.40	4.51	4.71	4.70	5.62	.....	6.26
21	7.60	8.75	6.65	7.96	5.28	5.95	4.40	4.52	4.46	5.38	.....	5.87
22	6.88	9.22	8.55	10.06	6.30	5.80	4.26	4.22	4.28	5.26	.....	5.64
23	6.94	8.73	7.85	10.90	5.82	5.76	4.48	4.01	4.13	5.22	5.50	5.71
24	7.19	8.45	7.28	10.20	5.45	6.28	5.05	3.92	4.70	7.08	5.75	5.62
25	6.94	9.50	8.28	8.80	5.26	6.46	5.45	3.73	5.82	7.10	5.65	5.68
26	6.74	8.52	9.55	8.00	5.76	5.92	5.00	3.68	5.19	6.59	5.46	5.64
27	6.45	8.18	8.82	7.46	6.91	5.52	4.64	3.72	4.80	6.30	5.28	5.53
28	6.18	7.72	9.78	8.24	6.48	6.02	4.44	3.77	4.58	6.06	5.19	5.57
29	6.10	.....	9.65	8.14	6.22	5.80	4.62	3.70	4.37	5.77	5.19	5.60
30	6.48	.....	8.52	7.97	5.86	7.16	4.60	3.68	4.29	5.48	5.24	5.34
31	5.94	.....	7.74	.....	5.54	.....	4.68	3.66	.....	5.34	.....	5.30

NOTE.—Ice conditions December 19 to 31.

GAULEY RIVER AT BELVA, W. VA.

This station is located about one-half mile below Belva, W. Va. It was established August 25, 1908, to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

Twentymile Creek enters on the right bank about one-eighth mile above the station. The drainage area above the section is about 1,420 square miles.

Discharge measurements are made by means of a boat and cable, or by wading. A staff gage is fastened to a tree on the right bank about 1,000 feet below the gaging section. The gage datum has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

The following discharge measurement was made by H. J. Jackson:

April 1, 1909: Width, 258 feet; area, 1,620 square feet; gage height, 4.98 feet; discharge, 3,990 second-feet.

Daily gage height, in feet, of Gauley River at Belva, W. Va., for 1909.

[L. L. Davis and C. L. Davis, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.50	3.50	4.87	5.08	7.60	3.06	4.32	2.29	1.26	1.84	2.58	2.56
2	4.63	3.70	4.46	4.72	8.00	2.85	5.55	2.34	1.21	1.78	2.48	2.52
3	4.06	3.52	4.34	4.74	6.75	2.71	4.65	2.30	1.19	1.69	2.45	2.50
4	3.78	3.43	5.32	4.90	5.82	2.72	3.80	2.25	1.15	1.62	2.46	2.47
5	3.58	3.48	5.49	5.32	5.21	2.78	3.30	2.14	1.50	1.56	2.39	2.45
6	6.34	3.89	5.18	5.74	4.76	3.22	3.34	2.02	1.35	1.50	2.30	2.42
7	6.20	4.99	6.15	5.54	4.30	3.28	5.11	1.89	2.08	1.44	2.24	2.39
8	5.30	4.84	7.58	4.94	4.12	3.00	4.70	1.80	1.92	1.39	2.21	2.40
9	5.06	4.49	7.05	4.40	4.68	2.80	4.00	1.71	1.88	1.32	2.34	2.60
10	4.04	6.48	8.30	4.10	4.54	4.25	3.50	1.65	2.02	1.29	4.24	2.68
11	3.76	7.22	7.96	3.82	6.85	4.71	3.08	1.69	2.28	1.38	4.82	2.45
12	3.60	5.97	6.38	3.54	5.98	4.65	2.78	1.74	2.81	1.36	4.26	2.48
13	3.70	5.30	5.60	3.48	5.22	4.00	2.74	1.69	2.61	3.55	3.74	2.68
14	3.48	5.38	5.90	7.00	4.62	3.72	3.30	1.64	2.32	2.86	3.38	4.54
15	6.49	5.52	6.00	8.08	4.12	3.82	3.41	1.62	2.10	2.52	3.14	5.30
16	8.50	7.55	5.44	6.40	3.77	4.41	3.11	1.63	1.94	2.36	2.94	4.52
17	7.64	8.38	4.94	5.40	3.48	4.21	2.86	2.58	3.70	2.38	2.82	3.96
18	6.45	6.75	4.25	4.74	3.22	4.22	2.66	3.08	2.90	2.46	2.72	3.58
19	5.45	6.36	4.05	4.29	3.00	4.52	2.65	2.75	2.51	2.32	2.62	3.25
20	4.82	5.83	3.92	4.26	2.88	3.85	2.55	2.46	2.30	2.26	2.52	2.90
21	4.52	6.15	3.68	5.05	2.81	3.40	2.43	2.27	2.12	2.55	2.44	3.01
22	4.42	6.52	5.70	7.30	2.82	3.18	2.34	2.12	1.98	2.40	2.40	3.12
23	4.34	6.42	5.45	8.58	3.45	3.11	2.52	1.96	1.88	2.36	2.40	3.55
24	4.46	6.02	4.92	8.05	3.08	3.45	2.68	1.86	1.80	2.46	2.55	3.35
25	4.42	6.90	5.24	6.70	2.89	3.78	2.85	1.76	2.42	4.00	2.90	3.32
26	4.17	6.29	7.58	5.73	2.88	3.58	2.80	1.68	2.71	3.57	2.82	3.30
27	4.12	5.76	7.01	5.14	4.00	3.12	2.56	1.59	2.38	3.38	2.68	3.15
28	3.92	5.34	7.76	5.20	4.17	3.38	2.42	1.52	2.18	3.25	2.58	3.00
29	3.77	.....	7.72	5.48	4.05	3.30	2.35	1.45	2.06	3.05	2.51	2.88
30	3.90	.....	6.52	5.46	3.70	3.51	2.40	1.38	1.95	2.86	2.50	2.72
31	3.75	.....	5.70	.....	3.35	.....	2.35	1.31	.....	2.70	.....	2.62

NOTE.—Ice conditions the latter part of December. December 28, thickness of ice 0.25 foot.

CHERRY RIVER AT RICHWOOD, W. VA.

This station is located at the highway bridge in the town of Richwood, W. Va. It was established July 3, 1908, to obtain data for use in studying water supply, water power, flood control, and storage problems.

The datum of the chain gage attached to the bridge has not been changed; the records are reliable and accurate. Sufficient data have not yet been obtained to enable estimates of the flow to be made.

Discharge measurements of Cherry River at Richwood, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 28	H. J. Jackson	118	342	4.04	744
March 29	do	118	296	3.69	509
November 13	A. H. Horton	112	222	3.00	225

Daily gage height, in feet, of Cherry River at Richwood, W. Va., for 1909.

[D. S. Connelly and Floyd Artrip, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.30	.....	3.34	3.11	3.71	2.76	3.30	2.40	2.10	2.25	2.52	2.50
2	3.10	.....	3.51	3.30	3.58	2.75	3.82	2.42	2.10	2.22	2.50	2.48
3	3.00	.....	3.87	3.25	3.36	2.72	3.28	2.35	2.05	2.20	2.48	2.45
4	2.90	.....	3.84	3.17	3.22	2.84	3.05	2.30	2.05	2.20	2.42	2.45
5	4.50	.....	3.74	3.55	3.12	2.84	2.86	2.28	2.92	2.18	2.40	2.40
6	4.30	.....	3.70	3.72	3.00	3.08	3.50	2.25	2.45	2.15	2.40	2.40
7	4.21	.....	3.68	3.46	2.92	2.81	3.58	2.35	2.25	2.15	2.40	2.42
8	4.20	.....	3.66	3.26	3.30	2.74	3.25	2.28	2.20	2.15	2.40	2.75
9	.....	.....	3.90	3.16	3.05	2.82	3.05	2.22	2.22	2.10	3.15	2.45
10	3.21	.....	4.12	3.04	3.80	3.16	2.92	2.20	2.72	2.10	3.70	2.45
11	3.13	.....	4.57	2.96	3.75	3.28	2.78	2.20	2.82	3.08	3.45	2.45
12	3.25	.....	.....	2.92	3.43	3.08	2.70	2.15	2.52	3.20	3.15	2.45
13	3.10	3.44	.....	3.05	3.24	2.96	2.82	2.15	2.38	2.70	2.98	3.32
14	3.00	3.64	.....	5.16	3.10	2.90	2.82	2.15	2.30	2.60	2.82	3.95
15	3.81	4.14	.....	4.00	2.99	3.10	2.68	2.75	2.28	2.55	2.78	3.20
16	4.20	4.58	.....	3.42	2.90	3.01	2.60	2.95	2.25	2.60	2.70	2.95
17	3.80	3.80	.....	3.25	2.82	2.96	2.58	2.65	2.45	2.58	2.62	2.88
18	3.72	3.53	.....	3.12	2.74	3.40	.....	2.52	2.35	2.50	2.58	2.78
19	3.71	3.66	.....	3.02	2.66	3.07	2.50	2.48	2.30	2.60	2.55	2.48
20	3.50	4.04	.....	3.00	2.64	2.91	2.42	2.40	2.25	2.60	2.50	.....
21	.....	3.66	.....	3.18	2.90	2.81	2.40	2.32	2.20	2.52	2.50	.....
22	3.39	3.58	.....	3.78	3.15	2.73	2.39	2.30	2.20	2.50	2.50	.....
23	3.39	3.48	.....	3.90	2.81	2.72	2.40	2.28	2.25	2.65	2.55	.....
24	.....	3.48	.....	3.68	2.72	3.22	2.62	2.25	3.10	3.08	2.62	.....
25	.....	3.48	.....	3.55	2.72	3.22	2.58	2.20	2.68	2.88	2.52	.....
26	3.24	3.42	.....	3.26	3.30	3.10	2.50	2.20	2.55	2.85	2.50	.....
27	.....	3.34	.....	3.15	3.40	2.92	2.48	2.15	2.40	2.82	2.50	.....
28	3.00	3.36	4.08	3.38	3.21	2.88	2.65	2.12	2.40	2.78	2.48	.....
29	.....	.....	3.66	3.21	3.06	2.92	2.55	2.10	2.35	2.72	2.48	.....
30	.....	.....	3.48	3.36	2.92	3.22	2.48	2.10	2.30	2.65	2.55	.....
31	.....	.....	3.20	.....	2.82	.....	2.55	2.10	.....	2.60	.....	.....

NOTE.—Ice conditions December 10 to 31. Ice increased to 0.5 foot during this period. Thickness of ice December 25 was 0.25 foot. Breaks in records, January to March, were due to poor gage reading.

MEADOW RIVER NEAR RUSSELLVILLE, W. VA.

This station is located at Bays Ferry, about 3 miles below Russellville, W. Va. It was established July 17, 1908, to obtain data for use in studying water power, flood control, and storage problems.

Youngs Creek enters about one-fourth mile above the section. The drainage area above the section is about 297 square miles.

This is a cable and boat station. Low-water measurements are made by wading.

The chain gage is attached to trees on the left bank above the ferry. The datum of the gage has remained unchanged. The records are reliable and accurate. Sufficient data have not been obtained to enable estimates of the flow to be made.

Discharge measurements of Meadow River near Russellville, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	H. J. Jackson	117	545	5.84	686
April 13	do	108	378	4.57	260

Daily gage height, in feet, of Meadow River near Russellville, W. Va., for 1909.

[Jacob R. Bays, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.79	6.33	5.80	6.05	8.08	4.76	4.33	3.48	2.94	3.16	3.76	3.73
2	6.45	5.94	5.50	5.75	8.16	4.51	5.40	3.56	2.90	3.14	3.72	3.71
3	5.70	5.65	5.43	5.70	7.54	4.42	5.06	3.90	2.89	3.10	3.66	3.70
4	5.33	5.45	6.36	5.65	6.76	4.40	4.72	3.60	2.94	3.06	3.64	3.68
5	5.99	5.39	6.30	5.88	6.22	4.68	4.32	3.51	3.16	3.02	3.56	3.66
6	8.17	5.59	6.23	5.94	5.72	4.78	4.90	3.38	3.14	3.00	3.50	3.60
7	7.59	5.65	6.90	5.73	5.42	4.78	6.48	3.29	3.30	3.00	3.45	3.60
8	6.78	5.46	8.21	5.40	5.32	4.52	6.04	3.23	3.26	2.99	3.42	3.74
9	6.08	5.37	8.49	5.16	5.32	4.41	5.56	3.20	3.26	3.00	3.52	3.88
10	5.48	6.72	9.29	5.02	5.84	4.64	5.11	3.26	3.60	3.03	3.68	3.79
11	5.22	7.37	8.62	4.82	7.44	4.97	4.53	3.24	4.52	3.18	5.00	3.80
12	5.12	6.82	7.42	4.68	6.92	5.18	4.26	3.18	4.46	3.75	4.88	3.96
13	4.96	6.48	6.74	4.58	6.39	5.07	4.18	3.12	4.12	4.40	4.56	4.32
14	4.82	6.33	6.92	8.72	5.82	5.37	4.68	3.10	3.74	4.15	4.38	6.13
15	6.75	6.15	6.78	8.70	5.36	5.69	4.48	3.20	3.52	3.95	4.21	6.12
16	8.04	7.49	6.35	7.48	5.07	5.42	4.18	4.36	3.40	3.76	4.08	5.96
17	7.68	7.79	5.93	6.58	4.84	5.10	3.96	5.38	3.36	3.66	.....	5.20
18	7.15	7.03	5.55	5.88	4.60	5.16	3.80	4.86	3.40	3.64	.....	5.32
19	6.55	6.53	5.27	5.44	4.44	4.94	3.90	4.34	3.62	3.67	.....	5.44
20	6.14	6.55	5.12	5.22	4.34	4.60	3.82	3.98	3.48	3.52	.....	5.09
21	6.03	6.62	5.07	5.11	4.30	4.36	3.74	3.69	3.32	3.47	.....	4.65
22	6.08	7.20	5.39	6.26	4.62	4.26	3.64	3.49	3.24	3.45	.....	4.40
23	6.14	7.06	5.49	7.40	4.81	4.12	3.64	3.34	3.20	3.51	.....	4.26
24	6.16	6.88	5.65	7.57	4.68	4.25	3.80	3.28	3.26	3.82	.....	4.08
25	5.93	7.10	6.71	6.98	4.49	4.35	3.97	3.19	4.06	4.43	.....	4.06
26	5.74	6.84	8.03	6.39	4.98	4.24	3.38	3.12	3.74	4.42	.....	4.04
27	5.58	6.52	7.96	5.96	6.00	4.02	3.64	3.10	3.56	4.40	.....	3.95
28	5.36	6.20	8.75	5.75	6.16	3.92	3.61	3.08	3.43	4.28	.....	3.94
29	5.28	.....	8.20	5.58	6.05	3.83	3.52	3.05	3.38	4.10	.....	3.91
30	5.22	.....	7.31	5.98	5.55	3.99	3.54	3.01	3.13	4.01	.....	3.88
31	6.31	.....	6.55	.....	5.08	.....	3.48	2.98	.....	3.85	.....	3.86

NOTE.—Ice conditions December 9 to 31. December 21, thickness of ice 0.3 foot. December 26 to 31, gage readings are to top of ice.

ELK RIVER AT WEBSTER SPRINGS, W. VA.

This station is located at the suspension bridge on the grounds of the Webster Springs Hotel at Webster Springs, W. Va. It was established July 1, 1908, to obtain data for use in studying water supply, water power, flood control, and storage problems.

A vertical staff gage is fastened to the right abutment of the bridge. The gage datum has remained unchanged. The records are reliable and accurate. Sufficient data have not yet been collected to enable estimates of the flow to be made.

Discharge measurements of Elk River at Webster Springs, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 25	H. J. Jackson	123	732	3.72	957
Do	do	126	766	3.82	1,150
November 26	do	125	736	3.52	830
Do	do	124	726	3.44	743
November 11	A. H. Horton	124	734	3.52	800
Do	do	124	734	3.50	767

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for 1909.

[Cherry Woodzell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.10	.....	3.12	2.92	3.78	2.02	2.65	2.85	1.61	1.68	2.28	2.31
2	2.78	.....	3.00	3.05	3.68	2.00	2.45	2.90	1.56	1.63	2.28	2.30
3	2.60	.....	3.18	3.15	3.35	2.30	2.25	2.28	1.52	1.59	2.30	2.28
4	2.40	.....	3.38	3.28	3.25	2.25	2.08	2.14	1.58	1.56	2.26	2.25
5	3.10	2.70	3.18	3.78	3.10	2.68	2.00	2.00	1.64	1.54	2.19	2.20
6	3.68	3.02	3.15	3.85	2.95	2.49	1.99	1.96	1.68	1.52	2.15	2.20
7	3.35	3.15	3.35	3.50	2.79	2.38	2.10	1.88	1.64	1.52	2.20	2.18
8	2.95	2.95	3.90	3.20	2.78	2.22	2.00	1.86	1.60	1.50	2.12	2.20
9	2.82	2.85	3.80	2.95	2.72	2.20	1.89	1.81	1.56	1.49	2.95	2.20
10	2.70	3.85	4.40	2.82	3.12	2.30	1.82	1.74	1.58	1.48	3.80	2.20
11	2.65	3.80	3.80	2.70	3.45	2.49	1.72	1.68	1.62	1.58	3.50	2.20
12	2.65	3.32	3.40	2.70	3.15	2.35	1.72	1.62	1.68	3.55	3.15	2.20
13	2.60	3.30	3.25	2.75	2.92	2.20	2.30	1.61	1.66	2.85	2.95	2.32
14	2.70	3.75	3.55	5.60	2.72	2.25	2.40	1.60	1.60	2.35	2.72	4.20
15	4.70	3.90	3.35	4.10	2.64	2.85	2.29	1.80	1.54	2.25	2.62	3.45
16	4.10	4.25	3.12	3.58	2.54	3.29	2.18	3.14	2.25	2.50	2.45	3.18
17	3.70	3.90	2.95	3.22	2.46	2.78	2.08	2.95	2.32	2.39	2.40	2.95
18	3.35	3.55	2.80	2.95	2.40	3.05	2.00	2.55	2.05	2.35	2.39	2.55
19	3.05	3.30	2.70	2.82	2.30	2.85	2.10	1.88	1.92	2.60	2.35	2.28
20	2.92	3.95	2.68	2.75	2.25	2.65	2.00	1.72	1.79	2.59	2.29	2.25
21	2.95	3.65	2.68	3.45	2.28	2.45	1.88	1.72	1.69	2.48	2.28	2.25
22	3.00	3.85	2.88	4.30	2.90	2.30	1.75	1.62	1.63	2.38	2.25	2.25
23	2.90	3.55	2.80	4.20	2.52	2.42	1.80	1.99	1.66	2.40	2.65	2.25
24	2.90	3.45	2.80	4.05	2.44	2.70	2.72	1.92	2.70	3.25	2.85	2.25
25	2.88	3.70	3.38	3.50	2.32	2.78	2.35	1.84	2.30	3.05	2.72	2.50
26	2.82	3.40	3.52	3.30	2.30	2.55	2.15	1.79	2.05	2.88	2.62	2.52
27	2.72	3.28	3.36	3.15	2.40	2.42	1.98	1.74	1.92	2.70	2.52	2.50
28	2.60	3.20	3.75	3.70	2.34	2.29	1.96	1.70	1.84	2.62	2.42	2.50
29	2.55	.....	3.52	3.48	2.28	2.20	2.00	1.68	1.79	2.52	2.40	2.50
30	2.60	.....	3.32	3.45	2.22	2.85	3.05	1.66	1.74	2.48	2.36	2.50
31	2.50	.....	3.08	.....	2.12	.....	3.10	1.64	.....	2.38	.....	2.50

NOTE.—Ice conditions January 29 to February 7; ice from 0.16 to 0.4 foot thick. Ice conditions December 8 to 31. Thickness of ice December 21, 0.4 foot; December 28, 0.5 foot.

ELK RIVER AT GASSAWAY, W. VA.

This station is located at the Coal & Coke Railroad bridge in the northeastern part of Gassaway, W. Va. It was established July 1, 1908, to obtain data for use in studying water supply, water power, flood control, and storage problems.

Little Otter Creek enters immediately above the station.

Discharge measurements are made from a footbridge attached to the upper side of the railroad bridge or by wading. The datum of the chain gage attached to the railroad bridge has not been changed. The records are reliable and accurate. Estimates of the flow are withheld until estimates can be made at the other stations on Elk River.

Discharge measurements of Elk River at Gassaway, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 24	H. J. Jackson	156	536	3.31	744
March 30	do	176	974	5.58	2,410
November 10	A. H. Horton	169	799	4.80	2,130

Daily gage height, in feet, of Elk River at Gassaway, W. Va., for 1909.

[H. A. Hays, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.69	2.87	4.40	4.88	10.44	2.18	4.30	5.44	2.79	1.85	3.29	2.23
2	3.28	2.61	4.04	4.78	8.96	2.06	4.07	5.07	2.72	1.75	3.17	2.20
3	3.16	2.65	4.45	4.59	7.84	1.97	4.10	4.52	2.65	1.65	2.89	2.13
4	2.79	2.69	5.88	4.52	6.18	2.00	3.96	3.92	2.59	1.61	2.82	2.26
5	2.52	3.05	5.34	4.36	5.29	2.06	3.86	3.37	2.47	1.59	2.73	2.36
6	4.38	3.59	4.94	4.28	4.48	2.17	3.34	2.88	2.39	1.55	2.62	2.40
7	4.22	4.37	5.84	4.10	3.99	2.28	2.84	2.71	2.33	1.49	2.49	2.38
8	4.11	4.27	7.16	4.04	3.70	2.30	2.76	2.60	2.25	1.45	2.43	2.34
9	3.76	4.37	6.50	4.00	3.53	2.35	2.72	2.43	2.03	1.43	2.97	2.32
10	3.18	6.57	7.34	3.95	3.46	2.39	2.62	1.86	1.83	1.41	4.40	2.26
11	3.05	7.10	6.72	3.72	4.80	2.44	2.50	1.78	1.67	1.44	4.46	2.31
12	2.72	5.91	6.18	3.44	4.50	2.46	2.32	1.70	1.77	1.73	3.94	2.42
13	3.19	5.19	6.00	3.13	4.03	2.39	2.38	1.66	1.58	2.85	3.70	2.50
14	5.33	4.52	6.30	12.62	3.82	2.94	2.20	1.62	1.49	2.71	2.96	2.84
15	8.63	4.47	5.34	8.96	3.48	3.28	2.26	1.58	1.49	2.64	2.72	3.74
16	7.99	7.82	4.87	5.91	3.22	3.90	2.32	2.00	1.51	2.71	2.68	3.60
17	7.30	6.92	4.56	4.44	2.94	4.08	2.36	2.23	2.95	2.66	2.59	3.40
18	6.73	6.45	3.90	4.14	2.57	4.42	2.46	2.31	2.49	2.63	2.53	3.24
19	4.93	6.15	3.28	4.04	2.35	4.16	2.41	2.25	2.13	2.58	2.42	3.10
20	3.48	5.95	3.10	4.52	2.28	3.85	2.37	2.81	2.03	2.67	2.35	3.06
21	3.52	5.85	2.98	5.42	2.22	3.76	2.31	4.06	1.86	3.17	2.28	3.01
22	3.45	6.05	2.86	10.86	2.17	3.68	2.30	3.84	1.83	4.20	2.20	2.98
23	3.42	6.15	2.80	10.32	2.09	3.64	2.40	3.76	1.79	4.81	2.56	2.96
24	3.37	6.27	2.84	9.09	2.29	3.79	2.53	3.65	1.77	5.31	2.69	2.94
25	3.32	7.47	3.40	7.82	2.35	3.92	2.65	3.49	2.33	5.09	2.68	2.89
26	3.26	6.16	4.29	6.46	2.60	4.06	2.72	3.16	2.67	4.97	2.58	2.83
27	3.03	5.55	5.67	5.62	2.72	4.25	2.68	2.37	2.73	4.83	2.52	2.78
28	2.92	4.85	6.54	5.23	2.72	4.32	2.60	2.25	2.67	4.35	2.46	2.74
29	2.90	.....	5.94	5.14	2.64	4.42	2.51	1.97	2.55	3.93	2.38	2.70
30	2.95	.....	5.58	8.27	2.58	4.36	2.43	2.75	2.14	3.59	2.29	2.60
31	2.95	.....	5.13	.....	2.47	.....	5.59	2.85	.....	3.40	.....	2.74

ELK RIVER AT CLENDENIN, W. VA.

This station, which is located at the highway bridge in the town of Clendenin, W. Va., was established June 27, 1908, to obtain data for use in studying water power, water supply, flood control, and storage problems.

Big Sandy River enters Elk River immediately below the station.

Discharge measurements are made from the highway bridge or by wading. The datum of the chain gage attached to the bridge has not been changed.

The records are reliable and accurate, except that high water on the Big Sandy alone may produce backwater at the gage. This will not occur often, however, as the Big Sandy is a small stream. The gage reader has been instructed to note any backwater effect. Sufficient data have not yet been collected to enable estimates of discharge to be made.

Discharge measurements of Elk River at Clendenin, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 23	H. J. Jackson	214	834	4.78	1,940
March 31	do	246	1,250	6.14	4.170
November 6	A. H. Horton	142	471	2.77	319
November 29	G. L. Parker	170	562	3.21	637

Daily gage height, in feet, of Elk River at Clendenin, W. Va., for 1909.

[E. C. Riley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	3.66	5.32	5.55	14.24	2.79	4.47	3.88	2.26	2.50	3.01	2.95
2	3.73	3.48	4.98	5.17	12.26	2.71	4.01	3.81	2.21	[illegible]	2.93	2.91
3	3.79	3.38	4.92	5.06	8.50	2.63	3.48	3.44	2.18	2.28	2.87	2.85
4	3.52	3.52	5.81	5.44	6.72	2.66	3.30	3.35	2.23	2.25	2.79	2.84
5	3.33	3.85	6.34	5.82	5.98	2.67	3.15	3.03	2.23	2.22	2.75	2.78
6	3.30	4.13	5.85	6.14	5.44	2.74	3.05	2.81	2.23	2.15	2.72	2.75
7	4.30	4.62	6.15	6.14	4.94	2.71	2.95	2.65	2.22	2.13	2.64	2.74
8	4.60	5.21	6.92	5.46	4.56	2.87	2.81	2.58	2.18	2.12	2.62	2.84
9	4.12	5.36	7.29	4.95	4.30	2.95	2.74	2.49	2.18	2.11	2.80	2.96
10	3.84	7.82	6.98	4.62	4.18	3.98	2.63	2.43	2.18	2.03	3.00	3.02
11	3.65	8.41	7.46	4.36	4.13	4.13	2.66	2.38	2.14	2.05	5.90	2.94
12	3.44	6.66	6.36	4.14	4.55	3.73	2.58	2.35	2.23	2.05	5.41	2.74
13	3.41	5.57	5.74	3.98	4.60	3.41	2.54	2.29	2.32	2.03	4.58	2.92
14	3.80	5.35	5.48	4.28	4.31	3.37	2.56	2.29	2.23	2.03	4.16	3.16
15	7.88	5.41	5.66	10.97	4.10	3.19	2.66	2.39	2.18	2.79	3.70	4.64
16	4.72	11.19	5.56	7.62	3.85	3.23	3.10	2.47	2.13	2.85	3.48	5.86
17	9.50	10.40	5.13	6.09	3.61	4.05	3.27	3.09	2.12	2.67	3.24	4.98
18	7.15	8.01	4.86	5.18	3.42	4.71	3.03	3.75	2.10	2.55	3.09	3.90
19	5.83	6.40	4.49	4.71	3.27	4.79	2.91	3.71	2.88	2.54	2.98	3.52
20	4.97	6.06	4.24	5.98	3.18	4.53	2.78	3.41	2.87	2.69	2.87	3.48
21	4.50	6.76	4.18	7.52	3.21	3.99	2.76	3.04	2.65	2.82	2.75	3.28
22	4.16	6.74	4.71	12.84	3.19	3.78	2.60	3.29	2.52	3.29	2.86	3.33
23	4.00	6.89	4.78	12.80	3.16	3.58	2.71	3.00	2.46	3.27	2.74	3.43
24	3.87	7.12	4.63	10.91	3.16	3.73	2.76	2.82	2.36	3.33	2.72	3.38
25	3.72	8.68	4.93	8.77	3.19	4.11	2.75	2.68	2.28	4.57	3.38	3.22
26	3.82	7.62	5.94	6.89	3.22	4.17	3.12	2.55	2.30	4.94	3.68	3.04
27	3.82	6.43	6.20	6.16	3.54	4.22	3.70	2.47	2.52	4.29	3.48	3.06
28	3.74	5.89	7.40	7.22	3.20	3.92	3.18	2.41	2.86	3.83	3.32	3.22
29	3.65	.....	7.84	7.12	3.02	4.12	2.95	2.39	2.65	3.61	3.20	3.22
30	3.64	.....	7.00	9.35	2.95	4.21	2.91	2.32	2.54	3.43	3.04	3.14
31	3.74	.....	6.60	.....	2.85	.....	2.82	2.29	.....	3.19	.....	2.98

COAL RIVER AT BRUSHTON, W. VA.

This station, which is located at the Chesapeake & Ohio Railway bridge at Brushton station near Cobbs, W. Va., was established June 23, 1908, to obtain data for water power, water supply, flood control, and storage purposes.

The drainage area above the station is about 379 square miles. Brush Creek enters a short distance below the station.

The datum of the chain gage attached to the railroad bridge has remained unchanged. The records are reliable and accurate. Sufficient data have not yet been collected to enable estimates of the flow to be made.

Discharge measurements of Coal River at Brushton, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 19	H. J. Jackson	136	236	2.68	423
November 7 [a]	A. H. Horton	.....	.....	1.20	23

[a] Made by wading.

Daily gage height, in feet, of Coal River at Brushton, W. Va., for 1909.

[G. W. Fitzpatrick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.75	2.15	2.95	3.35	6.8	1.7	3.25	2.1	1.0	1.2	1.3	1.3
2	2.35	2.15	3.25	3.15	6.2	1.6	2.9	2.2	1.0	1.2	1.3	1.3
3	2.15	2.1	2.75	3.15	4.7	1.65	2.65	2.05	1.0	1.2	1.3	1.3
4	2.0	2.1	3.25	3.1	3.95	1.75	2.25	1.85	1.0	1.1	1.25	1.3
5	2.0	2.05	3.65	3.0	3.65	1.8	2.05	1.7	1.1	1.1	1.2	1.3
6	2.15	2.2	3.8	2.9	3.4	1.75	2.65	1.6	1.15	1.1	1.2	1.3
7	2.4	2.3	5.65	2.8	3.1	1.8	9.5	1.6	1.2	1.1	1.2	1.35
8	2.3	2.45	5.15	2.65	3.2	1.7	5.4	1.55	1.2	1.1	1.2	1.4
9	2.2	2.6	5.7	2.6	3.1	2.95	3.95	1.45	2.0	1.0	1.25	1.35
10	2.1	3.95	6.85	2.5	2.95	3.85	3.05	1.4	2.75	1.0	1.3	1.4
11	2.0	4.3	5.6	2.4	2.85	3.75	2.6	1.4	3.15	1.05	1.3	1.4
12	2.0	3.45	4.25	2.35	2.8	3.45	2.35	1.3	2.6	1.1	1.3	1.5
13	1.9	3.1	3.65	2.35	2.7	3.1	2.45	1.3	2.2	1.1	1.3	1.5
14	2.0	2.75	3.6	2.65	2.6	2.95	2.7	1.35	1.95	1.2	1.3	1.5
15	3.85	2.55	3.5	2.85	2.45	3.2	2.6	2.0	1.75	1.2	1.3	2.05
16	4.55	4.65	3.3	2.8	2.4	2.9	2.5	1.95	1.7	1.3	1.3	2.05
17	4.4	5.2	3.15	2.7	2.25	2.6	2.25	1.9	1.6	1.2	1.3	1.85
18	3.95	4.15	2.85	2.6	2.1	2.8	2.1	1.65	1.6	1.3	1.25	1.75
19	3.1	3.5	3.0	2.5	2.0	2.7	2.0	1.6	1.5	1.3	1.2	1.65
20	2.7	3.45	2.55	3.35	2.0	2.35	1.9	1.5	1.45	1.3	1.2	1.6
21	2.45	3.6	2.6	3.7	2.0	2.2	1.75	1.45	1.4	1.2	1.2	1.5
22	2.25	4.35	2.75	6.05	1.95	2.15	1.65	1.35	1.4	1.2	1.2	1.5
23	2.2	4.2	3.1	5.55	1.85	2.1	2.0	1.3	1.4	1.25	1.35	1.4
24	2.05	3.9	2.85	5.3	1.75	2.2	2.0	1.3	1.4	1.3	1.4	1.4
25	2.0	4.8	3.15	4.4	1.8	2.2	1.9	1.2	1.3	1.5	1.3	1.4
26	2.15	4.2	4.85	3.85	2.0	2.05	1.8	1.2	1.3	1.6	1.3	1.5
27	2.2	3.7	4.75	3.3	2.0	1.9	1.8	1.15	1.3	1.6	1.35	1.5
28	2.2	3.25	5.4	3.2	2.05	1.8	2.0	1.1	1.25	1.5	1.35	1.6
29	2.25	.....	5.45	3.05	1.95	2.15	1.95	1.1	1.2	1.45	1.35	1.55
30	2.3	.....	4.35	3.75	1.9	2.45	2.25	1.05	1.2	1.4	1.3	1.5
31	2.1	.....	3.7	.....	1.8	.....	2.05	1.0	.....	1.35	.....	1.5

NOTE.—During the latter part of December ice formed in pools above and below the gage; no ice at gage. Ice affects the gage heights very slightly, if any.

COAL RIVER AT TORNADO, W. VA.

This station is located at the highway bridge near Tornado, W. Va. It was established June 24, 1908, to obtain data for water-power, water-supply, flood-control, and storage problems.

The datum of the chain gage attached to the bridge has not been changed. The records are reliable and accurate. The low-water gage heights may be affected by a dam a short distance below the station. Sufficient data have not yet been collected to enable estimates of the discharge to be made.

Discharge measurements of Coal River at Tornado, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 19	H. J. Jackson	168	922	3.08	904
November 6 [a]	A. H. Horton	.....	.....	2.50	20

[a] Weir measurement.

Daily gage height, in feet, of Coal River at Tornado, W. Va., for 1909.

[J. F. Burdette, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.90	3.30	3.54	9.00	2.42	3.46	2.72	2.37	2.22	2.61	2.50
2	.....	2.90	3.15	3.38	7.95	2.40	3.30	2.69	2.41	2.35	2.51	2.54
3	.....	2.95	3.15	3.31	5.20	2.50	3.38	2.69	2.39	2.42	2.47	2.51
4	.....	3.00	3.35	3.31	4.18	2.68	3.03	2.57	2.42	2.39	2.45	2.52
5	.....	2.90	3.75	3.26	3.82	3.06	2.83	2.46	2.82	2.45	2.45	2.58
6	.....	3.00	4.05	3.18	3.64	2.80	3.32	2.39	2.78	2.43	2.52	2.56
7	.....	3.10	6.15	3.14	3.36	2.56	13.02	2.30	2.71	2.49	2.58	2.59
8	3.00	3.35	4.75	3.06	3.30	2.66	7.00	2.48	2.68	2.47	2.50	2.58
9	2.95	3.65	5.85	2.98	3.29	3.20	4.26	2.30	2.92	2.46	2.75	2.58
10	2.85	4.30	8.40	2.99	3.30	3.94	3.58	2.30	3.72	2.52	2.60	2.58
11	2.90	4.65	5.65	2.92	3.28	3.86	3.02	2.29	3.39	2.52	2.45	2.58
12	2.80	3.90	4.30	2.86	3.10	3.88	2.88	2.37	2.61	2.47	2.50	2.60
13	2.85	3.65	3.90	2.85	3.08	3.60	2.83	2.48	2.51	2.41	2.54	2.64
14	3.05	3.35	4.85	3.22	3.02	3.48	2.80	2.83	2.75	2.41	2.58	2.90
15	4.08	4.25	4.75	3.70	3.12	3.56	3.00	2.67	2.59	2.28	2.58	2.86
16	4.98	5.80	4.65	3.40	2.72	3.50	2.87	2.79	2.42	2.35	2.59	2.85
17	4.40	5.95	3.45	3.35	2.68	3.40	2.80	2.76	2.35	2.45	2.58	2.82
18	4.05	4.35	3.15	3.18	2.60	3.43	2.67	2.68	2.30	2.46	2.54	2.74
19	4.55	3.90	3.08	3.12	2.72	3.38	2.46	2.76	2.38	2.39	2.51	2.65
20	3.30	3.70	3.00	3.82	2.70	3.28	2.28	2.77	2.39	2.45	2.51	2.65
21	3.10	3.70	3.00	4.48	2.71	3.18	2.19	2.64	2.28	2.48	2.51	2.65
22	2.95	4.25	3.00	7.02	2.65	3.10	2.42	2.41	2.43	2.45	2.52	2.65
23	2.95	4.05	3.25	7.45	2.60	3.06	3.46	2.39	2.38	2.38	2.52	2.64
24	2.85	4.45	3.08	6.86	2.52	3.13	3.60	2.49	2.36	2.38	2.54	2.62
25	2.75	4.95	3.40	5.08	2.54	3.08	3.73	2.34	2.31	2.41	2.54	2.52
26	2.80	4.25	4.42	3.98	2.68	2.50	3.26	2.55	2.41	2.42	2.56	2.68
27	2.85	3.95	4.40	3.70	2.70	2.86	2.56	2.57	2.31	2.38	2.58	2.65
28	3.00	3.60	4.80	3.58	2.70	2.76	2.62	2.51	2.30	2.46	2.60	2.65
29	3.00	.....	5.20	3.35	2.70	2.70	2.60	2.55	2.29	2.53	2.58	2.62
30	3.05	.....	4.25	3.80	2.60	2.88	2.60	2.56	2.22	2.59	2.56	2.61
31	2.90	.....	3.78	.....	2.52	.....	2.84	2.32	.....	2.58	.....	2.59

NOTE.—No ice conditions January to April. Ice conditions December 10 to 31. Gage read to top of ice except on December 19. December 27, thickness of ice 0.3 foot; gage height to water surface, 2.30 feet. December 31, thickness of ice 0.5 foot.

POCOTALIGO RIVER AT SISSONVILLE, W. VA.

This station is located at the highway bridge near the post-office at Sissonville, W. Va. It was established June 26, 1908, to obtain data for use in studying water-power, water-supply, flood-control, and storage problems.

A dam and small power plant above the station may modify the flow in low water. The datum of the chain gage attached to the bridge has not been changed. The records are reliable and accurate. Sufficient data have not been collected to enable estimates of the flow to be made.

Discharge measurements of Pocotaligo River at Sissonville, W. Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 21	H. J. Jackson	81	133	2.55	99
March 22	do	81	148	2.72	117
November 8[a]	A. H. Horton	.....	.....	1.76	3.5

[a] Made by wading.

Daily gage height, in feet, of Pocotaligo River at Sissonville, W. Va., for 1909.

[W. N. Sisson and B. N. Sisson, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.00	2.49	3.25	2.58	20.00	1.99	2.52	2.55	1.05	1.05	1.64	1.90
2	2.07	2.37	2.84	2.44	7.19	1.99	2.02	2.30	1.10	.99	1.67	1.66
3	2.20	2.30	3.12	2.62	4.13	2.38	1.50	1.90	1.05	.99	1.67	1.73
4	2.30	2.59	3.04	2.60	3.33	2.39	1.65	1.65	1.15	.99	1.64	1.69
5	2.30	3.89	2.78	2.66	3.38	3.24	1.80	1.90	1.12	.98	1.64	1.73
6	2.11	2.49	2.39	2.51	3.24	3.35	1.80	1.72	1.10	.98	1.65	1.72
7	2.03	2.75	2.30	2.33	2.53	2.69	1.90	1.45	1.18	.98	1.58	1.68
8	2.10	2.80	2.46	2.40	2.40	3.63	1.65	1.34	1.15	1.03	1.66	2.28
9	2.00	3.65	2.56	2.36	2.50	3.49	1.65	1.35	1.16	1.03	2.18	2.15
10	2.01	3.41	2.39	2.06	2.42	4.02	1.62	1.28	1.25	1.04	2.50	2.27
11	1.70	2.54	4.85	2.25	2.54	5.61	1.25	1.18	1.25	1.03	2.61	1.99
12	1.72	2.89	4.62	2.10	2.50	5.93	1.40	1.21	1.32	1.05	2.40	1.95
13	1.79	3.35	4.84	2.05	2.28	2.97	2.30	1.22	1.32	1.05	2.48	2.34
14	1.83	3.32	3.15	2.50	2.20	3.12	2.40	1.05	1.28	1.05	2.32	2.76
15	2.71	3.20	2.90	2.45	2.32	3.03	2.08	1.95	1.20	.98	2.26	3.14
16	6.90	3.77	2.71	2.40	1.98	2.95	2.45	2.55	1.20	1.04	2.03	2.95
17	7.65	12.80	2.42	2.30	1.98	2.55	2.80	3.65	1.25	1.04	2.01	2.65
18	3.53	5.89	2.62	2.41	2.20	2.77	2.52	3.15	1.20	1.05	1.88	2.50
19	2.03	4.32	2.76	2.42	2.20	3.39	2.30	2.68	1.16	1.05	1.92	2.28
20	2.07	3.56	2.52	9.40	2.29	3.45	2.05	2.10	1.15	1.04	1.80	2.20
21	2.11	3.01	2.54	7.60	2.26	3.09	2.12	1.70	1.16	1.04	1.82	2.06
22	2.20	3.12	2.78	7.95	2.26	2.39	1.80	1.78	1.08	1.04	1.70	2.00
23	2.30	3.01	2.35	8.75	2.26	2.02	1.90	1.74	1.06	1.38	1.70	1.90
24	2.05	10.44	2.45	6.25	3.10	2.02	2.20	1.47	1.05	1.69	1.95	1.68
25	2.00	6.44	2.68	5.43	2.98	1.97	2.00	1.35	1.08	1.65	1.82	1.75
26	2.01	4.92	2.66	4.93	2.66	1.97	1.75	1.45	1.08	1.64	1.84	1.92
27	2.15	3.21	4.53	4.84	2.39	2.02	2.50	1.47	1.05	1.55	1.86	2.55
28	2.41	3.36	5.84	4.22	2.22	1.99	2.55	1.22	1.06	1.54	1.82	1.96
29	2.37	.....	4.72	4.49	2.15	2.02	2.50	1.18	1.05	1.55	1.82	2.50
30	2.29	.....	3.24	12.26	2.15	2.28	2.70	1.25	1.05	1.61	1.84	2.25
31	2.33	.....	2.48	.....	2.14	.....	2.45	1.35	.....	1.67	.....	2.21

NOTE.—Ice conditions December 20 to 31. Thickness of ice December 24, 0.2 foot; December 31, 0.25 foot.

MIAMI RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Miami River lies in southwestern Ohio and southeastern Indiana, one-third of the area being in the latter State. The river is formed in Logan County by small streams rising in Auglaize and Hardin counties, Ohio, flows in a slight southwesterly direction and joins Ohio River at the Indiana State line. Stillwater River from the west and Mad River from the east, both tributary near Dayton, are the only important tributaries in the upper part of the basin. Whitewater River is tributary from the west a few miles above the mouth of the river. Nearly all of the drainage area of the Whitewater is in Indiana. The length of the Miami is about 140 miles (map measurement), and its drainage area comprises about 5,400 square miles.

The drainage basin is fairly regular in shape. The valleys of the headwaters as far down as Dayton are narrow and comparatively shallow. Below Dayton the valley is broad and open and is flanked by low hills. Along this section the river occupies the preglacial drainage lines which are only partially filled with glacial deposits. The contrast between the southern and northern portion of the drainage basin is due not to the work of the present streams, but to the less complete concealment of preglacial drainage lines. The surface of the surrounding country is level or rolling.

The elevation of the sources of the river is about 1,000 feet; at Dayton the elevation is about 725 feet; at Hamilton it is about 565 feet; at the mouth of the river the elevation is 428 feet. The average fall of the river is 3 to 4 feet per mile.

There are no forested areas in this drainage basin, what timber there is being in small groves or wood lots. The mean annual rainfall is about 42 inches. The winters are comparatively mild in the northern part of the basin. The snowfall is not heavy and ice does not form very thick. In the southern part the winters are mild and snowfall is light, but ice forms to some extent where the current is sluggish.

The basin affords a few opportunities for storage. Lewistown and Loramie reservoirs, near the headwaters of the Miami, are used to supply water for the Miami & Erie Canal. These reservoirs were constructed about 1830; construction of reservoirs at the present time would be prohibited by the cost of the overflowed land. It is probable that other sites might be found at the headwaters of the tributaries.

The high average slope is favorable to the development of water power, but the bed and banks of the stream are not as a rule suitable for the foundation of dams, as they are generally composed of gravel

and alluvial soil, and the banks are low. These conditions are met by building low dams to divert the water into canals. The gravelly and sandy soil is favorable for the formation of springs, of which there are a great many in the basin. These springs tend to keep up the flow during dry spells and increase the value of the stream for water power. At different places water is diverted from the river to feed the Miami & Erie Canal, which parallels the river from Hamilton to Piqua and thence along Loramie River, crossing the divide at its sources. Numerous power plants situated along this canal have leased water rights from the State.

MIAMI RIVER AT DAYTON, OHIO.

This station is located at the Main Street Bridge at Dayton, Ohio. The gage, which belongs to the United States Weather Bureau, was established October 1, 1892; it was repaired in 1903, and also in 1904. It is a vertical staff spiked to the downstream end of the first pier from the left bank. On March 18, 1905, the United States Geological Survey began taking discharge measurements to obtain data for water-power, water-supply, and pollution problems. The United States Weather Bureau supplies the United States Geological Survey with daily gage heights. The station is one-half mile below the mouth of Mad River and 1 mile above Wolf Creek, which is tributary from the west. The drainage area above the station is about 2,450 square miles.

A power plant about a mile above the station may divert water around the section, and a dam on Mad River about 2 miles above the section diverts water into the Miami & Erie Canal.

The winters are comparatively mild, and ice generally causes little trouble as it rarely lasts for a month at a time.

The datum of the gage has probably remained unchanged since the date of establishment in 1892.

This station has not been inspected since June, 1906, and nothing is known about the existing conditions; hence no monthly discharge is published for 1909.

Daily gage height, in feet, of Miami River at Dayton, Ohio, for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	.....	4.5	2.5	5.5	3.2	2.7	2.1	1.2	0.8	1.8	2.2
2	1.9	.....	4.1	2.5	4.7	3.0	2.2	1.7	1.1	.8	1.8	2.1
3	1.9	.....	4.2	2.4	3.7	3.0	1.9	1.5	1.1	.8	2.0	2.1
4	1.9	.....	4.0	2.4	3.5	2.9	1.8	1.4	1.2	.8	1.8	2.1
5	2.0	2.1	3.6	2.3	4.0	3.1	1.7	1.3	1.5	.7	1.8	2.1
6	2.0	2.1	3.3	3.2	3.7	2.9	1.6	1.2	1.2	.7	1.7	2.0
7	.....	2.1	3.2	5.6	3.4	2.6	1.6	1.2	1.1	.7	1.7	2.1
8	.....	2.1	3.0	6.0	3.2	2.5	1.5	1.3	1.1	.7	1.6	2.2
9	.....	2.1	3.5	5.0	3.7	2.7	1.4	1.1	1.1	.7	1.5	.....
10	2.0	2.2	7.3	4.4	10.1	3.2	1.3	1.0	1.1	.7	1.7	.....

Daily gage height, in feet, of Miami River at Dayton, Ohio, for 1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.0	2.2	6.0	3.8	9.6	3.1	1.3	1.0	1.3	1.0	1.6	.....
12	.....	2.2	4.9	3.3	8.0	2.5	1.3	1.0	1.2	1.0	1.6	.....
13	.....	2.2	4.0	3.1	6.3	2.4	3.9	1.1	1.2	1.0	1.5	5.8
14	.....	2.3	3.7	3.4	5.3	2.3	3.9	1.5	1.1	1.0	1.8	7.7
15	.....	3.5	3.4	3.3	4.3	2.2	2.8	3.4	1.0	1.0	1.5	5.9
16	.....	4.2	3.2	3.3	5.2	1.9	4.5	4.6	1.0	.9	1.4	4.3
17	.....	3.3	3.0	3.0	4.9	1.8	3.5	3.5	1.0	1.0	1.9	3.5
18	.....	2.9	3.0	2.9	3.9	1.7	3.0	2.8	1.0	1.2	2.1	3.0
19	.....	3.1	2.9	2.9	3.3	1.6	2.5	2.3	1.1	1.4	2.2	.....
20	.....	4.0	2.7	2.9	2.9	1.5	2.1	1.8	.8	1.1	2.2	.....
21	.....	5.6	2.6	2.9	3.0	1.5	1.8	1.7	.8	1.1	2.0	.....
22	2.0	5.3	2.6	4.4	3.4	1.5	1.6	1.4	.8	1.1	1.9	.....
23	2.1	5.3	2.5	3.0	2.9	1.5	5.1	1.2	.8	3.0	4.1	.....
24	2.2	12.0	2.4	3.1	2.5	3.5	3.2	1.2	1.0	4.1	4.9	.....
25	2.1	12.1	2.6	3.0	2.2	2.8	2.7	1.1	.9	3.7	3.8	.....
26	2.1	8.5	2.9	2.8	2.6	4.4	2.2	1.2	.8	3.0	3.2	.....
27	2.0	6.5	3.2	2.6	4.4	4.5	1.9	1.3	.8	2.6	2.8	.....
28	2.0	5.2	3.0	2.5	7.3	3.8	1.8	1.6	.8	2.4	2.6	.....
29	2.0	.....	2.9	2.5	5.9	3.6	1.6	2.1	.8	2.2	2.4	.....
30	2.0	.....	2.7	2.8	4.8	3.1	2.5	1.4	.8	1.9	2.3	.....
31	.....	.....	2.6	.....	4.0	.....	2.7	1.4	.....	1.9	.....	.....

NOTE.—Ice conditions prevailed on days having no gage record.

WABASH RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage area of Wabash River lies in Ohio, Illinois, and Indiana, slightly more than two-thirds of the area being in the last-named State.

The Wabash rises in the southwestern part of Mercer County, Ohio, flows northwestward across the Indiana state line to Huntington in Huntington County, and thence slightly southwestward to Logansport in Cass County. At Logansport the river turns more to the southwest until it reaches Covington in Fountain County, where it finally turns south, continuing in this direction to Terre Haute, below which its course is slightly southwestward to its junction with Ohio River about 30 miles below Mount Vernon, Ind. From a point about 15 miles below Terre Haute to the mouth it forms the boundary line between Indiana and Illinois.

The important tributaries, beginning at the sources and following down the left bank, are Salamonie and Mississinewa rivers, Wild Cat Sugar, and Raccoon creeks, and White and Patoka rivers; on the right bank are Little, Eel, Tippecanoe, Vermilion, Embarrass, Little Wabash, and Saline rivers. White River is much the largest tributary. The length of the Wabash is about 410 miles (map measurement), and its drainage area comprises approximately 33,000 square miles.

The basin is regular in shape. Only a small part of the entire drainage area lies outside the glaciated region. The Wabash and the West Branch of the White lie within that area for their entire length. The East Branch of the White leaves the glaciated area in the lower part of its course, and enters it again about 20 miles above its mouth.

All the rock formations are more or less covered with glacial drift in the form of sand and gravel ridges and till plains. In general the surface of the country is flat, with a general slope toward the southwest. In the unglaciated section in southern Indiana the country is more uneven. Rock outcrops at many places in the bed of the main stream and its tributaries.

Along Little Wabash River, which enters the Wabash about 15 miles above its mouth, drainage and flood control are subjects of considerable interest. The Department of Agriculture is making a study of conditions with a view to developing a plan for reclaiming and protecting areas that are overflowed during floods. Portions of the river have already been mapped for use in this study.

The elevation of the sources of Wabash River is about 1,000 feet; at Huntington the elevation is 699 feet; at Logansport it is 583 feet; at Terre Haute, 478 feet; at the mouth of White River, 376 feet; at the mouth, 311 feet.

The basin is thickly settled and highly cultivated, and the timber standing comprises only groves and woodlots, generally of small extent.

The mean annual rainfall is about 40 inches. The winters in the northern part of the basin are comparatively severe. The snowfall is not heavy, but ice forms on the streams about 1 foot in thickness; in the lower part of the basin the winters are mild and ice does not form very thick.

The high value of farm land in this section would undoubtedly prohibit the construction of reservoirs for storage.

The main stream and its tributaries afford good opportunities for water power, especially the East and West branches of the White, where the fall is much more than on the Wabash. In general, the water power is not being developed.

At the headwaters of Wabash River, in Mercer County, Ohio, is a large reservoir, called Grand Reservoir, that is used to store water which is supplied to the Miami and Erie Canal. This reservoir receives the drainage from about 200 square miles, and its capacity is about 4,000,000,000 cubic feet. The water that is thus fed to the canal is diverted from the basin of the Wabash River.

The Wabash is navigable for part of its length.

STATIONS ON MAIN WABASH RIVER.

WABASH RIVER AT MOUNT CARMEL, ILL.

This station, which is located at the Southern Railway bridge at Mount Carmel, Ill., was established June 16, 1884. The original gage belonged to the United States Engineer Corps, but it was rebuilt in November, 1904, by the United States Weather Bureau, which

furnishes the gage readings. It is a staff gage attached to the first round pier from the west side of the railway bridge. On October 10, 1908, the United States Geological Survey began taking discharge measurements to obtain data for water power, flood control, storage, and navigation problems.

Patoka River enters immediately above the station. Measurements of extreme floods may be difficult to obtain on account of the many overflow channels east of the station.

Winters in this locality are mild. Ice does not form very thick and rarely lasts a month at a time.

The datum of the gage has probably remained unchanged since it was established in 1884. Sufficient data have not yet been collected to enable estimates of discharge to be made.

Discharge measurements of Wabash River at Mount Carmel, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 9	W. M. O'Neill	1,370	19,800	13.92	58,600
April 30	H. J. Jackson	973	13,400	9.18	37,600
May 24	do	981	10,400	6.33	22,400

Daily gage height, in feet, of Wabash River at Mount Carmel, Ill., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	.....	18.6	6.7	10.6	12.5	11.2	3.8	2.7	3.4	4.0	7.0
2	1.4	.....	19.1	6.4	12.0	12.3	10.2	3.7	2.7	3.0	3.8	6.1
3	1.4	.....	19.4	6.0	12.8	12.2	9.3	4.0	2.7	2.8	3.5	5.8
4	1.4	.....	19.7	5.7	13.0	11.9	8.1	4.2	2.6	2.6	3.3	5.3
5	1.4	.....	19.5	5.7	13.1	12.0	6.9	4.5	2.6	2.5	3.0	5.2
6	1.4	1.7	18.3	5.5	13.1	12.4	5.9	4.6	2.6	2.5	2.8	5.1
7	1.4	2.3	16.8	5.2	13.2	12.9	6.3	4.4	2.5	2.4	2.6	5.1
8	1.4	2.5	14.7	7.0	13.0	13.4	9.1	4.0	2.5	2.4	2.5	5.0
9	1.4	2.8	13.2	10.1	12.6	13.7	11.8	3.8	2.5	2.3	2.4	5.2
10	1.4	2.9	15.9	11.9	12.1	13.5	11.3	3.6	2.4	2.3	2.4	5.4
11	1.4	3.0	17.4	12.9	12.1	13.1	10.2	3.5	2.4	2.2	2.4	5.0
12	1.4	3.0	18.1	13.4	12.3	13.1	9.3	3.4	2.4	2.2	2.3	4.7
13	.....	4.0	18.3	14.1	13.0	13.3	10.2	3.3	2.4	2.1	2.1	4.7
14	.....	5.0	18.3	14.2	13.6	13.1	12.7	3.2	2.3	2.0	2.1	10.1
15	.....	5.7	18.4	13.9	13.8	13.3	15.0	3.2	2.3	1.9	2.1	12.5
16	.....	7.8	18.6	13.7	13.4	13.2	15.9	3.3	2.2	1.8	2.1	13.3
17	.....	9.5	18.4	13.6	12.8	13.4	16.0	3.8	2.2	1.8	2.3	14.2
18	.....	9.8	17.6	13.3	11.6	13.0	15.2	4.0	2.2	1.9	2.9	.....
19	.....	9.7	15.0	13.0	10.2	12.1	14.4	3.9	2.2	2.0	3.2	.....
20	.....	10.6	11.3	12.4	9.9	11.3	13.1	3.7	2.2	2.0	3.4	.....
21	1.4	11.8	9.3	12.5	9.2	10.2	12.0	3.5	2.1	2.1	3.8	.....
22	1.4	12.7	8.3	12.6	8.1	9.0	11.0	3.4	2.2	2.3	4.3	.....
23	1.4	13.6	7.5	12.8	7.3	7.8	10.9	3.3	2.3	3.0	4.3	.....
24	1.4	15.4	6.9	13.2	6.8	7.3	9.0	3.2	2.3	3.0	4.9	6.0
25	1.4	16.5	6.5	13.0	6.5	6.5	7.6	3.1	2.2	3.0	6.3	.....
26	1.5	17.2	6.1	12.3	6.0	6.0	6.5	3.0	2.2	3.2	7.8	.....
27	1.5	17.8	5.8	11.9	6.0	6.9	5.4	2.9	2.1	3.4	9.0	.....
28	1.5	18.2	5.7	10.0	7.8	9.1	4.5	2.8	3.1	4.1	9.8	.....
29	1.6	.....	6.0	9.1	9.2	10.7	4.0	2.8	4.0	4.3	10.0	.....
30	.....	.....	6.3	9.0	11.3	11.6	4.0	2.8	4.0	4.5	9.6	.....
31	.....	.....	7.0	.....	12.2	.....	4.0	2.8	.....	4.2	.....	.....

NOTE.—River frozen on days for which no gage heights are given.

EMBARRASS RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage area of Embarrass River lies in the southeastern portion of the State of Illinois.

The river rises in the central part of Champaign County, near Urbana, flows in a southerly direction through Douglas, Coles, and Cumberland counties to the center of Jasper County, whence it takes an extremely tortuous but in general southeasterly course across Jasper County, the southwestern corner of Crawford County, and Lawrence County to its junction with Wabash River, about midway between Vincennes, Ind., and St. Francisville, Ill. Exclusive of the bends, its length is about 125 miles, and its drainage area comprises 2,410 square miles. Its most important tributary is Hickory Creek, or North Fork Creek, which enters from the left bank about 2½ miles below St. Marie, Ill. The sources of the river are about 730 feet and the mouth about 400 feet above sea level.

The basin is long and narrow, with a length of about 100 miles and a fairly uniform width ranging from 15 to 30 miles. The surrounding country, which is level or gently rolling, is diversified by some small hills along the river. In the lower part of the basin, in the vicinity of St. Marie, the soil is sandy along the river; farther north and west it is the familiar black loam. To the east the soil is a light colored clay, which was formerly covered with a heavy growth of "water oak." Near Oakland, in the upper part of the area, a sandy red soil occurs near the river and black loam away from the river. A mile back from the river on either side is prairie country.

In the southwestern part of the basin, west of Lawrenceville, there are extensive oil fields.

The chief crop in the valley of the Embarrass is corn. Some wheat is also grown. Forested areas are lacking in this basin.

The mean annual rainfall is about 40 inches. The winters are, as a rule, mild, the snowfall extending over a period of about two months and lasting only a few days at a time. For about a month ice in the river is 3 or 4 inches thick. During periods of extreme drought there is little flow in the river, for there are no springs in the basin and the ground-water storage is insufficient to maintain the low-water flow. In wet seasons the ground becomes saturated, and heavy rains reach the river too rapidly for the streams to care for them. Large areas of bottom land throughout the entire length of the river are inundated by the floods, which cause a great amount of damage. Land drainage and flood control are therefore

subjects of much importance and are now under investigation. Little drainage work has been done in the uplands, but the bottoms have been drained to some extent. No water-power sites are available in this basin. The question of storage has not been studied.

The stations in this drainage are maintained in cooperation with the State of Illinois.

EMBARRASS RIVER NEAR OAKLAND, ILL.

This station, which is located at the highway bridge known as the "Antioch bridge," about 2 miles northwest of Oakland, Ill., on the county-line road to Hindsboro and Arcola, was established October 23, 1909, to obtain data for use in studying water supply, drainage, and flood-control problems.

Brushy Fork Creek enters from the left bank about 5 miles above the station. The total drainage area above the gaging station is 535 square miles.

The datum of the chain gage, attached to the bridge, has remained unchanged since its installation. The data are accurate and reliable. There was no flow at this station during a portion of the summer of 1908. The flood of 1897 reached a height of about 24 feet by the present gage datum.

Discharge measurements of Embarrass River near Oakland, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 22	H. J. Jackson	87	165	2.36	24
October 25	do	90	237	3.20	76
December 8	do	92	276	3.70	126

Daily gage height, in feet, of Embarrass River near Oakland, Ill., for 1909.

[A. J. McDanels, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	2.4	3.95	11	.....	2.5	3.95	21	.....	4.0	5.65
2	.....	2.45	3.8	12	.....	2.5	4.0	22	.....	4.9	5.4
3	.....	2.6	3.85	13	.....	2.45	7.5	23	2.85	6.7	5.2
4	.....	2.6	3.75	14	.....	2.5	8.7	24	3.2	6.6	5.15
5	.....	2.55	3.7	15	.....	2.55	8.65	25	3.2	6.4	5.1
6	.....	2.5	3.9	16	.....	2.8	7.9	26	3.1	5.85	5.1
7	.....	2.45	3.7	17	.....	4.6	6.8	27	2.9	4.65	5.0
8	.....	2.6	3.7	18	.....	5.0	6.2	28	2.65	4.3	4.9
9	.....	2.65	3.8	19	.....	4.55	6.0	29	2.6	3.9	4.5
10	.....	2.55	3.85	20	.....	4.1	5.75	30	2.45	3.85	4.4
								31	2.3	.....	4.25

NOTE.—Ice conditions existed from December 7 to 31. On December 8, 31 per cent of the discharge was under ice cover, this probably being the minimum amount of ice for the balance of the month.

Daily discharge, in second-feet, of Embarrass River near Oakland, Ill., for 1909.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		27	158	11		32		21		165	
2		30	140	12		32		22		316	
3		37	146	13		30	878	23	52	693	
4		37	134	14		32	1,190	24	76	671	
5		34	128	15		34	1,170	25	76	627	
6		32	152	16		49	975	26	68	508	
7		30	128	17		260	715	27	55	269	
8		37		18		336	583	28	40	210	
9		40		19		252	540	29	37	152	
10		34		20		179	488	30	30	146	
								31	22		

NOTE.—These discharges are based on a rating curve that is well defined between 22 and 1,270 second-feet. Discharges estimated equivalent to 117 second-feet for period December 8 to 12; 300 second-feet for December 21 to 25, and 200 second-feet for December 26 to 31.

Monthly discharge of Embarrass River near Oakland, Ill., for 1909.

[Drainage area, 535 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October 23–31	76	22	50.7	0.095	0.03	A.
November	693	27	178	.333	.37	A.
December	1,190		349	.652	.75	C.

EMBARRASS RIVER AT ST. MARIE, ILL.

This station which is located at the highway bridge at the north end of Main street, St. Marie, Ill., about 150 yards downstream from the Cincinnati, Hamilton & Dayton Railway bridge, was established October 20, 1909, to obtain data for use in studying problems of water supply, drainage, and flood control.

Hickory Creek, or North Fork Creek, enters from the left bank about 2½ miles below the station. The total drainage area above the gaging station is 1,540 square miles.

The datum of the chain gage, attached to the highway bridge, has remained unchanged since its installation. The data are accurate and reliable. The flood of the spring of 1908 reached a height of about 22.5 feet by the present gage.

Discharge measurements of Embarrass River at St. Marie, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 7 [a]	H. J. Jackson	97	634	3.48	245
August 7	do	111	432	3.44	236
October 20	do	112	368	2.89	181

[a] Measurement made from railroad bridge about 150 yards above regular section.

Daily gage height, in feet, of Embarrass River at St. Marie, Ill., for 1909.

[T. L. Britton, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	2.2	4.0	11	.....	2.2	4.0	21	2.85	3.7	5.4
2	.....	2.2	3.9	12	.....	2.2	4.6	22	2.45	3.5	5.4
3	.....	2.3	3.7	13	.....	2.2	12.0	23	2.25	5.8	5.4
4	.....	2.2	3.5	14	.....	2.2	16.1	24	3.1	10.0	.....
5	.....	2.2	3.5	15	.....	2.3	15.9	25	3.6	7.1	.....
6	.....	2.1	3.5	16	.....	2.3	14.0	26	2.9	6.2	.....
7	.....	2.15	3.7	17	.....	2.7	11.1	27	2.5	5.7	.....
8	.....	2.15	3.7	18	.....	4.4	8.8	28	2.4	5.1	.....
9	.....	2.15	3.5	19	.....	3.5	7.5	29	2.5	4.6	.....
10	.....	2.2	4.0	20	2.9	3.0	6.5	30	2.4	4.4	4.5
								31	2.3	.....	.....

NOTE.—Ice conditions from December 8 to 31. December 12 to 19 the ice was floated out by a rise. From December 20 to 31 river was frozen from bank to bank because of ice gorge below. Gage readings are to top of ice for December 10, 11, 22, 23, and 30.

Daily discharge, in second-feet, of Embarrass River at St. Marie, Ill., for 1909.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	113	367	11	.....	113	250	21	170	306	500
2	.....	113	346	12	.....	113	503	22	130	267	400
3	.....	119	306	13	.....	113	3,110	23	116	828	400
4	.....	113	267	14	.....	113	4,790	24	201	2,310	400
5	.....	113	267	15	.....	119	4,710	25	286	1,240	400
6	.....	108	267	16	.....	119	3,930	26	176	952	350
7	.....	110	306	17	.....	153	2,740	27	134	798	350
8	.....	110	250	18	.....	457	1,860	28	126	627	350
9	.....	110	250	19	.....	267	1,380	29	134	503	350
10	.....	113	250	20	176	188	800	30	126	457	350
								31	119	.....	350

NOTE.—Discharges December 8 to 11 and 20 to 31 have been estimated because of ice conditions. Other daily discharges are based on a rating well defined between 126 and 2,310 second-feet.

Monthly discharge of Embarrass River at St. Marie, Ill., for 1909.

[Drainage area, 1,540 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October 20–31	286	116	158	0.103	0.05	A.
November	2,310	108	372	.242	.27	A.
December	.....	.....	1,000	.649	.75	C.

WHITE RIVER DRAINAGE BASIN.

DESCRIPTION.

White River, the largest tributary of Wabash River, is formed by the junction of the East and West branches near Petersburg, Ind., and discharges into the Wabash above Mount Carmel, Ill. The area of the oval-shaped basin comprises about one-half of the Wabash drainage in Indiana, or one-sixth of the entire State.

The two branches rise in eastern Indiana at an elevation of about 1,000 feet and flow in a general southwesterly direction nearly across the State. The West Branch rises in Randolph County near the Ohio-Indiana State line, flows west to Hamilton County near the center of the State, then southwest to its junction with the East Branch. The East Branch is formed in Bartholomew County by several streams which have their sources in Henry and Hancock counties. Its course is south and west through Jackson, Lawrence, Martin, and Daviess counties to the junction with the West Branch.

The fall is much greater on the East and West branches of the White than on the Wabash, and these streams afford good water-power sites which have not been utilized to a great extent because of the abundance of cheap fuel.

EAST BRANCH OF WHITE RIVER AT SHOALS, IND.

This station, which is located at the highway bridge between East and West shoals, Ind., a short distance above the Baltimore & Ohio Southwestern Railroad bridge, was established June 25, 1903; discontinued July 21, 1906, and reestablished October 12, 1908. The data collected are for use in studying water power, water supply, and pollution problems.

The bed of the river is of solid rock and the estimates of the flow at this station should be excellent. Gage readings are taken from December 1 to May 31 by the United States Weather Bureau.

The datum of the chain gage, which is attached to the highway bridge, was raised 61 feet on January 1, 1909, so as to be the same as that used by the Weather Bureau. The records are reliable and accurate. The winters are mild in this vicinity and the winter flow is affected but little by ice.

Discharge measurements of East Fork of White River at Shoals, Ind., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 8	W. M. O'Neill	337	1,150	4.68	4,470
May 24	H. J. Jackson	333	1,060	4.48	3,930

Daily gage height, in feet, of East Fork of White River at Shoals, Ind., for 1909.

[O. H. Greist, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.2	14.7	3.8	9.1	11.4	4.45	3.65	2.85	2.4	3.4	4.1
2	2.3	2.2	13.6	3.7	8.0	10.1	4.15	3.6	2.8	2.4	3.3	3.95
3	2.3	2.3	11.1	3.7	7.4	7.4	3.95	3.85	2.8	2.3	3.15	3.8
4	2.3	2.4	8.4	3.5	6.6	6.0	3.65	4.3	2.7	2.3	3.05	3.75
5	2.3	2.6	6.4	3.5	6.1	5.4	3.5	4.1	2.7	2.3	3.0	3.6
6	2.3	2.7	5.5	3.6	6.1	5.3	4.5	3.75	2.6	2.3	3.0	3.5
7	2.3	2.8	5.0	5.3	6.0	5.7	7.2	3.45	2.55	2.3	2.9	3.6
8	2.3	2.7	4.8	5.6	5.6	6.0	6.25	3.35	2.5	2.3	2.9	3.9
9	2.3	2.7	6.8	6.7	4.9	5.9	5.45	3.2	2.5	2.3	2.85	3.65
10	2.3	2.6	14.4	7.9	5.0	5.9	5.15	3.1	2.5	2.3	2.8	3.3
11	2.3	2.7	15.2	7.0	6.4	6.0	4.95	3.05	2.75	2.3	2.8	3.65
12	2.3	2.7	14.8	6.1	8.0	6.0	5.45	3.1	3.0	2.3	2.75	5.05
13	2.2	2.8	16.2	5.4	8.8	7.1	8.8	3.0	3.25	2.3	2.7	7.35
14	2.2	3.1	17.2	5.4	8.7	6.7	10.9	3.0	3.05	2.3	2.7	8.7
15	2.3	4.7	15.6	5.3	8.0	5.4	8.85	3.0	2.85	2.2	2.7	8.75
16	2.3	5.1	12.2	5.2	6.8	4.8	7.9	3.0	2.75	2.2	2.8	9.2
17	2.4	5.2	8.8	5.0	6.7	4.4	8.0	3.1	2.65	2.3	3.05	8.65
18	2.4	5.6	6.4	4.8	7.8	4.2	7.9	3.1	2.5	2.4	3.2	8.05
19	2.4	5.6	5.3	4.5	7.7	4.0	7.1	3.15	2.5	2.4	3.2	6.8
20	2.4	5.7	4.8	4.7	6.5	3.9	5.85	3.25	2.4	2.4	3.1	5.4
21	2.4	5.7	4.6	5.3	5.6	3.8	4.8	3.3	2.4	2.85	3.25	4.4
22	2.3	5.8	4.5	8.5	5.0	3.8	4.2	3.3	2.4	3.55	3.45	4.4
23	2.3	6.2	4.3	8.4	4.7	3.7	3.95	3.2	2.4	3.55	3.8	4.3
24	2.3	10.4	4.2	8.4	4.6	3.6	3.75	3.2	2.4	3.65	4.0	4.0
25	2.3	12.2	4.0	7.2	4.4	3.6	3.6	3.25	2.4	3.8	4.2	3.7
26	2.4	12.2	4.0	6.2	4.4	3.6	3.6	3.35	2.4	3.95	4.6	4.05
27	2.4	13.2	4.1	5.6	5.3	3.7	3.6	3.4	2.4	4.25	5.15	4.3
28	2.4	14.3	4.0	5.0	7.6	4.1	3.55	3.4	2.4	4.25	5.15	3.7
29	2.4	.....	4.0	5.4	8.6	4.7	3.35	3.3	2.4	4.05	4.8	4.0
30	2.4	.....	3.9	7.4	9.0	4.6	3.5	3.1	2.4	3.75	4.4	4.0
31	2.3	.....	3.9	.....	10.2	.....	3.65	2.95	.....	3.55	.....	4.1

Daily discharge, in second-feet, of East Branch of White River at Shoals, Ind., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	410	340	22,600	2,460	13,900	17,600	4,120	2,160	940	490	1,720	3,180
2	410	340	20,900	2,260	12,000	15,600	3,310	2,070	880	490	1,560	2,800
3	410	410	17,200	2,260	10,800	10,800	2,800	2,570	880	410	1,340	2,460
4	410	490	12,700	1,890	9 240	7,950	2,160	3,710	770	410	1,200	2,360
5	410	670	8,820	1,890	8,170	6,560	1,890	3,180	770	410	1,130	2,070
6	410	770	6,800	2,070	8,170	6,320	4,250	2,360	670	410	1,130	1,890
7	410	880	5,580	6,320	7,950	7,270	10,400	1,800	625	410	1,000	2,070
8	410	770	5,060	7,040	7,040	7,950	8,500	1,640	580	410	1,000	2,680
9	410	770	9,650	9,450	5,320	7,730	6,680	1,410	580	410	940	2,160
10	410	670	22,100	11,800	5,580	7,730	5,960	1,270	580	410	880	1,560
11	410	770	23.300	10,000	8,820	7,950	5,450	1,200	825	410	880	2,160
12	410	770	22,700	8,170	12,000	7,950	6,680	1,270	1,130	410	825	5,700
13	340	880	24,800	6,560	13,400	10,200	13,400	1,130	1,480	410	770	10,700
14	340	1,270	26,300	6,560	13,200	9,450	16,800	1,130	1,200	410	770	13,200
15	410	4,790	23,900	6,320	12,000	6,560	13,500	1,130	940	340	770	13,300
16	410	5,830	18,800	6,080	9,650	5,060	11,800	1,130	825	340	880	14,100
17	490	6,080	13,400	5,580	9,450	3,980	12,000	1,270	720	410	1,200	13,100
18	490	7,040	8,820	5,060	11,600	3,440	11,800	1,270	580	490	1,410	12,000
19	490	7,040	6,320	4,250	11,400	2,920	10,200	1,340	580	490	1,410	9,650
20	490	7,270	5,060	4,790	9,030	2,680	7,620	1,480	490	490	1,270	6,560
21	490	7,270	4,520	6,320	7,040	2,460	5,060	1,560	490	940	1,480	3,980
22	410	7,500	4,250	12,800	5,580	2,460	3,440	1,560	490	1,980	1,800	3,980
23	410	8,390	3,710	12,700	4,790	2,260	2,800	1,410	490	1,980	2,460	3,710
24	410	16,000	3,440	12,700	4,520	2,070	2,360	1,410	490	2,160	2,920	2,920
25	410	18,800	2,920	10,400	3,980	2,070	2,070	1,480	490	2,460	3,440	2,260
26	490	18,800	2,920	8,390	3,980	2,070	2,070	1,640	490	2,800	4,520	3,050
27	490	20,300	3,180	7,040	6,320	2,260	2,070	1,720	490	3,580	5,960	3,710
28	490	22,000	2,920	5,580	11,200	3,180	1,980	1,720	490	3,580	5,960	2,260
29	490	.....	2,920	6,560	13,000	4,790	1,640	1,560	490	3,050	5,060	2,920
30	490	.....	2,680	10,800	13,800	4,520	1,890	1,270	490	2,360	3,980	2,920
31	410	.....	2,680	.....	15,700	.....	2,160	1,060	.....	1,980	.....	3,180

NOTE.—These discharges are based on a rating curve that is well defined between 340 and 4,000 second-feet.

Monthly discharge of East Branch of White River at Shoals, Ind., for 1909.

[Drainage area, 4,900 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	490	340	431	0.088	0.10	A.
February	22,000	340	5,960	1.22	1.27	B.
March	26,300	2,680	11,000	2.24	2.58	B.
April	12,800	1,890	6,800	1.39	1.55	B.
May	15,700	3,980	9,310	1.90	2.19	B.
June	17,600	2,070	6,130	1.25	1.40	B.
July	16,800	1,640	6,030	1.23	1.42	B.
August	3,710	1,060	1,640	.335	.39	A.
September	1,480	490	698	.142	.16	A.
October	3,580	340	1,140	.233	.27	A.
November	5,960	770	1,990	.406	.45	A.
December	14,100	1,560	5,120	1.04	1.20	B.
The year	26,300	340	4,690	.956	12.98	

LITTLE WABASH RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Little Wabash River lies in the southeastern part of the State of Illinois.

The river rises in the southwestern corner of Coles County, flows slightly southeastward, and discharges into Wabash River about 15 miles above its mouth, at the boundary line between White and Gallatin counties. Skillet Fork, its only important tributary, joins it not far above its mouth. The Little Wabash is about 150 miles long and its drainage area comprises 3,200 square miles. The elevation of the sources of the river is about 720 feet; at its mouth it is about 340 feet above sea level.

The basin is shaped somewhat like a parallelogram with the long sides north and south. The country is level or undulating. The soil, a rich black loam in the northern part, gradually changes into a yellow clay or "mulatto soil" in the southern part. There are no forested areas in this basin.

The annual rainfall is about 42 inches. The winters are mild; ice does not form very thick, and snowfall is light and does not last long.

No water-power sites exist anywhere in this basin.

The question of storage has not been investigated, though it is recognized as important in connection with the growing demand for water supplies and the general subjects of drainage and flood control. The United States Department of Agriculture is making a study of surface conditions with a view to formulating a plan for reclaiming and protecting areas that are overflowed during floods. Portions of the river have already been mapped for use in this study.

The gaging stations in this drainage are maintained in cooperation with the State of Illinois.

LITTLE WABASH RIVER NEAR CLAY CITY, ILL.

This station, which is located at the Baltimore & Ohio Southwestern Railroad bridge about 2 miles east of Clay City, Ill., was established October 3, 1908, to obtain data for use in studying problems of drainage and flood control.

Big Muddy Creek enters from the left bank about 5 miles below the section. The total drainage area above the gaging station is 808 square miles.

This station is at the toe of a horseshoe bend in the river, and the ground inside the bend along the railroad track is low. During high water the Little Wabash overflows into Little Muddy Creek, a branch of Big Muddy Creek, and in extreme high water also overflows into Big Muddy Creek, forming at such times a sheet of water about 4 miles wide along the railroad embankment. The discharge of the Little Wabash at the gaging station during extreme high water can not be determined on account of the above conditions, for the water which passes the gaging station includes some of the flood water of Big Muddy Creek. The station is not good for measurement of low-water flow because of comparatively large area of the section and low velocity of the current at low stages. Springs feed the river near the gaging station and the river has not been known to go dry at this point.

The datum of the chain gage, attached to the railroad bridge, has remained unchanged since its installation, and the records are reliable and accurate. Sufficient data have not yet been obtained to enable estimates of flow to be made.

Discharge measurements of Little Wabash River near Clay City, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 7	H. J. Jackson	59	266	7.62	157
November 6	do	50	182	6.10	18

Daily gage height, in feet, of Little Wabash River near Clay City, Ill., for 1909.

[W. F. Davis, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.9	11.9	11.2	7.7	9.5	8.6	8.7	.....	6.0	6.0	6.2	7.1
2	5.9	9.5	10.9	7.7	.....	10.2	7.9	.....	6.0	6.0	6.2	7.0
3	.....	8.0	8.8	7.6	8.3	9.2	7.3	8.4	6.0	.....	6.1	6.9
4	5.9	7.0	8.2	.....	8.1	9.2	.....	7.3	6.0	6.0	6.1	6.8
5	5.9	7.0	8.2	7.5	7.8	12.5	.....	7.0	.....	6.0	6.1	6.7
6	5.9	6.9	7.9	7.2	7.7	.....	6.6	6.8	6.0	6.0	6.0	6.65
7	5.9	11.3	.....	8.3	7.6	10.6	10.2	6.6	6.0	5.9	6.25	6.95
8	5.9	13.7	7.9	12.7	7.4	9.4	14.7	.....	6.0	5.9	6.7	7.1
9	5.9	12.9	18.3	17.4	.....	8.6	16.8	6.3	6.0	5.9	6.6	7.1
10	.....	9.2	18.7	18.0	9.1	8.5	17.2	6.3	.....	.....	6.3	7.1

Daily gage height, in feet, of Little Wabash River near Clay City, Ill., for 1909—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	5.9	9.2	18.8	.....	15.4	8.3	.....	6.3	.....	5.8	6.2	7.4
12	6.0	11.3	18.8	17.9	15.1	10.9	18.0	6.3	.....	5.8	6.8	12.4
13	6.0	8.6	18.6	12.5	11.9	.....	17.8	6.3	.....	5.8	7.5	17.05
14	6.0	.....	.....	18.1	10.0	10.6	17.6	6.3	6.4	5.8	7.4	18.1
15	6.0	13.0	15.9	18.6	12.6	12.6	17.8	.....	6.2	5.8	7.3	18.15
16	6.0	16.7	11.5	18.9	.....	10.8	18.1	6.2	6.0	5.8	7.4	18.4
17	.....	17.0	9.1	18.6	10.0	8.4	18.1	6.2	6.0	.....	9.4	17.8
18	6.0	17.0	8.9	.....	8.9	8.5	.....	6.2	6.0	6.4	10.7	13.4
19	6.0	13.7	8.1	13.6	8.3	9.5	18.0	6.2	.....	6.6	10.5	11.0
20	6.0	16.4	8.1	13.8	8.0	.....	17.8	6.2	6.0	.....	9.05	9.8
21	6.0	.....	.....	14.5	7.6	7.4	15.0	6.2	6.0	9.3	9.0	8.4
22	6.0	18.0	7.9	16.3	7.3	7.4	10.3	.....	6.2	8.6	7.7	8.4
23	6.0	18.5	7.6	17.3	.....	7.5	8.3	6.2	7.6	7.6	10.7	7.9
24	.....	18.5	7.6	17.4	7.1	7.5	7.8	6.2	9.1	.....	14.0	7.4
25	7.4	18.4	7.6	.....	7.0	7.8	.....	6.0	8.2	7.7	15.0	7.4
26	7.4	18.2	8.9	13.3	7.0	9.5	7.4	6.0	.....	7.8	11.9	7.25
27	7.4	18.2	9.2	9.9	7.6	.....	7.2	6.0	7.0	7.7	9.6	7.1
28	7.0	.....	.....	8.9	12.3	10.1	7.1	6.0	6.8	7.0	8.1	7.1
29	6.9	.....	8.3	10.1	10.8	9.3	7.1	.....	6.2	6.8	7.6	7.0
30	6.9	.....	7.9	12.0	.....	8.3	7.1	6.0	6.1	6.4	7.25	6.9
31	.....	.....	7.8	.....	.....	.....	.....	6.0	.....	.....	.....	6.9

NOTE.—River frozen over on January 12. Flow was affected by ice from December 8 to 31. Gage heights are to top of ice from December 22 to 31.

LITTLE WABASH RIVER NEAR GOLDEN GATE, ILL.

This station, which is located at the Southern Railway bridge about 1 mile west of Golden Gate, Ill., was established August 17, 1908, to procure data for use in drainage and flood control investigations.

Elm Creek enters from the right bank about 3 miles above the station. The total drainage area above the gaging station is 1,780 square miles.

The datum of the chain gage, which is attached to the railroad bridge, has not been changed since its installation, and the records are accurate and reliable.

The stream does not go dry at this point.

During high water there is flow through three openings in the railroad embankment east of the main channel. All of the flood flow can be measured. No reliable estimates of discharge can yet be made because of the backwater conditions which are known to exist at this station.

Discharge measurements of Little Wabash River near Golden Gate, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
March 10	W. M. O'Neill	1,220	9,750	23.50	9,650
May 4	H. J. Jackson	88	578	6.00	351
May 5	do	85	550	5.60	306
November 11	do	75	311	2.80	60

Daily gage height, in feet, of Little Wabash River near Golden Gate, Ill., for 1909.

[Henry Chalcraft, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	2.8	22.8	4.8	11.0	7.7	7.7	4.1	2.5	2.6	3.3	4.7
2	1.8	2.7	22.4	4.5	9.1	5.3	7.7	4.0	2.6	2.4	3.0	4.3
3	1.9	3.3	21.8	3.8	8.0	5.1	6.9	4.9	2.4	2.3	2.6	4.0
4	1.8	4.4	21.0	4.3	7.5	6.9	5.5	5.8	2.3	2.1	2.5	3.8
5	1.7	4.8	19.2	4.1	6.1	10.9	4.5	4.9	2.3	2.3	2.4	4.0
6	1.7	4.0	16.1	4.1	5.7	14.4	4.0	4.7	2.3	2.2	2.7	4.1
7	1.7	3.9	16.1	5.8	5.2	14.9	3.5	3.8	2.2	2.2	2.4	4.2
8	1.6	4.1	17.7	4.2	5.1	15.5	.....	3.4	2.2	2.2	2.3	3.7
9	1.6	5.9	22.8	5.8	5.7	14.5	7.3	3.2	2.3	2.1	2.4	4.0
10	1.6	8.9	22.6	11.1	5.8	11.5	9.9	3.7	3.5	2.2	2.4	4.2
11	1.6	7.5	24.8	12.1	5.2	9.7	12.7	2.9	4.3	2.2	2.7	4.3
12	1.6	7.6	25.8	13.8	8.0	6.6	13.8	2.8	6.2	2.1	3.4	6.4
13	1.6	7.7	25.2	15.4	8.7	7.8	14.2	3.0	5.9	2.1	3.7	13.6
14	1.6	10.6	25.1	16.6	8.9	11.0	15.3	3.3	4.9	2.0	3.8	16.3
15	1.6	15.5	24.8	17.6	9.0	9.9	15.5	3.0	4.6	2.1	6.1	17.3
16	1.6	16.0	24.5	18.1	8.4	9.1	17.4	2.9	3.6	1.9	6.1	18.4
17	1.6	17.0	24.0	18.1	9.0	9.0	18.2	3.0	3.0	2.2	7.7	19.1
18	1.6	16.1	23.5	17.8	7.2	8.0	18.3	2.9	2.7	2.5	9.0	19.1
19	1.6	16.1	22.8	18.2	7.3	6.4	18.3	2.7	2.6	2.7	10.0	19.0
20	1.7	18.0	21.6	20.6	7.2	5.9	18.2	2.6	2.5	2.9	9.8	19.0
21	1.7	18.7	19.5	22.1	7.1	5.8	17.6	2.5	2.4	3.6	7.5	18.8
22	1.9	18.8	17.3	22.4	6.9	6.1	17.1	2.4	2.6	3.7	6.7	17.9
23	2.1	19.1	13.3	22.2	4.9	5.1	16.9	2.5	3.1	5.6	6.0	14.3
24	2.0	20.9	9.5	21.8	4.1	6.9	16.7	2.4	3.1	5.7	8.2	8.5
25	2.3	22.0	5.8	21.8	4.0	9.1	15.7	2.3	3.0	6.1	12.0	7.5
26	2.8	22.5	5.3	21.8	4.2	10.1	10.5	2.3	4.9	5.3	13.2	5.4
27	2.7	23.5	5.2	19.0	4.9	9.1	10.4	2.4	4.6	4.7	12.8	5.4
28	3.2	22.8	6.6	18.0	6.7	8.8	10.6	2.3	3.6	4.6	11.1	4.6
29	3.9	.....	7.0	17.3	8.3	8.2	4.7	3.3	3.5	4.5	8.0	4.1
30	3.6	.....	6.6	9.3	9.9	8.5	4.7	2.4	3.1	4.0	6.7	4.0
31	3.0	.....	5.5	.....	7.7	.....	4.4	2.5	.....	3.6	.....	3.9

NOTE.—Ice conditions existed from December 8 to 31. On December 31 ice was 3 inches thick at, above and below the gage.

LITTLE WABASH RIVER AT CARMI, ILL.

This station, which is located at the highway bridge in the northeastern part of Carmi, Ill., about one-fourth mile below the bridge of the Big Four and Louisville & Nashville railroads, was established October 9, 1908, to obtain data for use in studying problems connected with drainage, flood control, and levee construction.

Skillet Fork River enters on the right bank about 4½ miles above the station. The drainage area above the gaging section is 3,090 square miles.

The relation between discharge and gage height at this station is affected by backwater from Wabash and Ohio rivers, especially during extreme floods. (See Pl. V.) There is but one channel at all stages.

The datum of the chain gage, attached to the highway bridge, has remained unchanged since its installation. The records are accurate and reliable, but are affected by backwater as stated above.

The data thus far obtained are insufficient to enable estimates of the flow to be made.

Discharge measurements of Little Wabash River at Carmi, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec-ft.*
May 1	H. J. Jackson	222	2,290	13.30	4,880
May 2	do	187	1,080	7.61	2,140
November 12	do	125	115	1.88	65

Daily gage height, in feet, of Little Wabash River at Carmi, Ill., for 1909.

[Noah Weigant, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	2.3	23.3	3.2	12.7	4.8	4.6	2.4	1.8	2.2	2.3	3.4
2	1.8	2.3	23.65	2.9	7.75	3.8	4.1	2.6	1.8	2.1	2.2	2.85
3	1.9	2.2	23.65	2.7	5.4	3.2	3.7	3.5	1.8	2.0	2.1	2.6
4	1.9	2.5	23.45	2.6	4.75	5.8	3.5	3.7	1.8	2.0	2.0	2.45
5	2.3	3.1	22.9	2.5	4.6	6.8	3.0	3.7	1.8	1.9	2.0	2.4
6	2.6	3.0	21.7	2.4	4.7	9.0	2.6	3.3	1.8	1.9	1.9	2.35
7	2.4	2.7	19.45	3.0	5.2	10.8	2.5	2.6	1.8	1.8	1.9	2.35
8	2.2	2.7	17.75	4.0	5.8	11.7	2.7	2.4	1.8	1.8	1.9	2.3
9	2.0	2.9	22.35	3.9	6.5	11.7	2.5	2.2	1.8	1.8	1.9	2.25
10	2.0	3.3	23.0	4.0	6.9	10.6	3.3	2.1	2.2	1.8	1.9	2.3
11	2.2	4.5	22.8	5.8	7.1	7.9	6.1	2.1	2.4	1.7	1.8	2.8
12	2.3	4.9	23.85	6.9	6.9	5.2	7.9	2.0	2.4	1.7	1.8	4.5
13	2.1	5.7	25.55	9.4	6.8	7.1	16.0	2.0	3.0	1.7	2.0	6.3
14	1.9	8.15	26.9	12.9	7.5	9.1	15.7	1.9	3.3	1.7	2.2	10.05
15	1.9	12.4	27.75	13.7	7.5	9.3	14.0	1.9	3.0	1.7	2.3	12.1
16	1.9	13.45	28.1	14.5	6.5	9.1	19.9	1.9	2.6	1.7	3.0	13.05
17	1.9	13.7	28.05	15.2	5.3	8.3	18.6	1.9	2.4	1.7	4.15	13.9
18	1.9	14.2	27.6	15.75	5.5	7.1	16.4	1.9	2.2	1.7	4.7	14.35
19	1.9	16.45	27.0	16.25	5.1	5.3	14.1	1.9	2.1	1.8	5.3	14.75
20	1.8	17.65	26.1	19.4	4.2	3.8	12.7	1.9	2.0	1.9	6.5	14.75
21	1.9	17.2	24.9	20.85	3.4	3.4	11.8	1.9	1.9	2.0	6.5	13.9
22	1.9	16.85	23.15	21.4	3.0	3.4	11.0	1.8	2.1	2.0	5.4	13.25
23	1.9	20.8	20.5	21.5	2.7	3.4	10.5	1.8	2.0	2.4	4.3	12.5
24	2.0	22.3	15.95	21.6	2.5	3.3	10.2	1.8	2.0	2.7	3.65	10.0
25	2.0	21.95	9.8	21.55	2.6	4.7	9.8	1.8	2.1	3.0	5.2	6.0
26	2.3	21.8	5.0	21.3	2.6	6.8	8.8	1.8	2.4	3.0	7.3	3.8
27	2.4	22.15	3.55	20.5	5.5	6.3	6.0	1.8	2.7	3.0	8.4	3.15
28	2.4	22.7	3.2	19.2	5.2	5.5	3.6	1.8	2.7	2.9	7.95	2.95
29	2.5	.....	3.45	16.9	5.0	5.0	2.9	1.8	2.5	2.7	6.55	3.15
30	2.5	.....	3.7	17.05	6.3	4.7	2.6	1.8	2.3	2.6	4.7	3.15
31	2.4	.....	3.4	.....	6.0	.....	2.4	1.8	.....	2.4	.....	3.0

NOTE.—River frozen at bridge on January 12. Ice conditions existed from December 8 to 31.

SKILLET FORK NEAR WAYNE CITY, ILL.

This station, which is located at the Southern Railway bridge, about 1 mile east of Wayne City, Ill., was established August 16, 1908, to obtain data for use in studying problems of drainage and flood control.

Horse Creek enters on the right bank about 4 miles above the section. The drainage area above the gaging section is 481 square miles.

The datum of the chain gage, which is attached to the railroad bridge, has remained unchanged since its installation, and the records are accurate and reliable.

A. LOW WATER.

B. HIGH WATER.

LITTLE WABASH RIVER AT CARMI, ILL.

Discharge measurements of Skillet Fork near Wayne City, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 19	R. J. Taylor	136	1,150	12.36	1,430
March 11	W. M. O'Neill	648	5,140	20.75	8,260
November 10 [a]	H. J. Jackson	24	45	2.54	4

[a] Made from boat about 500 feet below bridge.

Daily gage height, in feet, of Skillet Fork near Wayne City, Ill., for 1909.

[Evert Higdon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	2.7	5.0	2.8	3.2	3.4	3.9	8.2	2.0	2.4	2.6	2.0
2	2.1	2.6	4.1	2.6	2.8	3.0	3.8	3.2	2.1	2.3	2.7	2.8
3	2.1	2.8	3.5	2.4	2.7	4.2	3.6	3.1	2.2	2.3	2.7	2.7
4	2.1	2.7	3.2	2.6	2.6	11.2	3.4	3.0	2.1	2.2	2.8	2.7
5	2.2	2.6	3.2	2.8	2.8	14.1	3.0	2.8	2.1	2.2	2.8	2.7
6	2.2	2.9	2.6	2.7	2.6	16.3	2.4	2.6	1.9	2.2	2.7	2.85
7	2.1	3.1	3.1	4.0	2.7	7.5	2.4	2.9	1.9	2.2	2.6	2.9
8	2.0	4.2	3.6	5.6	2.8	4.5	2.4	2.7	2.0	2.1	2.6	2.9
9	2.1	4.2	3.1	7.7	2.9	3.3	3.3	2.5	4.2	2.0	2.6	3.0
10	2.0	4.9	21.1	5.6	3.0	3.2	3.9	2.5	4.9	2.0	2.55	3.1
11	2.1	4.9	21.8	4.8	3.2	3.0	4.2	2.4	3.5	2.0	2.55	3.15
12	2.2	4.6	21.3	4.2	3.6	2.9	9.2	2.3	3.0	1.9	5.65	3.6
13	2.2	4.9	20.6	5.6	4.0	6.8	9.5	2.3	3.1	1.9	8.15	17.6
14	2.2	8.5	19.6	16.5	4.8	8.5	10.3	2.2	2.8	1.9	8.3	18.8
15	2.3	11.6	12.0	19.6	8.6	7.8	13.4	2.1	2.6	2.0	5.8	18.7
16	2.3	17.4	5.6	19.0	8.4	3.6	4.1	2.2	2.5	2.0	5.85	18.0
17	2.0	9.3	4.1	18.2	6.2	5.4	3.7	2.2	2.4	2.0	9.4	13.3
18	2.1	7.5	3.5	12.2	3.5	4.3	3.5	2.2	2.3	2.1	10.9	6.7
19	2.2	7.5	3.1	5.2	3.4	6.8	2.9	2.1	2.3	2.1	8.5	5.0
20	2.2	18.4	2.9	12.4	2.8	4.3	3.0	2.1	2.3	4.1	5.4	4.7
21	2.9	17.2	2.6	18.3	2.5	2.6	3.6	2.0	2.4	4.2	3.9	3.55
22	2.8	13.0	2.9	19.0	2.3	2.8	3.1	2.0	2.9	4.7	3.4	3.0
23	2.9	18.2	2.6	19.2	2.0	2.6	2.9	2.1	5.1	3.2	4.85	2.9
24	2.9	20.6	2.5	18.3	2.5	6.4	2.7	2.2	5.7	5.2	10.3	2.8
25	2.8	20.3	2.7	17.4	2.5	4.6	2.6	2.1	3.7	4.7	10.9	2.7
26	2.9	18.0	2.8	11.3	2.5	4.5	2.5	2.2	3.0	3.3	5.8	2.5
27	2.7	13.0	2.7	8.5	11.2	4.4	2.5	2.2	2.8	3.1	4.3	2.55
28	2.6	7.1	5.2	3.2	14.1	4.6	2.4	2.0	2.7	2.8	3.5	2.5
29	2.9	.....	3.7	2.9	6.6	3.9	2.5	1.9	2.5	2.7	3.1	2.45
30	2.6	.....	3.1	3.3	6.3	4.0	6.5	1.9	2.4	2.6	3.0	2.4
31	2.9	.....	2.8	.....	6.4	.....	7.9	1.9	.....	2.6	.....	2.35

NOTE.—Ice conditions existed from December 8 to 31. Ice does not form at the gage, but was about 6 inches thick above and below the gage on December 31.

Daily discharge, in second-feet, of Skillet Fork near Wayne City, Ill., for 1908–9.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.						1908.					
1	.....	2.0	1.2	2.0	5.0	16	3.5	1.4	1.1	1.2	2.0
2	.....	2.0	1.1	1.7	7.0	17	3.5	1.4	1.2	1.1	1.4
3	.....	2.0	1.1	1.4	8.5	18	3.5	1.4	1.4	1.4	2.5
4	.....	2.0	1.2	1.1	2.5	19	3.5	1.4	1.7	1.7	2.0
5	.....	2.0	1.7	1.7	2.5	20	3.5	1.2	1.4	1.2	1.7
6	.....	2.0	1.2	1.2	3.5	21	3.5	1.2	1.1	1.4	2.0
7	.....	2.0	1.7	1.4	5.0	22	3.5	1.1	1.2	1.4	2.5
8	.....	2.0	1.4	1.7	7.0	23	3.5	1.1	1.7	1.2	3.5
9	.....	2.0	1.1	2.0	1.7	24	3.5	1.1	1.4	1.7	2.0
10	.....	2.0	1.2	1.4	1.4	25	3.5	1.2	1.1	2.0	1.7
11	.....	1.7	1.4	1.2	1.2	26	3.5	1.2	1.0	1.4	2.0
12	.....	1.7	1.7	1.7	1.7	27	2.5	1.1	1.2	1.1	2.0
13	.....	1.7	1.4	2.0	2.5	28	2.5	1.7	1.4	1.2	2.0
14	.....	1.7	1.4	1.7	1.7	29	2.0	1.4	1.1	19	1.4
15	.....	1.4	1.2	1.4	1.4	30	2.0	1.4	1.2	10	2.0
						31	2.0	.....	1.4	.....	2.5

Daily discharge, in second-feet, of Skillet Fork near Wayne City, Ill., for 1908–9—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
1	2.5	19	190	25	55	70	107	499	2.0	7.0	14	2.0
2	2.5	14	122	14	25	40	100	55	2.5	5.0	19	25
3	2.5	25	77	7.0	19	130	85	47	3.5	5.0	19	19
4	2.5	19	55	14	14	992	70	40	2.5	3.5	25	19
5	3.5	14	55	25	25	1,850	40	25	2.5	3.5	25	19
6	3.5	32	14	19	14	2,860	7.0	14	1.7	3.5	19	28
7	2.5	47	47	115	19	420	7.0	32	1.7	3.5	14	32
8	2.0	130	85	235	25	152	7.0	19	2.0	2.5	14	32
9	2.1	130	47	442	32	62	62	10	130	2.0	14	40
10	2.0	182	6,960	235	40	55	107	10	182	2.0	12	47
11	2.5	182	7,760	175	55	40	130	7.0	77	2.0	12	51
12	3.5	160	7,180	130	85	32	630	5.0	40	1.7	238	85
13	3.5	182	6,420	235	115	343	678	5.0	47	1.7	493	3,640
14	3.5	535	5,400	2,960	175	535	814	3.5	25	1.7	511	4,620
15	5.0	1,080	1,180	5,400	547	453	1,600	2.5	14	2.0	250	4,520
16	5.0	3,500	235	4,800	523	85	122	3.5	10	2.0	254	3,930
17	2.0	646	122	4,100	283	220	92	3.5	7.0	2.0	662	1,560
18	2.5	420	77	1,230	77	137	77	3.5	5.0	2.5	930	333
19	3.5	420	47	205	70	343	32	2.5	5.0	2.5	535	190
20	3.5	4,260	32	1,280	25	137	40	2.5	5.0	122	220	167
21	32	3,380	14	4,180	10	14	85	2.0	7.0	130	107	81
22	25	1,460	32	4,800	5.0	25	47	2.0	32	167	70	40
23	32	4,100	14	5,000	2.0	14	32	2.5	197	55	178	32
24	32	6,420	10	4,180	10	303	19	3.5	242	205	814	25
25	25	6,110	19	3,500	10	160	14	2.5	92	167	930	19
26	32	3,930	25	1,010	10	152	10	3.5	40	62	250	10
27	19	1,460	19	535	992	145	10	3.5	25	47	137	12
28	14	376	205	55	1,850	160	7.0	2.0	19	25	77	10
29	32	.....	92	32	323	107	10	1.7	10	19	47	8.5
30	14	.....	47	62	293	115	313	1.7	7.0	14	40	7.0
31	32	.....	25	.....	303	.....	464	1.7	.....	14	.....	6.0

NOTE.—These discharges are based on a rating curve that is fairly well defined between 2.0 and 1,180 second-feet.

Monthly discharge of Skillet Fork near Wayne City, Ill., for 1908–9.

[Drainage area, 481 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1908.						
August 16–31	3.5	2.0	3.09	0.0064	0.004	B.
September	2.0	1.1	1.58	.0033	.004	C.
October	1.7	1.0	1.31	.0027	.003	C.
November	19	1.1	2.35	.0049	.005	C.
December	7.0	1.2	2.61	.0054	.006	C.
1909.						
January	32	2.0	11.3	.023	.03	B.
February	6,420	14	1,400	2.91	3.03	B.
March	7,760	10	1,180	2.45	2.82	B.
April	5,400	7.0	1,500	3.12	3.48	B.
May	1,850	2.0	195	.405	.47	B.
June	2,860	14	338	.703	.78	B.
July	1,600	7.0	188	.391	.45	B.
August	499	1.7	26.3	.055	.06	B.
September	242	1.7	41.2	.086	.10	B.
October	205	1.7	34.9	.073	.08	B.
November	930	12	231	.480	.54	B.
December	4,620	2.0	633	1.32	1.52	B.
The period	7,760	1.7	482	1.00	13.36	

SKILLET FORK NEAR MILL SHOALS, ILL.

This station, which is located at the Baltimore & Ohio Southwestern Railroad bridge about 1 mile south of Mill Shoals, Ill., was established October 9, 1908, to obtain data for use in studying drainage and flood control problems.

Griffin Creek joins the river on the left bank about 1½ miles above the station, and Haw Creek enters on the right bank about 5 miles above the station. The drainage area above the gaging section is 912 square miles.

The datum of the chain gage, attached to the railroad bridge, has remained unchanged since its installation, and the records are accurate and reliable. There is but one channel at all stages, and the entire flood discharge can be measured at the regular section. The data at present are insufficient for a determination of the flow on account of the backwater conditions.

Discharge measurements of Skillet Fork near Mill Shoals, Ill., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	H. J. Jackson	61	198	5.22	214
November 9	do	38	31	2.26	11

Daily gage height, in feet, of Skillet Fork near Mill Shoals, Ill., for 1909.

[J. A. Clow, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	3.0	21.0	4.5	11.4	5.7	4.1	5.6	1.4	2.4	2.6	3.4
2	.....	3.0	20.1	3.7	8.8	4.5	3.7	6.4	1.4	2.2	2.6	3.3
3	.....	3.2	18.0	3.5	5.2	5.6	3.5	8.9	1.4	2.2	2.4	3.2
4	1.6	3.4	14.5	3.4	4.9	9.3	3.0	8.5	1.4	2.0	2.3	3.2
5	1.6	3.4	13.0	3.3	4.4	13.8	2.5	7.3	1.4	2.0	2.2	3.1
6	.....	4.0	12.5	4.8	4.1	14.6	2.5	3.5	1.4	2.0	2.2	2.9
7	1.6	4.3	10.5	8.4	3.9	14.5	2.5	3.4	1.4	2.0	2.2	2.7
8	.....	4.5	11.0	8.3	3.9	13.1	2.3	3.2	1.4	2.0	2.2	2.6
9	1.6	4.5	18.5	8.2	4.5	8.9	2.3	3.0	1.4	1.5	2.2	2.7
10	.....	4.9	19.8	8.4	5.6	6.8	3.8	2.8	1.7	1.5	2.2	3.5
11	1.6	5.4	23.3	6.4	6.6	4.7	5.3	2.7	1.9	1.5	2.2	3.9
12	1.6	5.8	24.1	5.5	6.2	4.2	8.1	2.5	4.7	1.8	2.2	6.3
13	1.6	6.5	24.2	7.2	5.4	6.9	13.1	2.4	4.0	1.6	2.2	12.3
14	1.6	11.4	24.4	15.5	5.3	10.9	14.7	2.1	3.7	1.6	2.2	15.0
15	1.6	15.5	24.1	16.8	5.7	13.85	14.3	2.0	3.4	1.5	4.6	15.5
16	1.6	15.9	23.6	17.9	6.5	12.2	15.0	2.0	2.8	1.5	6.6	15.9
17	1.6	16.4	23.0	18.3	7.0	8.8	11.0	1.8	2.6	1.5	6.8	16.3
18	1.6	16.9	22.6	17.8	6.0	5.9	6.3	1.7	2.4	1.6	7.6	16.4
19	1.6	17.8	21.8	17.6	5.1	4.8	5.4	1.6	2.3	2.0	9.5	15.1
20	1.6	17.5	21.0	18.3	4.6	4.6	5.3	1.6	2.2	2.0	8.5	9.3
21	1.6	17.8	19.4	18.8	3.8	4.5	5.0	1.6	2.2	2.5	7.3	8.0
22	1.6	18.0	18.0	19.5	3.3	3.8	4.5	1.6	2.2	3.5	5.0	6.3
23	1.6	19.0	17.3	19.9	3.0	4.5	3.8	1.6	2.9	4.0	5.0	5.2
24	1.6	20.4	15.1	20.1	2.7	5.5	3.6	1.5	4.9	4.0	6.1	5.0
25	1.9	20.9	13.2	20.2	2.7	6.6	3.4	1.5	4.3	5.0	9.5	4.5
26	3.5	21.0	8.9	20.0	3.0	6.9	3.0	1.4	4.1	5.2	8.9	3.5
27	3.5	21.2	5.4	19.3	6.4	6.7	2.5	1.4	3.6	4.2	7.8	3.4
28	3.5	21.4	5.9	17.8	9.9	5.7	2.4	1.4	3.1	3.9	6.3	3.2
29	3.5	.....	5.9	14.8	12.4	5.5	2.2	1.4	2.8	3.5	5.2	3.1
30	3.3	.....	4.9	12.4	10.9	5.0	2.1	1.4	2.5	3.0	4.0	3.0
31	3.0	.....	4.5	.....	8.9	.....	2.5	1.4	.....	2.8	.....	3.0

NOTE.—The flow was affected by frozen conditions from December 8 to 31. Gage heights are to top of ice from December 29 to 31.

TENNESSEE RIVER DRAINAGE BASIN.

DESCRIPTION.[a]

Tennessee River gathers its waters from seven States—Virginia, North Carolina, Georgia, Tennessee, Alabama, Mississippi, and Kentucky. Its drainage area comprises about 39,000 square miles, and its extreme range discharge to the present time has been estimated at about 650,000 second-feet for flood stages and about 8,000 second-feet for low stages.

The exact point at which Tennessee River begins was long a matter of uncertainty. Rivière des Cheraquis, or Cherake, of the early French explorers, and Cherokee River, as referred to in cessions to the English by the Indians in 1767, has been considered as being formed by the junction of what are now called Little Tennessee and Holston rivers, near the town of Lenoirs, Tenn. Tannassee, the chief town of the Cherokee Indians, was situated near this point, and the fact that the river derives its present name from that town seems to add weight to the arguments of the geographers who have placed the headwaters of the river at this junction. In some of the older geographies the head of this river has been placed at the mouth of Clinch River.

The legislature of the State of Tennessee in 1889 passed an act declaring "that the Tennessee extends from its junction with the Ohio River at Paducah, in the State of Kentucky, past the Clinch and French Broad rivers, to the junction of the north fork of the Holston River with the Holston at Kingsport, in Sullivan County, Tenn., all usages to the contrary notwithstanding."

Congressional legislation in several laws appropriating money for the improvement of the upper Tennessee between Knoxville and Chattanooga has given authority for extending the name at least to the former city. In the river and harbor act of 1890 the head of Tennessee River appears to have been definitely fixed by the specific language of the act providing for a survey of Tennessee River from Chattanooga to the junction of Holston and French Broad rivers.

The Tennessee is, therefore, here considered as beginning at the junction of the French Broad and Holston rivers, which are designated headwater tributaries; and in determining the order in which the various tributaries and their gaging stations are described, the French Broad is regarded as the main stream.

The French Broad, the largest tributary stream in the system, heads in the Blue Ridge Mountains in Transylvania County, N. C., where the mountain peaks and ridges have an elevation of more than 5,000 feet above sea level. The headwater creeks descend very rapidly until they reach an elevation of about 2,200 feet at a point above

[a] Description abstracted in part from Rept. Chief Engineers, U. S. Army, 1893, pt. 3, p. 2330; 1897, pt. 3, pp. 2247, 2249, 2250.

Brevard, N. C., below which the river, though yet quite small, flows with a smooth current through a flat valley of considerable width for some 50 miles to the vicinity of Asheville, N. C. Among the tributaries entering this portion of the French Broad are Davidsons and Mills rivers, both of which are small, rapid streams flowing southeastward from the highest mountains in this part of the drainage area, the Pisgah Ridge with its numerous knobs and peaks. Excepting the cultivated districts in the immediate river valley, this part of the area is largely in forest land, much of which, especially in the basins of Davidsons and Mills rivers, lies in the forest reserves of the Biltmore estates.

The river flows at first northeastward, but its course becomes nearly due north before it reaches Asheville; below Asheville, where its general course is northwestward, at right angles to the mountain ridges, it descends rapidly from an extensive plateau region in the midst of the Appalachian Mountains, cutting through the Unaka Mountains, which form its northwestern rim, and passing to the Appalachian Valley. The river channel is narrow and canyon like, with steep, rocky bluffs which give a very rugged appearance to the adjacent country when viewed from the river, although it is really a broad, elevated basin, comparatively smooth and mostly cleared and in cultivation. Farther down in the vicinity of the North Carolina-Tennessee State line, where the mountain ranges are higher, and up the tributary streams a long way from the river, the area is mostly forested.

Opportunities for water-power development on the French Broad are very great, the fall in the river from Asheville down to the state line being 800 feet in 45 miles. Special engineering problems would have to be solved, however, in making developments, as the tracks of the Southern Railway lie along the river, usually just above the water's edge, for its entire length.

For the remainder of its course, about 90 miles in length, the French Broad has a much flatter grade and flows through a valley which widens rapidly into the broad agricultural valley of the upper Tennessee and Holston rivers.

Tennessee River, below the junction of its headwater tributaries, flows southwestward, crossing into Alabama about 40 miles below Chattanooga, Tenn. At Gunthersville, Ala., it turns almost a right angle and flows northwestward past the corner of Mississippi into Tennessee for the second time, then almost due north across the State, emptying into Ohio River at Paducah, about 40 miles above Cairo.

French Broad River has at its mouth a drainage area of 4,800 square miles. The Holston is somewhat smaller, having 3,750 square miles of drainage area. Fifty miles below, in Loudon County, Tenn., the Little Tennessee River contributes its area of 2,650 square miles, and

at Kingston, 30 miles farther down, the Clinch, with its nearly 4,400 square miles of drainage area, is added. Hiwassee River, having about 2,700 square miles of basin, enters 50 miles below the mouth of the Clinch, and is the last of the five large tributaries which combine to make up a great river within the comparatively short distance of 130 miles. Indeed, with the exception of Duck River, with between 3,000 and 4,000 square miles of area, which enters the lower portion of the Tennessee 100 miles above its mouth, all other tributaries in the 500 miles of length below the Hiwassee are comparatively small.

The first large tributary of the French Broad River, Pigeon River, rises among the Balsam and Pisgah mountains, cuts its way through the Great Smoky Mountains, thus passing to the Appalachian Valley, and joins the French Broad a short distance below Newport, Tenn. It drains an interior agricultural basin which is oval in outline, the longer axis northwest, parallel to the general course of the stream and almost entirely within the Appalachian Mountain region. It is circumscribed by lofty mountains, with many peaks more than 6,000 feet in altitude. Many minor ranges springing from the surrounding mountains converge toward the middle of the basin, dividing it into deep, narrow valleys except near its upper end between the towns of Canton and Waynesville, where there is a broad open valley of alluvial plains and rolling hills, dotted with low mountains. The basin has an area of about 667 square miles.

Nolichucky River, the second large tributary of French Broad River, is formed by the junction of Toe and Caney rivers about 8 or 9 miles east of the Tennessee State line. The river flows almost due north for several miles, then turns toward the northwest and flows in a deep gorge through the Unaka Mountains into Tennessee near Embreville, where, preserving its general westerly direction, it finally enters the French Broad about 7½ miles southeast of Morristown and about 5 miles below the mouth of Pigeon River. Its tributaries, like the main stream, rise near the summits of mountain chains and flow over rocky and precipitous beds through narrow valleys. The total fall of the river between the junction of the North and South Toe and Embreville is about 850 feet, in a distance following the course of the river of about 40 miles. The whole area is subject to sudden and violent rains, producing great floods. The rainfall over the basin is about 51.0 inches per annum.

The rocks of the upper portion of the drainage basins of French Broad River and other eastern tributaries heading in the Appalachian Mountains include the older granites, quartzites, conglomerates schists, shales, and sandstones.

The Cumberland Plateau, drained in part by Clinch River and other western tributaries of the Tennessee and crossed by Tennessee

River below Chattanooga, comprises widespread beds of limestone and extensive deposits of coal.

Tennessee River has always held an important place in the projects for the improvement of the navigable waterways of the country. The Muscle Shoals Canal having been opened to navigation the river is now navigable from its mouth for a distance of 673 miles during several months of the year, and as work is continued upon other less formidable obstructions the season of navigation will he correspondingly lengthened. The river channel, especially at low stages, is mainly a succession of pools of comparatively deep water with smooth surfaces separated by bars or ledges where most of the fall is concentrated. These ridges, many of which are solid rock ledges, are usually at the wider parts of the river channel, and are the obstructions to low-water navigation, causing shallow and swift water at such stages. The radical improvement of this river, so as to make navigation continuous throughout its length for boats of moderate draft, is by no means impossible.

In connection with navigation projects a large amount of water power can be developed. One large plant a short distance below Chattanooga, Tenn., is now under construction, but other places are equally favorable for the production of power. The greatest water power possibilities, however, are at Muscle Shoals and other shoals near Florence, Ala.

The following special reports contain information regarding the hydrography of the Tennessee River basin:

Water power in North Carolina: Bull. North Carolina Geol. Survey No. 8 (postage 16c.).

Water powers of North Carolina (in preparation): Bull. North Carolina Geol. Survey. Dr. J. H. Pratt, state geologist, Chapel Hill, N. C. This report will contain all records of discharge collected in the Tennessee River basin in North Carolina prior to 1908 by engineers of the U. S. Geological Survey.

Water resources of Georgia, by B. M. and M. R. Hall: Water-Supply Paper U. S. Geol. Survey No. 197. Contains data on stream flow, water power, and river surveys collected in the Tennessee basin in Georgia prior to 1906.

Water powers of Alabama, by B. M. Hall: Water-Supply Paper U. S. Geol. Survey No. 107. Contains data on stream flow collected in the Tennessee basin in Alabama prior to 1904.

Hydrography of the southern Appalachian Mountain region, Parts 1 and 2, by H. A. Pressey: Water-Supply Papers U. S. Geol. Survey Nos. 62 and 63. The Geological Survey has no copies of these papers for free distribution. Water-Supply Paper 62 may be consulted at libraries. Water-Supply Paper 63 may be purchased from the Superintendent of Documents, Washington, D. C., price 15c.

River surveys and profiles made during 1903, arranged by W. C. Hall and J. C. Hoyt: Water-Supply Paper U. S. Geol. Survey No. 115.

Relation of southern Appalachian Mountains to the development of inland water navigation and water power: U. S. Forest Service circulars Nos. 143 and 144.

STATIONS ON FRENCH BROAD AND MAIN TENNESSEE RIVERS.

FRENCH BROAD RIVER AT ROSMAN, N. C.

This station, which is located at a wagon bridge about 800 feet east of the railroad station at Rosman, N. C., about one-half mile above the mouth of East Fork of the river and an equal distance below the junction of North and West forks, was established May 7, 1907, in cooperation with the Forest Service, for the purpose of obtaining data for use in studying run-off conditions and available water power in the southern Appalachian Mountains. It was discontinued June 30, 1909.

The flow is little, if any, affected by artificial control, but the river is subject to sudden fluctuations in stage. Discharge measurements are made from a wooden truss bridge where the current is good, and the conditions are favorable for a constant rating. The vertical staff gage is fastened to an oak planking 5 feet upstream from the bridge, which is used to protect the right bank from erosion. As the gage is read but once a day, the recorded daily means for flood periods are liable to errors, being abnormally high when the gage is read at crest, or abnormally low when read at the trough of the flood.

As a comparatively high-water measurement was obtained in 1909, the rating curve has been extended and monthly estimates of discharge for 1907 and 1909 computed.

The following discharge measurement was made by E. H. Swett:

July 14, 1909: Width, 82 feet; area, 491 square feet; gage height, 5.05 feet; discharge, 2,310 second-feet.

Daily gage height, in feet, of French Broad River at Rosman, N. C., for 1909.

[L. M. Glazener, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.2	2.1	2.6	2.5	3.4	3.4	16	2.8	4.0	2.8	2.8	2.4	3.3
2	2.2	2.1	2.6	2.5	2.8	3.5	17	2.8	2.8	2.7	2.6	2.4	3.2
3	2.6	2.1	2.4	2.5	2.8	4.4	18	2.8	2.8	2.5	2.5	2.4	3.2
4	2.8	2.1	2.5	2.4	2.7	6.8	19	2.6	3.9	2.5	2.5	2.4	3.0
5	3.4	2.0	2.5	2.4	2.6	4.0	20	2.5	2.7	2.5	2.5	5.3	3.3
6	2.8	2.8	2.5	2.2	2.6	3.6	21	2.4	2.7	2.5	2.5	3.0	3.3
7	2.6	2.4	2.4	2.2	2.5	3.6	22	2.4	3.0	2.5	2.5	2.9	3.3
8	2.6	2.1	2.4	2.2	2.5	3.6	23	2.6	3.8	2.5	2.9	3.2	3.2
9	2.6	2.1	2.4	2.2	2.6	3.6	24	2.4	3.7	2.5	2.7	2.7	3.2
10	2.2	3.0	3.4	2.4	4.6	3.5	25	2.4	3.4	4.0	2.6	2.6	2.2
11	2.2	2.7	2.7	2.3	3.6	3.5	26	2.2	2.9	2.7	2.5	2.6	2.2
12	2.2	2.6	2.8	2.3	2.6	3.5	27	2.2	2.8	2.6	2.4	2.7	2.8
13	2.2	2.6	3.4	4.3	2.5	3.4	28	2.2	2.6	3.1	2.4	2.7	2.6
14	2.2	2.4	2.8	3.0	2.5	3.3	29	2.2	.....	2.8	2.4	2.7	2.6
15	2.4	3.0	2.8	2.8	2.5	3.3	30	2.3	.....	2.7	3.0	2.8	2.5
							31	2.2	.....	2.5	.....	3.7	.....

Daily discharge, in second-feet, of French Broad River at Rosman, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	190	160	345	300	850	850	16	450	1,340	450	450	260	775
2	190	160	345	300	450	925	17	450	450	395	345	260	705
3	345	160	260	300	450	1,690	18	450	450	300	300	260	705
4	450	160	300	260	395	4,180	19	345	1,260	300	300	260	570
5	850	133	300	260	345	1,340	20	300	395	300	300	2,560	775
6	450	450	300	190	345	1,000	21	260	395	300	300	570	775
7	345	260	260	190	300	1,000	22	260	570	300	300	510	775
8	345	160	260	190	300	1,000	23	345	1,170	300	510	705	705
9	345	160	260	190	345	1,000	24	260	1,080	300	395	395	705
10	190	570	850	260	1,870	925	25	260	850	1,340	345	345	190
11	190	395	395	223	1,000	925	26	190	510	395	300	345	190
12	190	345	450	223	345	925	27	190	450	345	260	395	450
13	190	345	850	1,600	300	850	28	190	345	635	260	395	345
14	190	260	450	570	300	775	29	190	.....	450	260	395	345
15	260	570	450	450	300	775	30	223	.....	395	570	450	300
							31	190	.....	300	.....	1,080	.....

These discharges are based on a rating curve that is well defined between discharges 130 and 570 second-feet. Above discharge 570 second-feet the curve is based on one measurement at gage height 5.05 feet.
Daily discharges for 1907 and 1908 were published in Water-Supply Paper 243, pp. 110–111.

Monthly discharge of French Broad River at Rosman, N. C., for 1907–1909.

[Drainage area, 66 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1907.						
May 7–31	223	133	164	2.48	2.31	B.
June	705	133	166	2.52	2.81	B.
July	300	110	127	1.92	2.21	B.
August	160	90	117	1.77	2.04	C.
September	1,510	90	167	2.53	2.82	C.
October	160	90	118	1.79	2.06	C.
November	1,000	110	229	3.47	3.87	A.
December	1,510	110	355	5.38	6.20	A.
1908.						
January	1,260	133	368	5.58	6.43	A.
February	4,760	190	625	9.47	10.21	B.
March	850	260	393	5.95	6.86	A.
April	1,960	133	407	6.17	6.88	A.
May	775	223	385	5.83	6.72	A.
June	395	223	263	3.98	4.44	A.
July	570	160	231	3.50	4.04	A.
August	1,170	133	299	4.53	5.22	A.
September	510	110	189	2.86	3.19	B.
October	1,690	110	305	4.62	5.33	A.
November	345	133	179	2.71	3.02	B.
December	1,420	160	308	4.67	5.38	A.
The year	4,760	110	329	4.99	67.72	
1909.						
January	850	190	299	4.53	5.22	A.
February	1,340	133	484	7.33	7.63	A.
March	1,340	260	415	6.29	7.25	A.
April	1,600	190	357	5.41	6.04	B.
May	2,560	260	551	8.35	9.63	B.
June	4,180	190	882	13.4	14.95	B.

FRENCH BROAD RIVER AT ASHEVILLE, N. C.

This station is located at the steel highway bridge known as Smith Bridge, about 1 mile below the Southern Railway depot at Asheville and near the end of the Patton avenue line of the Asheville Street Railway Company. It is about 2 miles below the mouth of Swannanoa River.

The United States Weather Bureau maintains a station at this place, and during 1904 a number of discharge measurements were made by the United States Geoogical Survey. Since the beginning of 1905 the discharge measurements have been continued at the bridge by the United States Geological Survey and the gage heights have been furnished by the United States Weather Bureau. The data are especially valuable for water-power estimates, the amount of fall in the river below being large.

The United States Weather Bureau gage is a heavy vertical timber securely bolted to a bridge pier. The gage terminates at zero on a stone shelf projection. An auxiliary chain gage is located on the bridge at about the same point. It is set to read the same as the staff gage and used only for minus readings. Discharge measurements are made from the downstream side of the bridge. The conditions of flow are favorable for accurate results.

The discharge at this station was not affected by any artificial control until 1907, when a new railroad bridge was constructed across the river about 1,500 feet below the gage. Measurements made since 1907 indicate that the conditions of flow have been changed. Owing to a necessary revision in the rating curve, all estimates for 1909 are withheld until more data have been obtained.

Discharge measurements of French Broad River at Asheville, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 16	M. R. Hall	315	1,080	1.00	2,600
June 12	E. H. Swett	320	1,450	1.95	4,230

Daily gage height, in feet, of French Broad River at Asheville, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.7	0.4	1.1	1.1	3.4	1.5	1.7	1.0	−0.1	0.1	−0.2	−0.3
2	.6	.3	.9	1.0	3.0	1.4	2.0	1.2	− .1	.1	− .2	− .3
3	.5	.3	.9	1.0	1.9	1.8	1.6	.8	− .1	.0	− .2	− .3
4	.4	.2	.9	.9	1.4	5.9	1.6	1.1	− .1	.0	− .2	− .4
5	1.4	.2	.8	.8	1.2	4.7	1.1	.8	.0	− .2	− .2	− .4
6	2.3	.4	.9	.7	1.1	4.3	1.2	.6	− .1	− .2	− .2	− .4
7	1.5	.4	1.2	.7	1.0	3.6	1.4	.5	− .1	− .2	− .2	− .1
8	1.0	.5	1.0	.7	.8	2.3	2.0	.4	− .1	− .2	− .2	.2
9	.8	.4	.9	.7	.5	2.2	2.0	.2	− .1	− .2	− .2	.8
10	.6	1.4	2.3	.8	4.5	3.4	2.0	.1	.2	− .1	− .3	.2
11	.5	1.6	2.1	.6	2.6	3.0	1.7	.3	.1	1.0	− .2	.0
12	.4	1.1	1.5	.5	1.6	2.0	1.4	.3	− .2	.7	− .2	− .1
13	.4	.8	1.4	.6	1.2	2.6	1.0	.6	− .2	.2	− .2	1.2
14	.3	.6	2.5	2.0	1.0	2.3	1.8	.9	− .2	.5	− .2	3.5
15	.5	.5	2.1	1.5	.9	2.7	1.9	.7	− .2	1.1	− .2	3.4
16	.6	1.5	1.6	1.1	.9	2.3	1.4	1.9	.1	.9	− .2	1.5
17	1.8	1.7	1.4	.9	.8	2.8	1.2	1.7	.9	.5	− .2	1.0
18	1.3	1.1	1.1	.8	.7	2.3	1.0	1.0	.5	.1	− .2	.7
19	1.0	1.9	1.0	.7	.6	1.7	.8	.6	.5	− .1	− .2	.5
20	.7	1.6	1.1	.6	1.6	3.6	.7	.4	.3	.0	− .2	.4
21	.6	.9	1.0	.5	4.5	3.6	.6	.3	.2	.0	− .2	.3
22	.5	1.2	1.1	.5	3.5	1.8	.5	.3	.5	.0	− .2	.2
23	.3	2.1	.9	.6	3.6	1.8	.7	.2	3.0	− .1	− .2	.1
24	.3	2.7	.8	1.0	2.6	2.2	.6	.2	2.0	− .1	− .2	.0
25	.3	2.8	2.6	.7	2.0	1.7	.5	.1	1.0	− .1	− .2	.3
26	.3	2.1	2.8	.6	1.8	1.7	.3	.0	.8	− .1	− .2	.2
27	.3	1.7	1.8	.5	1.8	1.5	.6	.0	.5	− .2	− .2	.2
28	.2	1.4	2.3	.5	1.5	1.9	1.5	.0	.4	− .2	− .3	.2
29	.2	.....	2.0	.4	1.2	2.1	.8	.1	.4	− .2	− .3	.2
30	.2	.....	1.6	.3	1.3	1.8	.6	.0	.3	− .2	− .3	.0
31	.5	.....	1.4	.....	1.3	.....	1.2	− .1	.....	− .2	.....	− .1

TENNESSEE RIVER AT KNOXVILLE, TENN.

This station is located at the Gay street or county highway bridge in the city of Knoxville, Tenn., and is about four miles below the junction of French Broad and Holston rivers.

Daily records are kept by the United States Weather Bureau and are furnished to the United States Geological Survey. Since 1899 discharge measurements have been made by the United States Geological Survey. The data are of use principally in connection with other station data in making general studies of run-off.

Gage heights up to 1899 were made from a staff gage at the old Gay Street Bridge. When this bridge was rebuilt the gage was moved to a temporary location at the Knoxville & Augusta Railroad bridge, one-half mile below, and was used during the greater part of 1899. On November, 1899, readings were begun from a new staff gage located on the right bank, just below the mouth of West Knoxville Bayou, about 1,000 feet below the temporary gage. These gages were at different datums.

The gage used for some years prior to 1909 was located near the foot of a series of rapids, just above a long stretch of deep smooth water. In 1909 a new staff gage attached to the bridge pier at Gay street, about half a mile above the old gage, has been used. Although

it was set to read with the old gage at low stages, the readings vary considerably, as rising water brings the beginning of the pool above the old gage. Comparative readings of the two gages have been made by the United States Weather Bureau to determine the relation between them at all stages, and this relation has been used to adjust the old rating curve to the new location of the gage. The derived curve shows a pronounced reversal between the gage heights 2 and 7 feet. Above 7 feet it again becomes approximately parallel to the old 1907–8 curve. Two of the measurements made in 1909 and referred to the new gage agree well with the derived curve; the result of other measurement is off from it in a direction that exaggerates the reversal.

Discharge measurements of Tennessee River at Knoxville, Tenn., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 11	W. A. Lamb	908	11,000	9.25	44,200
March 23	do	881	6,740	4.20	22,100
September 16	E. H. Swett	761	3,460	1.00	5,250

Relative gage heights on the old and new gages at Knoxville, Tenn.

[Furnished by the United States Weather Bureau.]

New gage.	Old gage.	New gage.	Old gage.	New gage.	Old gage.	New gage.	Old gage.
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
2.0	2.0	5.6	7.0	9.2	10.9	12.8	14.5
2.1	2.1	5.7	7.1	9.3	11.0	12.9	14.6
2.2	2.2	5.8	7.2	9.4	11.1	13.0	14.7
2.3	2.3	5.9	7.3	9.5	11.2	13.1	14.8
2.4	2.4	6.0	7.4	9.6	11.3	13.2	14.9
2.5	2.6	6.1	7.5	9.7	11.4	13.3	15.0
2.6	2.7	6.2	7.6	9.8	11.5	13.4	15.1
2.7	2.9	6.3	7.8	9.9	11.6	13.5	15.2
2.8	3.0	6.4	7.9	10.0	11.7	13.6	15.3
2.9	3.2	6.5	8.0	10.1	11.8	13.7	15.4
3.0	3.3	6.6	8.1	10.2	11.9	13.8	15.5
3.1	3.6	6.7	8.2	10.3	12.0	13.9	15.6
3.2	3.8	6.8	8.3	10.4	12.1	14.0	15.7
3.3	4.0	6.9	8.4	10.5	12.2	14.1	15.8
3.4	4.1	7.0	8.5	10.6	12.3	14.2	15.9
3.5	4.2	7.1	8.6	10.7	12.4	14.3	16.0
3.6	4.4	7.2	8.7	10.8	12.5	14.4	16.1
3.7	4.5	7.3	8.8	10.9	12.6	14.5	16.2
3.8	4.7	7.4	8.9	11.0	12.7	14.6	16.3
3.9	4.8	7.5	9.1	11.1	12.8	14.7	16.4
4.0	5.0	7.6	9.2	11.2	12.9	14.8	16.5
4.1	5.1	7.7	9.3	11.3	13.0	14.9	16.6
4.2	5.3	7.8	9.4	11.4	13.1	15.0	16.7
4.3	5.5	7.9	9.5	11.5	13.2	15.1	16.8
4.4	5.6	8.0	9.6	11.6	13.3	15.2	16.9
4.5	5.8	8.1	9.7	11.7	13.4	15.3	17.0
4.6	5.9	8.2	9.8	11.8	13.5	15.4	17.1
4.7	6.0	8.3	9.9	11.9	13.6	15.5	17.2
4.8	6.1	8.4	10.0	12.0	13.7	15.6	17.3
4.9	6.2	8.5	10.2	12.1	13.8	15.7	17.4
5.0	6.3	8.6	10.3	12.2	13.9	15.8	17.5
5.1	6.5	8.7	10.4	12.3	14.0	15.9	17.6
5.2	6.6	8.8	10.5	12.4	14.1	16.0	17.7
5.3	6.7	8.9	10.6	12.5	14.2	16.1	17.8
5.4	6.8	9.0	10.7	12.6	14.3		
5.5	6.9	9.1	10.8	12.7	14.4		

Daily gage height, in feet, of Tennessee River at Knoxville, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.7	2.3	4.4	5.7	8.4	2.8	3.2	2.2	1.0	1.0	0.5	−0.1
2	4.0	2.0	3.8	4.7	13.7	2.8	3.2	2.1	1.0	1.0	.5	− .1
3	3.5	1.9	3.5	4.0	11.3	2.8	3.5	2.5	1.0	.9	.5	− .2
4	3.0	2.1	3.4	3.6	7.1	5.8	3.1	3.3	1.0	.9	.5	− .2
5	3.3	2.0	3.4	3.3	4.8	14.0	2.9	2.8	1.0	.9	.4	− .2
6	3.7	2.5	3.3	3.1	4.3	10.4	2.5	2.5	1.0	.8	.2	− .3
7	5.0	3.1	5.5	3.3	3.5	7.2	2.5	2.2	1.0	.7	.2	− .1
8	4.4	3.0	5.5	3.2	3.1	5.2	7.9	2.2	1.0	.6	.2	.3
9	3.5	2.8	6.0	3.3	3.0	4.0	8.1	2.0	1.0	.5	.3	2.0
10	3.0	5.2	7.8	3.0	3.5	3.8	6.1	2.0	1.0	.5	.3	2.0
11	2.7	9.0	11.2	2.9	6.7	5.0	4.4	1.7	1.0	.5	.3	1.3
12	2.5	8.9	9.8	2.8	5.9	4.3	3.4	1.7	1.0	.9	.3	1.3
13	2.4	5.5	6.7	2.6	4.4	3.8	3.0	1.5	1.0	1.4	.3	.8
14	2.3	4.0	6.4	2.5	3.4	5.3	4.2	1.5	1.0	1.8	.3	1.0
15	2.2	3.5	7.7	3.7	3.0	5.6	5.0	1.9	1.0	1.8	.3	2.7
16	2.5	5.8	6.7	3.6	2.8	5.0	4.2	2.2	1.0	2.2	.1	2.7
17	6.0	7.4	5.2	3.3	2.5	4.0	3.1	10.0	1.0	2.1	.1	2.2
18	7.3	6.7	4.5	2.8	2.5	4.5	2.7	5.5	1.3	1.8	.2	1.5
19	6.3	4.9	3.9	2.8	2.3	4.5	2.7	3.5	1.5	1.4	.1	1.3
20	4.4	4.3	4.7	2.7	2.2	3.5	2.3	2.5	1.4	1.0	.1	1.1
21	3.5	4.5	5.1	2.8	3.1	3.0	2.1	2.1	1.3	1.0	.1	1.0
22	3.0	4.8	4.5	2.9	11.3	2.8	2.0	1.9	1.4	.9	.0	1.0
23	2.8	7.3	4.2	2.9	7.4	2.5	2.0	1.5	1.4	.8	.1	.8
24	2.6	7.1	4.1	3.3	5.6	3.1	2.2	1.2	3.2	.8	.1	.5
25	2.5	8.7	4.8	3.1	4.3	3.2	2.2	1.2	2.8	.7	.1	.5
26	2.4	8.9	7.3	3.1	3.5	3.5	2.0	1.2	2.3	.7	.0	.6
27	2.7	7.0	7.8	2.8	3.0	3.1	1.8	1.2	1.9	.7	.0	.5
28	2.8	5.2	7.5	2.8	3.0	2.8	1.8	1.2	1.3	.8	.0	.5
29	2.7	.....	12.0	2.9	2.9	3.0	2.0	1.2	1.1	.6	.0	.5
30	2.5	.....	11.2	3.0	2.6	3.4	2.0	1.2	1.2	.5	− .1	.4
31	2.4	.....	7.8	.....	2.5	.....	2.0	1.2	.....	.5	.....	.2

NOTE.—These gage heights refer to the new gage at Gay Street bridge. (See description.)

Daily discharge, in second-feet, of Tennessee River at Knoxville, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	19,900	10,300	24,000	30,700	43,800	13,300	16,200	9,860	5,190	5,190	3,730	2,320
2	21,800	9,000	20,600	25,600	73,000	13,300	16,200	9,420	5,190	5,190	3,730	2,320
3	18,500	8,580	18,500	21,800	59,300	13,300	18,500	11,400	5,190	4,870	3,730	2,120
4	14,600	9,420	17,700	19,200	37,200	31,200	15,400	17,000	5,190	4,870	3,730	2,120
5	17,000	9,000	17,700	17,000	26,200	74,700	13,900	13,300	5,190	4,870	3,470	2,120
6	19,900	11,400	17,000	15,400	23,500	54,400	11,400	11,400	5,190	4,570	2,980	1,930
7	27,200	15,400	29,800	17,000	18,500	37,700	11,400	9,860	5,190	4,280	2,980	2,320
8	24,000	14,600	29,800	16,200	15,400	28,300	41,200	9,860	5,190	4,000	2,980	3,220
9	18,500	13,300	32,200	17,000	14,600	21,800	42,200	9,000	5,190	3,730	3,220	9,000
10	14,600	28,300	40,700	14,600	18,500	20,600	32,600	9,000	5,190	3,730	3,220	9,000
11	12,600	46,900	58,700	13,900	35,300	27,200	24,000	7,760	5,190	3,730	3,220	6,220
12	11,400	46,400	51,100	13,300	31,700	23,500	17,700	7,760	5,190	4,870	3,220	6,220
13	10,800	29,800	35,300	12,000	24,000	20,600	14,600	6,970	5,190	6,590	3,220	4,570
14	10,300	21,800	34,000	11,400	17,700	28,800	22,900	6,970	5,190	8,170	3,220	5,190
15	9,860	18,500	40,200	19,900	14,600	30,300	27,200	8,580	5,190	8,170	3,220	12,600
16	11,400	31,200	35,300	19,200	13,300	27,200	22,900	9,860	5,190	9,860	2,750	12,600
17	32,200	38,600	28,300	17,000	11,400	21,800	15,400	52,200	5,190	9,420	2,750	9,860
18	38,200	35,300	24,600	13,300	11,400	24,600	12,600	29,800	6,220	8,170	2,980	6,970
19	33,500	26,700	21,200	13,300	10,300	24,600	12,600	18,500	6,970	6,590	2,750	6,220
20	24,000	23,500	25,600	12,600	9,860	18,500	10,300	11,400	6,590	5,190	2,750	5,520
21	18,500	24,600	27,800	13,300	15,400	14,600	9,420	9,420	6,220	5,190	2,750	5,190
22	14,600	26,200	24,600	13,900	59,300	13,300	9,000	8,580	6,590	4,870	2,530	5,190
23	13,300	38,200	22,900	13,900	38,600	11,400	9,000	6,970	6,590	4,570	2,750	4,570
24	12,000	37,200	22,300	17,000	30,300	15,400	9,860	5,860	16,200	4,570	2,750	3,730
25	11,400	45,300	26,200	15,400	23,500	16,200	9,860	5,860	13,300	4,280	2,750	3,730
26	10,800	46,400	38,200	15,400	18,500	18,500	9,000	5,860	10,300	4,280	2,530	4,000
27	12,600	36,700	40,700	13,300	14,600	15,400	8,170	5,860	8,580	4,280	2,530	3,730
28	13,300	28,300	39,200	13,300	14,600	13,300	8,170	5,860	6,220	4,570	2,530	3,730
29	12,600	.....	63,200	13,900	13,900	14,600	9,000	5,860	5,520	4,000	2,530	3,730
30	11,400	.....	58,700	14,600	12,000	17,700	9,000	5,860	5,860	3,730	2,320	3,470
31	10,800	.....	40,700	.....	11,400	.....	9,000	5,860	.....	3,730	.....	2,980

NOTE.—These discharges are based on a rating curve referring to the new gage at Gay Street bridge and is fairly well defined. The rating curve was developed from the table of relative gage heights on the old and new gages, furnished by the United States Weather Bureau.

Monthly discharge of Tennessee River at Knoxville, Tenn., for 1909.

[Drainage area, 8,990 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	38,200	9,860	17,100	1.90	2.19	A.
February	46,900	8,580	26,100	2.90	3.02	A.
March	63,200	17,000	32,500	3.62	4.17	A.
April	30,700	11,400	16,100	1.79	2.00	A.
May	73,000	9,860	24,600	2.74	3.16	A.
June	74,700	11,400	23,500	2.61	2.91	A.
July	42,200	8,170	16,100	1.79	2.06	A.
August	52,200	5,860	11,000	1.22	1.41	A.
September	16,200	5,190	6,450	.717	.80	B.
October	9,860	3,730	5,290	.588	.68	B.
November	3,730	2,320	2,990	.333	.37	B.
December	12,600	1,930	5,050	.562	.65	B.
The year	74,700	1,930	15,600	1.73	23.42	

TENNESSEE RIVER AT CHATTANOOGA, TENN.

This station is located at the Hamilton County highway bridge in the city of Chattanooga, Tenn.

The gage, consisting of a sloping section made of railroad rails bolted to solid rock and a vertical section of heavy timber bolted to the vertical face of the rock cliff, was established in 1873 by the United States Army engineers, but since July 1, 1891, it has been in charge of the United States Weather Bureau, by whom gage heights are furnished to the United States Geological Survey.

Discharge measurements were made by the army engineers in 1891 and 1892 and by the Weather Bureau in 1893, and have been continued by the United States Geological Survey since 1897. The data are of great value for scientific studies of run-off and for water-power estimates in connection with the great power sites below. A power plant is now under construction about 20 miles down the river, and the completed dam will raise the low-water surface several feet on the Chattanooga gage, thus destroying the usefulness of the gaging station.

Conditions for discharge measurements are good, as is also the station rating curve, which has remained practically constant. The gage datum has not been changed and the original iron sloping gage is the standard gage, although a recording gage is also used.

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

April 19, 1909: Width, 1,100 feet; area, 11,000 square feet; gage height, 6.52 feet; discharge, 36,600 second-feet.

Daily gage height, in feet, of Tennessee River at Chattanooga, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.2	6.1	13.3	16.5	14.2	6.9	7.9	6.1	3.1	3.0	2.1	1.8
2	7.9	5.9	11.1	13.2	21.4	6.8	8.2	7.6	3.1	2.8	2.1	1.8
3	7.6	5.7	9.7	11.0	24.8	7.1	8.5	8.4	3.1	2.6	2.1	1.7
4	7.2	5.6	8.8	9.5	24.1	16.2	8.2	8.9	3.1	2.4	2.0	1.7
5	7.2	5.4	8.1	8.6	20.0	23.2	7.6	9.1	2.7	2.2	2.0	1.7
6	8.5	5.6	7.7	8.1	14.5	25.3	6.9	8.8	2.7	2.2	2.0	1.7
7	9.9	6.7	8.3	7.8	11.8	23.5	6.3	7.6	2.6	2.1	2.0	1.9
8	9.9	8.1	10.6	7.9	10.7	17.2	6.8	6.8	2.6	2.0	2.0	3.5
9	9.6	8.0	11.5	8.8	8.7	13.1	11.7	6.2	2.6	2.0	1.9	4.5
10	8.5	9.6	16.0	9.1	8.1	14.6	18.5	5.5	2.9	2.0	1.9	4.6
11	7.8	13.5	20.3	8.4	8.2	13.1	17.3	5.2	3.3	2.1	1.8	4.2
12	7.1	18.0	22.8	7.7	8.9	12.4	12.5	5.0	3.2	2.3	1.8	4.0
13	6.8	17.0	21.5	7.6	10.6	11.6	9.7	4.8	3.3	2.6	1.8	3.7
14	6.6	16.3	23.3	8.1	9.8	10.5	9.4	4.4	3.2	3.0	1.8	4.3
15	6.8	13.5	24.6	8.3	8.4	11.1	12.3	4.8	3.1	4.0	1.8	4.9
16	9.5	14.5	21.7	8.3	7.5	11.7	13.2	4.9	2.9	6.1	1.7	5.4
17	12.4	19.6	17.1	8.1	7.0	11.7	11.9	4.8	2.8	5.6	1.7	5.9
18	14.2	19.9	14.7	7.7	6.6	10.8	10.3	10.5	2.7	4.7	1.7	5.5
19	16.4	16.6	12.6	7.0	6.3	9.8	8.3	13.2	2.9	4.3	1.7	5.0
20	16.1	14.5	11.5	6.2	6.1	9.7	7.1	9.0	3.0	3.7	1.7	4.2
21	12.9	12.6	11.4	6.0	7.2	9.0	6.7	7.0	3.1	3.2	1.7	3.8
22	10.0	12.0	12.2	6.2	10.6	9.2	6.4	5.8	3.0	3.1	1.7	3.6
23	8.3	17.2	12.0	6.8	19.9	8.6	6.1	5.0	3.8	2.8	1.7	3.4
24	7.5	20.2	11.1	8.2	21.4	8.0	5.8	4.8	4.0	2.7	1.7	3.1
25	6.9	21.6	10.4	9.3	15.8	8.5	6.7	4.2	4.8	2.5	1.9	2.8
26	6.4	21.3	11.8	8.7	11.2	9.3	6.1	3.8	5.5	2.4	2.0	3.0
27	6.0	18.9	14.3	8.1	9.3	8.8	5.7	3.6	5.0	2.4	2.1	3.4
28	5.7	16.3	14.7	7.9	8.2	9.5	5.4	3.5	4.0	2.4	2.0	3.4
29	5.6	.....	15.5	8.0	7.6	9.0	5.3	3.3	3.8	2.3	1.9	3.3
30	5.7	.....	17.6	8.1	7.4	8.3	4.7	3.2	3.5	2.3	1.8	(a)
31	5.8	.....	18.2	.....	7.1	.....	4.8	3.2	.....	2.2	.....	(a)

a River frozen.

Daily discharge, in second-feet, of Tennessee River at Chattanooga, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	43,000	35,500	84,400	106,000	90,600	40,900	47,700	35,500	17,400	16,900	12,400	11,000
2	47,700	34,100	69,500	83,800	140,000	40,200	49,800	45,700	17,400	15,800	12,400	11,000
3	45,700	32,800	60,000	68,800	163,000	42,300	51,800	51,100	17,400	14,800	12,400	10,600
4	43,000	32,100	53,800	58,600	158,000	104,000	49,800	54,500	17,400	13,800	11,900	10,600
5	43,000	30,800	49,100	52,500	130,000	152,000	45,700	55,900	15,300	12,800	11,900	10,600
6	51,800	32,100	46,400	49,100	92,600	166,000	40,900	53,800	15,300	12,800	11,900	10,600
7	61,300	39,600	50,400	47,000	74,200	154,000	36,800	45,700	14,800	12,400	11,900	11,400
8	61,300	49,100	66,100	47,700	66,800	111,000	40,200	40,200	14,800	11,900	11,900	19,600
9	59,300	48,400	72,200	53,800	53,200	83,100	73,600	36,200	14,800	11,900	11,400	25,300
10	51,800	59,300	103,000	55,900	49,100	93,300	120,000	31,500	16,300	11,900	11,400	25,900
11	47,000	85,800	132,000	51,100	49,800	83,100	112,000	29,600	18,500	12,400	11,000	23,500
12	42,300	116,000	149,000	46,400	54,500	78,300	79,000	28,300	17,900	13,300	11,000	22,400
13	40,200	110,000	140,000	45,700	66,100	72,900	60,000	27,100	18,500	14,800	11,000	20,700
14	38,900	105,000	152,000	49,100	60,600	65,400	57,900	24,700	17,900	16,900	11,000	24,100
15	40,200	85,800	161,000	50,400	51,100	69,500	77,600	27,100	17,400	22,400	11,000	27,700
16	58,600	92,600	142,000	50,400	45,000	73,600	83,800	27,700	16,300	35,500	10,600	30,800
17	78,300	127,000	110,000	49,100	41,600	73,600	74,900	27,100	15,800	32,100	10,600	34,100
18	90,600	129,000	94,000	46,400	38,900	67,400	64,000	65,400	15,300	26,500	10,600	31,500
19	106,000	107,000	79,700	41,600	36,800	60,600	50,400	83,800	16,300	24,100	10,600	28,300
20	103,000	92,600	72,200	36,200	35,500	60,000	42,300	55,200	16,900	20,700	10,600	23,500
21	81,700	79,700	71,500	34,800	43,000	55,200	39,600	41,600	17,400	17,900	10,600	21,200
22	62,000	75,600	77,000	36,200	66,100	56,600	37,500	33,400	16,900	17,400	10,600	20,100
23	50,400	111,000	75,600	40,200	129,000	52,500	35,500	28,300	21,200	15,800	10,600	19,000
24	45,000	131,000	69,500	49,800	140,000	48,400	33,400	27,100	22,400	15,300	10,600	17,400
25	40,900	141,000	64,700	57,200	101,000	51,800	39,600	23,500	27,100	14,300	11,400	15,800
26	37,500	139,000	74,200	53,200	70,200	57,200	35,500	21,200	31,500	13,800	11,900	16,900
27	34,800	123,000	91,200	49,100	57,200	53,800	32,800	20,100	28,300	13,800	12,400	19,000
28	32,800	105,000	94,000	47,700	49,800	58,600	30,800	19,600	22,400	13,800	11,900	19,000
29	32,100	.....	99,400	48,400	45,700	55,200	30,200	18,500	21,200	13,300	11,400	18,500
30	32,800	.....	114,000	49,100	44,300	50,400	26,500	17,900	19,600	13,300	11,000	18,000
31	33,400	.....	118,000	.....	42,300	.....	27,100	17,900	.....	12,800	.....	17,500

NOTE.—These discharges are based on a rating curve that is well defined. Frozen conditions December 30 and 31, discharges estimated.

Monthly discharge of Tennessee River at Chattanooga, Tenn., for 1909.

[Drainage area, 21,400 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	106,000	32,100	52,800	2.47	2.85	A.
February	141,000	30,800	83,900	3.92	4.08	A.
March	161,000	46,400	91,500	4.28	4.93	A.
April	106,000	34,800	51,800	2.42	2.70	A.
May	163,000	35,500	73,700	3.44	3.97	A.
June	166,000	40,200	74,400	3.48	3.88	A.
July	120,000	26,500	52,500	2.45	2.82	A.
August	55,900	17,900	36,000	1.68	1.94	A.
September	31,500	14,800	18,700	.874	.98	A.
October	35,500	11,900	16,600	.776	.89	A.
November	12,400	10,600	11,300	.528	.59	B.
December	34,100	10,600	19,900	.930	1.07	B.
The year	166,000	10,600	48,600	2.27	30.70	

STATIONS ON TRIBUTARIES OF FRENCH BROAD RIVER.

DAVIDSON RIVER NEAR DAVIDSON RIVER, N. C.

Davidson River, which empties into French Broad River near Davidson River, N. C., is a small, typical mountain stream, rising very rapidly after a rain and falling almost as fast as it rises. The rapid fluctuation to which the stream is subject makes it difficult to catch and measure the floods which carry off a large part of the total flow.

The gaging station, which was established May 19, 1904, at the request of and in cooperation with Dr. C. A. Schenck, of the Biltmore estate, for the purpose of studying the power resources of that section, is located at English Bridge, about 2 miles from Davidson River, N. C., and 500 feet above the mouth of Avery Creek. It is about 2 miles above the mouth of the river. The station was discontinued June 30, 1909.

Discharge measurements are made from the bridge.

The vertical staff gage is on the left bank, 40 feet below the bridge, and has remained unchanged in location and gage datum.

The current varies from rather sluggish at low stage to very swift at flood stage. The bed is mostly rock, a part of which is solid, and is comparatively smooth. Conditions of flow have remained fairly constant.

Discharge measurements of Davidson River near Davidson River, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 14	E. H. Swett	68.5	136	1.40	172
Do	do	68.5	136	1.40	173

Daily gage height, in feet, of Davidson River near Davidson River, N. C., for 1909.

[Mrs. C. T. Rankin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.15	1.5	1.45	1.25	1.8	1.4	16	1.35	1.7	1.5	1.3	1.3	1.5
2	1.1	1.1	1.45	1.25	1.35	1.35	17	1.45	1.5	1.45	1.25	1.2	1.5
3	1.1	1.05	1.35	1.25	1.3	2.3	18	1.35	1.4	1.4	1.25	1.2	1.45
4	1.15	1.0	1.3	1.25	1.3	2.9	19	1.45	1.9	1.35	1.25	1.2	1.4
5	1.65	1.0	1.25	1.25	1.3	2.0	20	1.2	1.5	1.35	1.25	3.0	1.4
6	1.3	1.15	1.25	1.3	1.25	1.8	21	1.2	1.4	1.3	1.2	2.2	1.35
7	1.25	1.05	1.3	1.25	1.2	1.7	22	1.15	1.65	1.25	1.2	2.2	1.4
8	1.2	1.05	1.3	1.25	1.2	1.6	23	1.15	2.0	1.3	1.5	1.75	1.35
9	1.15	1.05	1.25	1.25	1.2	1.6	24	1.1	2.1	1.25	1.25	1.65	1.35
10	1.15	1.6	1.7	1.2	2.95	1.6	25	1.1	1.75	2.0	1.2	1.6	1.4
11	1.15	1.3	1.25	1.2	1.55	1.5	26	1.1	1.65	1.5	1.2	1.55	1.35
12	1.1	1.2	1.3	1.25	1.45	1.5	27	1.1	1.5	1.45	1.2	1.5	1.3
13	1.1	1.2	1.9	2.3	1.4	1.5	28	1.1	1.45	1.4	1.15	1.45	1.4
14	1.1	1.25	1.7	1.5	1.35	1.4	29	1.05	.....	1.35	1.15	1.4	1.45
15	1.15	1.7	1.55	1.4	1.3	1.5	30	1.15	.....	1.3	1.15	1.35	1.45
							31	1.15	.....	1.25	.....	1.4	.....

Daily discharge, in second-feet, of Davidson River near Davidson River, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	111	210	193	134	345	176	16	162	295	210	147	147	210
2	100	100	193	134	162	162	17	193	210	193	134	122	210
3	100	90	162	134	147	660	18	162	176	176	134	122	193
4	111	79	147	134	147	1,170	19	193	400	162	134	122	176
5	272	79	134	134	147	460	20	122	210	162	134	1,260	176
6	147	111	134	147	134	345	21	122	176	147	122	590	162
7	134	90	147	134	122	295	22	111	272	134	122	590	176
8	122	90	147	134	122	250	23	111	460	147	210	320	162
9	111	90	134	134	122	250	24	100	520	134	134	272	162
10	111	250	295	122	1,220	250	25	100	320	460	122	250	176
11	111	147	134	122	230	210	26	100	272	210	122	230	162
12	100	122	147	134	193	210	27	100	210	193	122	210	147
13	100	122	400	660	176	210	28	100	193	176	111	193	176
14	100	134	295	210	162	176	29	90	.....	162	111	176	193
15	111	295	230	176	147	210	30	111	.....	147	111	162	193
							31	111	.....	134	.....	176	.....

NOTE.—These discharges are based on a rating curve that is well defined between discharges 32 and 250 second-feet.

Monthly discharge of Davidson River near Davidson River, N. C., for 1909.

[Drainage area, 41 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	272	90	124	3.02	3.48	A.
February	520	79	204	4.98	5.19	A.
March	460	134	188	4.59	5.29	A.
April	660	111	149	3.63	4.05	A.
May	1,260	122	275	6.71	7.74	A.
June	1,170	147	257	6.27	7.00	A.

NORTH FORK OF MILLS RIVER AT PINKBED, N. C.

This station is located at the wagon bridge in the village of Pinkbed and is 1 mile above the junction of North and South forks. It was established May 18, 1904, and was originally maintained in cooperation with the Biltmore estate, in whose forest reserves the drainage area lies. The station was discontinued June 30, 1909. The data obtained are useful for water power estimates and for general run-off studies, including those of the larger rivers below. The gage is a vertical staff spiked to the log crib on the high bank at the upstream side of the bridge. The North Fork of Mills River is a small stream, with very swift current at most places. At the station the stream flows over a relatively rough bed of loose rock, and at ordinary stage the water is shallow. The conditions are, therefore, not favorable for accurate measurements or a constant rating curve.

The following discharge measurement was made by E. H. Swett:

June 15, 1909: Width, 39 feet; area, 52 square feet; gage height, 1.65 feet; discharge, 140 second-feet.

Daily gage height, in feet, of North Fork of Mills River at Pinkbed, N. C., for 1909.

[R. K. Whitaker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.1	1.1	1.4	1.45	1.6	1.4	16	1.35	1.6	1.45	1.35	1.35	1.6
2	1.1	1.05	1.4	1.4	1.4	1.35	17	1.4	1.4	1.4	1.35	1.3	1.75
3	1.1	1.0	1.35	1.4	1.3	1.9	18	1.3	1.3	1.35	1.3	1.3	1.6
4	1.1	1.0	1.3	1.35	1.2	3.1	19	1.25	1.5	1.3	1.3	1.3	1.5
5	1.6	1.0	1.3	1.3	1.2	2.1	20	1.2	1.45	1.4	1.25	1.7	1.5
6	1.3	1.1	1.4	1.25	1.2	1.9	21	1.2	1.45	1.3	1.2	2.1	1.45
7	1.2	1.05	1.35	1.35	1.2	1.75	22	1.15	1.3	1.35	1.2	1.75	1.45
8	1.2	1.05	1.3	1.3	1.2	1.6	23	1.15	1.8	1.3	1.35	1.7	1.55
9	1.15	1.05	1.3	1.3	1.2	1.6	24	1.15	2.0	1.3	1.25	1.6	1.55
10	1.15	1.55	1.6	1.25	2.75	1.6	25	1.1	1.8	2.0	1.25	1.55	1.5
11	1.1	1.4	1.5	1.25	1.85	1.6	26	1.1	1.6	1.75	1.2	1.5	1.4
12	1.1	1.25	1.45	1.2	1.6	1.5	27	1.1	1.55	1.55	1.2	1.5	1.4
13	1.1	1.2	1.55	1.9	1.5	1.5	28	1.1	1.5	1.8	1.2	1.45	1.4
14	1.15	1.2	1.55	1.55	1.45	1.45	29	1.15	.....	1.6	1.15	1.4	1.6
15	1.15	1.35	1.5	1.45	1.4	1.6	30	1.1	.....	1.5	1.15	1.4	1.6
							31	1.1	.....	1.5	.....	1.4	.....

Daily discharge, in second-feet, of North Fork of Mills River at Pinkbed, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	69	69	112	121	150	112	16	104	150	121	104	104	150
2	69	63	112	112	112	104	17	112	112	112	104	96	182
3	69	57	104	112	96	218	18	96	96	104	96	96	150
4	69	57	96	104	82	611	19	89	130	96	96	96	130
5	150	57	96	96	82	270	20	82	121	112	89	171	130
6	96	69	112	89	82	218	21	82	121	96	82	270	121
7	82	63	104	104	82	182	22	76	96	104	82	182	121
8	82	63	96	96	82	150	23	76	194	96	104	171	140
9	76	63	96	96	82	150	24	76	243	96	89	150	140
10	76	140	150	89	479	150	25	69	194	243	89	140	130
11	69	112	130	89	206	150	26	69	150	182	82	130	112
12	69	89	121	82	150	130	27	69	140	140	82	130	112
13	69	82	140	218	130	130	28	69	130	194	82	121	112
14	76	82	140	140	121	121	29	76	.....	150	76	112	150
15	76	104	130	121	112	150	30	69	.....	130	76	112	150
							31	69	.....	130	.....	112	.....

NOTE.—These discharges are based on a rating table that is not well defined.

Monthly discharge of North Fork of Mills River at Pinkbed, N. C., for 1909.

[Drainage area, 24 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	150	69	80.0	3.33	3.84	C.
February	243	57	109	4.54	4.73	B.
March	243	96	124	5.17	5.96	B.
April	218	76	100	4.17	4.65	B.
May	479	82	137	5.71	6.58	B.
June	611	104	163	6.79	7.58	B.

SOUTH FORK OF MILLS RIVER NEAR SITTON, N. C.

This station, which is located at a footbridge about 1 mile below Sitton's mill, Sitton, N. C., and 1 mile above the junction of North and South Forks, was established May 18, 1904, for the purpose of obtaining general run-off data, and, like the station on North Fork of Mills River, was originally maintained in cooperation with the Biltmore estate. The station was discontinued June 30, 1909.

The current is sluggish at low-water stage, becoming very swift at time of floods.

The vertical gage attached to a tree on the right bank, about 40 feet above the bridge, has gone down with its support about two-tenths of a foot. The gage heights have been corrected accordingly in order to reduce them to the original datum, but the gage has not been changed.

Discharge measurements of South Fork of Mills River near Sitton, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
June 16	E. H. Swett	53	125	2.00	268
Do	do	53	124	2.00	269

Daily gage height, in feet, of South Fork of Mills River near Sitton, N. C., for 1909.

[W. E. Field, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.35	1.4	1.65	1.65	2.5	1.65	16	1.55	1.9	1.65	1.55	1.5	2.05
2	1.3	1.3	1.65	1.6	1.7	1.5	17	1.8	1.7	1.6	1.5	1.45	2.0
3	1.3	1.3	1.6	1.55	1.55	2.9	18	1.6	1.6	1.55	1.45	1.4	1.85
4	1.3	1.2	1.55	1.5	1.5	4.5	19	1.5	1.6	1.5	1.45	1.4	1.75
5	2.0	1.2	1.5	1.5	1.5	2.65	20	1.45	1.75	1.55	1.4	2.0	1.7
6	1.6	1.45	1.55	1.45	1.45	2.2	21	1.45	1.6	1.5	1.4	2.8	1.6
7	1.5	1.05	1.55	1.45	1.4	2.05	22	1.4	1.75	1.5	1.4	2.3	1.8
8	1.45	1.2	1.5	1.4	1.4	1.9	23	1.4	2.3	1.45	1.5	2.2	1.7
9	1.4	1.2	1.5	1.45	1.35	2.7	24	1.35	2.5	1.4	1.4	1.95	1.6
10	1.35	2.1	2.0	1.4	3.2	2.15	25	1.35	2.3	2.55	1.35	1.8	1.6
11	1.35	1.6	1.7	1.4	1.95	1.9	26	1.3	2.0	2.0	1.35	1.75	1.6
12	1.3	1.5	1.7	1.35	1.8	1.8	27	1.3	2.3	1.75	1.35	1.7	1.55
13	1.3	1.45	1.8	2.0	1.65	1.8	28	1.25	1.75	2.0	1.35	1.65	2.3
14	1.4	1.4	1.8	1.8	1.6	2.0	29	1.3	.....	1.85	1.35	1.6	1.95
15	1.35	1.4	1.7	1.65	1.55	2.5	30	1.3	.....	1.75	1.6	1.55	2.0
							31	1.25	.....	1.7	.....	1.6	.....

Daily discharge, in second-feet, of South Fork of Mills River near Sitton, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	115	125	180	180	415	180	16	157	240	180	157	146	280
2	105	105	180	168	191	146	17	215	191	168	146	136	265
3	105	105	168	157	157	550	18	168	168	157	136	125	228
4	105	86	157	146	146	1,250	19	146	168	146	136	125	203
5	265	86	146	146	146	462	20	136	203	157	125	265	191
6	168	136	157	136	136	325	21	136	168	146	125	515	168
7	146	60	157	136	125	280	22	125	203	146	125	355	215
8	136	86	146	125	125	240	23	125	355	136	146	325	191
9	125	86	146	136	115	480	24	115	415	125	125	252	168
10	115	295	265	125	660	310	25	115	355	430	115	215	168
11	115	168	191	125	252	240	26	105	265	265	115	203	168
12	105	146	191	115	215	215	27	105	355	203	115	191	157
13	105	136	215	265	180	215	28	96	203	265	115	180	355
14	125	125	215	215	168	265	29	105	.....	228	115	168	252
15	115	125	191	180	157	415	30	105	.....	203	168	157	265
							31	96	.....	191	.....	168	.....

NOTE.—These discharges are based on a rating curve that is fairly well defined between 35 and 420 second-feet.

Monthly discharge of South Fork of Mills River near Sitton, N. C., for 1909.

[Drainage area, 40.5 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	265	96	129	3.19	3.68	B.
February	415	86	184	4.54	4.73	B.
March	430	125	189	4.67	5.38	B.
April	265	115	144	3.56	3.97	B.
May	660	115	217	5.36	6.18	B.
June	1,250	146	295	7.28	8.12	B.

SWANNANOA RIVER AT SWANNANOA, N. C.

This station, which is located at the iron highway bridge one-fourth mile from the railroad station at Swannanoa, was established May 28, 1907, in connection with the special investigations of water resources in the Appalachian Mountains. The station is about 2 miles below the North Fork of the river and an equal distance above Beetree Creek.

The discharge measurements have been made from the highway bridge where the bank, river bed, current, and other conditions are fairly good.

The vertical staff gage is in two sections, the low-water section being spiked to a birch tree on the right bank 50 feet above the bridge. The upper section is lagged to a pile foundation on the right bank about 5 feet below the bridge.

The station was discontinued June 30, 1909.

The following discharge measurement was made by E. H. Swett:

June 11, 1909: Width, 60 feet; area, 179 square feet; gage height, 2.49 feet; discharge, 279 second-feet.

Daily gage height, in feet, of Swannanoa River at Swannanoa, N. C., for 1909.

[W. D. Patton and J. H. Porter, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.1	1.9	2.2	2.6	3.2	2.8	16	2.2	2.5	3.5	2.3	2.2	2.8
2	2.0	1.9	2.3	2.4	2.8	2.5	17	2.2	2.0	3.4	2.2	2.2	2.9
3	2.0	1.8	2.3	2.4	2.5	2.9	18	2.1	2.0	3.3	2.1	2.2	2.7
4	2.1	1.8	2.2	2.3	2.3	6.0	19	2.1	2.2	3.2	2.1	2.1	2.5
5	2.1	1.8	2.2	2.3	2.3	3.4	20	2.0	2.3	3.2	2.1	5.9	2.4
6	2.7	1.9	2.6	2.2	2.3	3.2	21	2.0	2.2	3.3	2.0	5.6	2.4
7	2.5	1.9	2.6	2.2	2.1	2.8	22	2.0	2.6	3.2	2.0	3.8	2.4
8	2.3	1.8	2.5	2.2	2.1	2.7	23	2.0	2.7	3.2	2.1	3.5	2.4
9	2.1	2.0	2.5	2.2	2.1	2.9	24	2.0	2.9	3.1	2.0	3.0	2.3
10	2.1	1.9	3.4	2.2	5.8	2.7	25	1.9	2.8	4.0	2.0	2.8	2.2
11	2.1	1.9	2.6	2.1	3.0	2.5	26	1.9	2.7	2.8	2.0	2.9	2.2
12	2.1	1.9	2.5	2.1	2.6	2.4	27	1.9	2.5	2.6	1.9	2.5	2.2
13	2.1	1.9	3.7	2.8	2.5	3.2	28	1.9	2.3	3.5	1.9	2.5	2.3
14	2.0	1.9	3.9	2.5	2.4	2.9	29	1.9	.....	2.9	1.9	2.5	2.3
15	2.0	1.9	3.7	2.3	2.2	2.9	30	1.9	.....	2.7	1.9	2.5	2.5
							31	1.9	.....	2.6	.....	2.5	.....

Daily discharge, in second-feet, of Swannanoa River at Swannanoa, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	162	120	186	.....	.....	.....	16	186	280	.....	214	186	.....
2	140	120	214	246	.....	280	17	186	140	.....	186	186	.....
3	140	102	214	246	280	.....	18	162	140	.....	162	186	.....
4	162	102	186	214	214	.....	19	162	186	.....	162	162	280
5	162	102	186	214	214	.....	20	140	214	.....	162	.....	246
6	.....	120	.....	186	214	.....	21	140	186	.....	140	.....	246
7	280	120	.....	186	162	.....	22	140	.....	.....	140	.....	246
8	214	102	280	186	162	.....	23	140	.....	.....	162	.....	246
9	162	140	280	186	162	.....	24	140	.....	.....	140	.....	214
10	162	120	.....	186	.....	.....	25	120	.....	.....	140	.....	186
11	162	120	.....	162	.....	280	26	120	.....	.....	140	.....	186
12	162	120	280	162	.....	246	27	120	280	.....	120	280	186
13	162	120	.....	.....	280	.....	28	120	214	.....	120	280	214
14	140	120	.....	280	246	.....	29	120	.....	.....	120	280	214
15	140	120	.....	214	186	.....	30	120	.....	.....	120	280	280
							31	120	.....	.....	.....	280	.....

NOTE.—These discharges are based on a rating curve that is well defined between 30 and 280 second-feet. The high-water portion of the curve has not been developed. Discharges for all missing days, January to June, are above 280 second-feet.

PIGEON RIVER AT CANTON, N. C.

This station, which is located at the wagon bridge about 1,000 feet above the railroad bridge of the Southern Railway at Canton, N. C., was established May 25, 1907, in cooperation with the Forest Service, for the purpose of studying the water resources of the southern Appalachian Mountains.

The vertical staff gage is attached to a post on the left bank about 50 feet above the bridge.

Discharge measurements have been made from the single-span highway bridge, where the flow is confined between the bridge abutments. The current is rather sluggish and at low stages is possibly affected by a low dam about one-fourth of a mile below.

The station was discontinued June 30, 1909.

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

April 17, 1909: Width, 130 feet; area, 405 square feet; gage height, 3.67 feet; discharge, 492 second-feet.

Daily gage height, in feet, of Pigeon River at Canton, N. C., for 1909.

[J. D. Holtsclaw, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.4	3.2	3.9	3.95	4.6	3.6	16	4.0	4.8	4.2	3.6	3.5	3.6
2	3.4	3.2	3.8	3.85	3.9	3.7	17	3.85	4.4	4.0	3.6	3.45	3.6
3	3.4	3.1	3.75	3.75	3.8	5.2	18	3.75	4.2	3.95	3.55	3.4	3.5
4	3.55	3.1	3.7	3.7	3.75	7.4	19	3.6	4.8	3.85	3.5	3.4	3.5
5	4.3	3.1	3.8	3.6	3.7	6.4	20	3.35	4.2	3.75	3.4	5.0	3.5
6	4.2	3.3	3.95	3.6	3.6	4.4	21	3.4	4.0	3.7	3.35	5.8	3.4
7	3.9	3.3	3.8	3.5	3.5	4.3	22	3.4	4.4	3.8	3.35	5.5	3.4
8	3.6	3.2	3.8	3.5	3.5	4.2	23	3.4	4.6	3.7	3.4	4.5	3.3
9	3.4	3.35	6.0	3.4	3.4	4.2	24	3.3	4.8	3.6	3.4	4.2	3.4
10	3.4	5.0	5.9	3.4	3.4	4.4	25	3.3	4.4	5.5	3.35	4.0	3.3
11	3.4	4.7	5.8	3.35	3.4	4.2	26	3.3	4.2	4.5	3.3	3.95	3.35
12	3.4	4.2	5.4	3.3	3.35	3.95	27	3.3	4.0	4.2	3.35	3.85	3.4
13	3.4	3.8	5.1	3.7	3.3	3.8	28	3.2	3.95	4.6	3.4	3.8	3.4
14	3.5	3.6	4.4	3.7	3.3	3.7	29	3.2	.....	4.3	3.4	3.7	3.4
15	3.6	4.7	4.3	3.6	3.3	3.7	30	3.2	.....	4.2	3.45	3.7	3.4
							31	3.2	.....	4.1	.....	3.6	.....

Daily discharge, in second-feet, of Pigeon River at Canton, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	376	300	592	614	.....	460	16	636	.....	.....	460	417	460
2	376	300	548	570	592	504	17	570	.....	636	460	396	460
3	376	265	526	526	548	.....	18	526	.....	614	438	376	417
4	438	265	504	504	526	.....	19	460	.....	570	417	376	417
5	.....	265	548	460	504	.....	20	356	.....	526	376	.....	417
6	.....	337	614	460	460	.....	21	376	636	504	356	.....	376
7	592	337	548	417	417	.....	22	376	.....	548	356	.....	376
8	460	300	548	417	417	.....	23	376	.....	504	376	.....	337
9	376	356	.....	376	376	.....	24	337	.....	460	376	.....	376
10	376	.....	.....	376	376	.....	25	337	.....	.....	356	636	337
11	376	.....	.....	356	376	.....	26	337	.....	.....	337	614	356
12	376	.....	.....	337	356	614	27	337	636	.....	356	570	376
13	376	548	.....	504	337	548	28	300	614	.....	376	548	376
14	417	460	.....	504	337	504	29	300	.....	.....	376	504	376
15	460	.....	.....	460	337	504	30	300	.....	.....	396	504	376
							31	300	.....	.....	.....	460	.....

NOTE.—These discharges are based on a rating curve that is well defined between discharges 110 and 640 second-feet. The high-water portion of the curve has not been developed. Discharges for all missing days from January to June are above 640 second-feet.

PIGEON RIVER AT NEWPORT, TENN.

This station is located at the highway bridge in the eastern part of Newport, 1 mile from the railroad station, and 300 feet above the railroad bridge of the Southern Railway.

The station was originally established September 4, 1900, but as the wire gage was damaged a number of times the records were not continuous until after December 14, 1902. The station was discon-

tinued on December 31, 1905, but on December 1, 1906, the United States Weather Bureau began reading the gage and since that time has furnished the gage heights to the United States Geological Survey. The chain gage installed April 30, 1903, by the United States Geological Survey is the one now used by the Weather Bureau, and the datum has remained the same.

The section at the station is rather poor for discharge measurements, and a water power on the river 1 mile below the station would possibly affect the low-water flow in case the pond should be considerably lowered.

The following discharge measurement was made by W. A. Lamb:

March 15, 1909: Width, 135 feet; area, 1,310 square feet; gage height, 3.59 feet; discharge, 3,490 second-feet.

Daily gage height, in feet, of Pigeon River at Newport, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	1.6	2.6	3.0	6.0	2.6	2.3	2.0	1.7	1.5	1.3	1.1
2	2.1	1.5	2.6	2.8	3.8	2.2	2.8	1.9	1.5	1.5	1.3	1.1
3	2.1	1.7	2.5	2.7	3.0	2.6	2.2	3.0	1.5	1.4	1.3	1.1
4	2.1	1.7	2.8	2.6	2.7	7.8	2.4	2.9	1.4	1.4	1.3	1.1
5	2.5	1.6	2.6	2.5	2.6	4.5	2.0	2.5	1.4	1.4	1.3	1.1
6	2.8	3.0	2.5	2.4	2.4	3.6	1.9	2.5	1.5	1.4	1.3	1.1
7	2.5	2.3	3.8	2.5	2.3	3.1	3.0	2.3	1.4	1.4	1.3	1.1
8	2.4	2.0	3.1	2.4	2.2	2.8	4.8	2.0	1.4	1.3	1.3	1.9
9	2.3	1.9	3.0	2.4	2.2	2.9	4.4	1.9	1.4	1.3	1.3	1.7
10	2.2	6.1	6.6	2.3	2.4	2.6	3.3	1.9	1.5	1.3	1.3	1.6
11	2.1	3.8	4.0	2.2	2.9	2.5	2.8	1.8	1.7	1.7	1.3	1.4
12	2.1	3.0	3.3	2.1	2.5	2.4	2.6	1.8	1.6	2.2	1.2	1.4
13	2.0	2.6	3.0	2.1	2.3	2.5	2.4	1.9	1.4	1.5	1.2	1.4
14	2.1	2.5	4.3	3.2	2.2	2.7	2.9	2.5	1.4	1.4	1.2	3.1
15	2.2	2.4	3.8	2.4	2.2	2.8	2.4	1.9	1.4	3.0	1.2	2.2
16	3.6	6.0	3.3	2.2	2.1	2.5	2.2	4.1	1.4	2.3	1.2	1.9
17	3.4	3.5	3.0	2.2	2.1	2.8	2.2	3.8	1.7	1.9	1.2	1.8
18	2.6	2.8	2.8	2.1	2.0	2.6	2.0	2.6	1.6	1.8	1.3	1.7
19	2.3	2.5	2.7	2.0	2.0	2.3	2.0	2.3	1.5	1.6	1.3	1.6
20	2.2	3.3	3.2	2.0	2.0	2.2	1.9	2.1	1.5	1.5	1.3	1.6
21	2.1	2.8	3.8	2.0	4.2	2.1	1.8	2.0	1.4	1.5	1.2	1.6
22	2.0	3.0	3.5	1.9	3.6	2.2	1.8	1.9	1.4	1.5	1.1	1.4
23	2.0	4.3	2.9	2.0	3.9	2.1	2.2	1.8	1.4	1.4	1.1	1.4
24	1.9	3.9	2.7	2.4	3.2	2.3	2.2	1.7	2.7	1.4	1.1	1.4
25	1.9	4.1	3.6	2.0	2.9	2.4	1.9	1.7	2.0	1.3	1.1	1.4
26	1.9	3.4	3.8	2.0	2.7	2.2	1.8	1.7	1.8	1.4	1.1	1.4
27	2.3	3.1	3.2	2.0	2.7	2.4	1.9	1.6	1.7	1.4	1.1	1.4
28	2.1	2.8	6.3	2.0	2.5	2.6	2.0	1.6	1.6	1.4	1.1	1.4
29	1.9	.....	4.6	1.9	2.3	2.3	1.9	1.6	1.5	1.4	1.1	1.8
30	1.9	.....	3.6	1.9	2.2	2.5	1.8	1.7	1.5	1.4	1.1	1.9
31	1.7	.....	3.2	.....	2.6	.....	2.0	1.8	.....	1.3	.....	(a)

a Frozen.

Daily discharge, in second-feet, of Pigeon River at Newport, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,590	820	2,000	2,600	8,420	2,000	1,590	1,220	910	740	595	460
2	1,340	740	2,000	2,290	4,020	1,460	2,290	1,110	740	740	595	460
3	1,340	910	1,860	2,140	2,600	2,000	1,460	2,600	740	665	595	460
4	1,340	910	2,290	2,000	2,140	12,300	1,720	2,440	665	665	595	460
5	1,860	820	2,000	1,860	2,000	5,370	1,220	1,860	665	665	595	460
6	2,290	2,600	1,860	1,720	1,720	3,640	1,110	1,860	740	665	595	460
7	1,860	1,590	4,020	1,860	1,590	2,760	2,600	1,590	665	665	595	460
8	1,720	1,220	2,760	1,720	1,460	2,290	5,970	1,220	665	595	595	1,110
9	1,590	1,110	2,600	1,720	1,460	2,440	5,170	1,110	665	595	595	910
10	1,460	8,630	9,690	1,590	1,720	2,000	3,100	1,110	740	595	595	820
11	1,340	4,020	4,400	1,460	2,440	1,860	2,290	1,010	910	910	595	665
12	1,340	2,600	3,100	1,340	1,860	1,720	2,000	1,010	820	1,460	525	665
13	1,220	2,000	2,600	1,340	1,590	1,860	1,720	1,110	665	740	525	665
14	1,340	1,860	4,970	2,930	1,460	2,140	2,440	1,860	665	665	525	2,760
15	1,460	1,720	4,020	1,720	1,460	2,290	1,720	1,110	665	2,600	525	1,460
16	3,640	8,420	3,100	1,460	1,340	1,860	1,460	4,590	665	1,590	525	1,110
17	3,280	3,460	2,600	1,460	1,340	2,290	1,460	4,020	910	1,110	525	1,010
18	2,000	2,290	2,290	1,340	1,220	2,000	1,220	2,000	820	1,010	595	910
19	1,590	1,860	2,140	1,220	1,220	1,590	1,220	1,590	740	820	595	820
20	1,460	3,100	2,930	1,220	1,220	1,460	1,110	1,340	740	740	595	820
21	1,340	2,290	4,020	1,220	4,780	1,340	1,010	1,220	665	740	525	820
22	1,220	2,600	3,460	1,110	3,640	1,460	1,010	1,110	665	740	460	665
23	1,220	4,970	2,440	1,220	4,210	1,340	1,460	1,010	665	665	460	665
24	1,110	4,210	2,140	1,720	2,930	1,590	1,460	910	2,140	665	460	665
25	1,110	4,590	3,640	1,220	2,440	1,720	1,110	910	1,220	595	460	665
26	1,110	3,280	4,020	1,220	2,140	1,460	1,010	910	1,010	665	460	665
27	1,590	2,760	2,930	1,220	2,140	1,720	1,110	820	910	665	460	665
28	1,340	2,290	9,050	1,220	1,860	2,000	1,220	820	820	665	460	665
29	1,110	.....	5,570	1,110	1,590	1,590	1,110	820	740	665	460	1,010
30	1,110	.....	3,640	1,110	1,460	1,860	1,010	910	740	665	460	1,110
31	910	.....	2,930	.....	2,000	.....	1,220	1,010	.....	595	.....	a1,000

a Estimated.

NOTE.—These discharges are based on a rating curve that is fairly well defined between 820 and 5,400 second-feet.

Monthly discharge of Pigeon River at Newport, Tenn., for 1909.

[Drainage area, 655 square miles.]

Month.	Drainage in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	3,640	910	1,560	2.38	2.74	B.
February	8,630	740	2,770	4.23	4.40	B.
March	9,050	1,860	3,450	5.27	6.08	A.
April	2,930	1,110	1,580	2.41	2.69	A.
May	8,420	1,220	2,310	3.53	4.07	A.
June	12,300	1,340	2,380	3.63	4.05	A.
July	5,970	1,010	1,790	2.73	3.15	A.
August	4,590	820	1,490	2.27	2.62	B.
September	2,140	665	812	1.24	1.38	B.
October	2,600	595	825	1.26	1.45	B.
November	595	460	538	.821	.92	C.
December	2,760	460	824	1.26	1.45	C.
The year	12,300	460	1,690	2.59	35.00	

HOLSTON RIVER DRAINAGE BASIN.

DESCRIPTION.

Holston River rises in Wythe and Bland counties, Va., partly in the western border of the Appalachian Mountains and partly in the plateau region of the Appalachian Valley, in three forks known as the North, Middle, and South forks. These forks flow almost parallel and rather close together in a southwesterly direction conforming with the long ridges and valleys characteristic of the drainage basin, and continue in the same general direction and entirely in the Appalachian Valley until they have united and the main stream has joined the French Broad to form the Tennessee.

Although it contains many steep and rocky mountainous ridges, the valley portion of the Holston basin is mainly an agricultural region, a large part of its area being cleared and under cultivation. The valley parallels the western mountain border and the tributaries from that side are mountain streams, some of them descending from great heights.

Watauga River, a large and important tributary, heads with the Catawba on Grandfather Mountain in the Blue Ridge and, like French Broad and Little Tennessee rivers, cuts entirely across the Appalachian Mountains. It is the uppermost of the Tennessee River tributaries to occupy the entire width of the Appalachian summit. The mountains in its basin are high and rugged and are mostly forest covered.

The average annual rainfall in the Holston River basin is about 45 inches.

SOUTH FORK OF HOLSTON RIVER NEAR CHILHOWIE, VA.

This station, which is located 4½ miles south of Chilhowie, just above the mouth of Grose Creek and 2 miles below St. Clair Creek, was established June 10, 1907, to obtain data for use in determining the water resources of the southern Appalachian Mountains, also for supplying run-off data on the upper Holston drainage where no stream gaging work had previously been done.

It is probable that the operation of mills above has some influence on the flow, especially at low stages. The station was discontinued December 31, 1909.

The vertical staff gage is spiked to an oak on the left bank, about 100 feet below the bridge.

Discharge measurements have been made from a suspension footbridge where the current is good ordinarily, but rather sluggish at low stage.

Discharge measurements of South Fork of Holston River near Chilhowie, Va., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 20	W. A. Lamb	77	232	1.06	188
September 23	E. H. Swett	74	173	.49	51
Do	do	74	170	.40	40

Daily gage height, in feet, of South Fork of Holston River near Chilhowie, Va., for 1909.

[P. Cole, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.7	0.8	1.1	1.3	1.8	0.7	0.8	0.6	0.5	0.4	0.4	0.4
2	1.5	.8	1.1	1.2	1.8	.7	.8	.7	.4	.4	.4	.4
3	1.3	.8	1.0	1.2	1.5	.8	.7	.6	.5	.4	.4	.4
4	1.2	.8	1.1	1.1	1.3	1.1	.7	.6	.5	.4	.4	.4
5	1.4	.8	1.0	1.0	1.2	1.3	.7	.6	.4	.4	.4	.4
6	1.7	.9	1.1	1.0	1.1	1.1	.7	.5	.4	.4	.4	.4
7	1.5	.8	1.6	1.0	1.0	.9	.9	.6	.5	.4	.4	.4
8	1.3	.9	1.4	.9	.9	.8	1.5	.6	.4	.4	.4	.5
9	1.2	.9	1.3	.9	.9	1.0	1.2	.6	.5	.4	.4	.5
10	1.1	2.4	1.4	.9	1.2	1.1	1.0	.5	.4	.4	.4	.4
11	1.0	1.9	1.4	.9	1.3	1.0	.9	.5	.5	.5	.4	.4
12	1.0	1.5	1.3	.8	1.2	.9	.8	.5	.4	.8	.4	.4
13	.9	1.3	1.2	.8	1.1	.9	.9	.5	.4	.4	.4	.5
14	.9	1.2	1.4	1.2	1.0	.9	1.3	.5	.4	.4	.4	.7
15	.9	1.1	1.5	1.2	.9	.8	1.1	.6	.4	.6	.4	.6
16	.9	1.3	1.4	1.1	.9	1.2	.9	.7	.6	.6	.4	.6
17	1.3	1.3	1.3	1.0	.9	1.0	.9	.7	.5	.5	.4	.5
18	1.3	1.2	1.2	.9	.8	1.1	.8	.8	.4	.5	.4	.5
19	1.2	1.2	1.1	.9	.8	1.0	.8	.7	.4	.5	.4	.4
20	1.2	1.2	1.0	.9	.8	.9	.7	.6	.4	.5	.4	.4
21	1.1	1.2	1.2	.9	1.2	.8	.7	.6	.4	.5	.4	.4
22	1.0	1.2	1.0	.9	1.5	.8	.7	.5	.4	.5	.4	.4
23	1.0	1.3	1.0	.9	1.2	.7	.7	.5	.4	.4	.4	.4
24	.9	1.4	1.0	.9	1.1	.8	.6	.5	.5	.5	.4	.4
25	.9	1.6	1.2	.9	1.0	.7	.6	.5	.5	.5	.4	.4
26	1.0	1.4	1.5	.9	.9	.7	.6	.5	.4	.5	.4	.4
27	1.1	1.3	1.4	.8	.9	.7	.6	.5	.4	.5	.4	.4
28	1.1	1.2	2.1	.9	.8	.8	.6	.5	.4	.5	.4	.4
29	1.0	.....	2.1	.8	.8	.8	.6	.5	.4	.5	.4	.4
30	1.0	.....	1.7	.8	.7	.8	.7	.5	.4	.4	.4	.4
31	.9	.....	1.5	.....	.7	.....	.6	.5	.....	.4	.....	.4

Daily discharge, in second-feet, of South Fork of Holston River near Chilhowie, Va., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.
1	585	120	210	300	670	95	120	75	55	40	40	40
2	430	120	210	250	670	95	120	95	40	40	40	40
3	300	120	175	250	430	120	95	75	55	40	40	40
4	250	120	210	210	300	210	95	75	55	40	40	40
5	360	120	175	175	250	300	95	75	40	40	40	40
6	585	145	210	175	210	210	95	55	40	40	40	40
7	430	120	505	175	175	145	145	75	55	40	40	40
8	300	145	360	145	145	120	430	75	40	40	40	55
9	250	145	300	145	145	175	250	75	55	40	40	55
10	210	1,260	360	145	250	210	175	55	40	40	40	40
11	175	760	360	145	300	175	145	55	55	55	40	40
12	175	430	300	120	250	145	120	55	40	120	40	40
13	145	300	250	120	210	145	145	55	40	40	40	55
14	145	250	360	250	175	145	300	55	40	40	40	95
15	145	210	430	250	145	120	210	75	40	75	40	75
16	145	300	360	210	145	250	145	95	75	75	40	75
17	300	300	300	175	145	175	145	95	55	55	40	55
18	300	250	250	145	120	210	120	120	40	55	40	55
19	250	250	210	145	120	175	120	95	40	55	40	40
20	250	250	175	145	120	145	95	75	40	55	40	40
21	210	250	250	145	250	120	95	75	40	55	40	40
22	175	250	175	145	430	120	95	55	40	55	40	40
23	175	300	175	145	250	95	95	55	40	40	40	40
24	145	360	175	145	210	120	75	55	55	55	40	40
25	145	505	250	145	175	95	75	55	55	55	40	40
26	175	360	430	145	145	95	75	55	40	55	40	40
27	210	300	360	120	145	95	75	55	40	55	40	40
28	210	250	945	145	120	120	75	55	40	55	40	40
29	175	.....	945	120	120	120	75	55	40	55	40	40
30	175	.....	585	120	95	120	95	55	40	40	40	40
31	145	.....	430	.....	95	.....	75	55	.....	40	.....	40

NOTE.—These discharges are based on a rating curve that is fairly well defined between 40 and 500 second-feet.

Monthly discharge of South Fork of Holston River near Chilhowie, Va., for 1909.

[Drainage area, 108 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	585	145	247	2.29	2.64	A.
February	1,260	120	296	2.74	2.85	A.
March	945	175	336	3.11	3.58	A.
April	300	120	168	1.56	1.74	A.
May	670	95	226	2.09	2.41	A.
June	300	95	149	1.38	1.54	A.
July	430	75	131	1.21	1.40	A.
August	120	55	68.7	.636	.73	B.
September	75	40	45.7	.423	.47	C.
October	120	40	51.1	.473	.55	C.
November	40	40	40.0	.370	.41	C.
December	95	40	46.5	.431	.50	C.
The year	1,260	40	150	1.39	18.82	

SOUTH FORK OF HOLSTON RIVER AT BLUFF CITY, TENN.

This station, which was originally established by the United States Weather Bureau, is located at the highway bridge at Bluff City, Tenn., about 300 feet below the bridge of the Virginia & Southwestern Railroad. It is about 10 miles above the mouth of Watauga River and 1

mile below Indian Creek. The United States Geological Survey maintained gage heights from July 17, 1900, to December 31, 1904, but since that time the records have been furnished by the United States Weather Bureau.

The station is maintained for the purpose of obtaining run-off data for the Holston River drainage basin, and its record is the longest and best one available. The flow is not affected by artificial control, nor, unless for a few days during exceptional years, by ice.

The bed is rocky and very rough, and ledges above and below the bridge cause eddies and sudden variations in the velocity, making discharge measurements difficult. The rating curve, however, is fairly good and constant. The staff gage, which is attached to the downstream side of a bridge pier, has not been changed.

Discharge measurements of South Fork of Holston River at Bluff City, Tenn., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 18	W. A. Lamb	228	795	2.50	1,880
September 18	E. H. Swett	164	384	.65	473
Do	do	164	377	.65	428

Daily gage height, in feet, of South Fork of Holston River at Bluff City, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.6	1.7	2.4	2.8	6.4	1.1	2.3	1.6	0.3	0.2	0.3	0.3
2	3.0	1.7	2.3	2.6	5.0	1.0	2.0	1.2	.3	.1	.3	.3
3	2.8	1.5	2.4	2.4	3.7	1.1	1.8	1.9	.3	.1	.2	.2
4	2.4	1.5	2.3	2.2	2.9	2.7	1.7	1.2	.3	.1	.2	.2
5	2.3	1.5	2.1	2.0	2.6	3.3	1.5	1.0	.5	.2	.3	2
6	3.6	1.9	2.1	2.0	2.2	2.6	1.1	1.2	.4	.2	.3	.2
7	3.0	1.9	3.5	2.0	2.0	2.0	1.5	1.3	.4	.2	.3	.2
8	2.7	1.9	3.5	2.0	1.8	1.7	3.3	1.1	.4	.2	.3	.7
9	2.3	1.8	3.1	2.0	1.9	1.6	2.5	.9	.4	.2	.3	.8
10	2.0	4.0	4.8	2.0	2.4	2.1	1.9	.8	.5	.1	.3	.5
11	2.0	4.9	3.9	1.8	3.4	1.8	1.8	.7	.5	.3	.3	.3
12	1.9	3.4	3.2	1.7	2.6	1.9	1.6	.7	.4	.9	.3	.3
13	1.8	2.9	2.9	1.7	2.3	1.8	1.9	.7	.3	.8	.3	.5
14	1.7	2.4	3.7	1.9	2.2	2.5	2.7	.6	.3	.5	.1	.7
15	1.7	2.4	3.9	2.0	1.8	2.1	2.0	.6	.3	.8	.1	.6
16	2.0	3.3	3.3	1.9	1.7	2.0	1.8	.9	.2	1.0	.2	.6
17	4.2	3.3	2.9	1.8	1.6	1.7	1.6	1.7	.5	.7	.2	.5
18	3.6	2.9	2.7	1.7	1.5	2.2	1.5	1.0	.7	.6	.2	.5
19	2.4	2.5	2.4	1.7	1.4	2.0	1.3	1.0	.4	.4	.2	.4
20	2.8	2.6	2.2	1.6	1.4	1.7	1.1	.8	.4	.4	.2	.4
21	2.4	2.3	2.1	1.7	1.8	1.5	1.1	.7	.3	.3	.2	.2
22	2.2	2.3	2.6	1.7	2.0	1.4	1.0	.6	.3	.3	.2	.0
23	2.0	2.3	2.4	1.8	2.0	1.3	1.0	.5	.4	.3	.2	.0
24	1.9	3.3	2.0	2.2	1.7	1.4	1.1	.5	.8	.5	.2	.0
25	1.8	4.3	2.5	2.0	1.6	1.8	1.0	.4	.8	.6	.2	.5
26	1.9	3.3	3.6	1.8	1.4	1.5	.9	.4	.5	.4	.2	.8
27	2.3	3.0	3.0	1.8	1.4	1.5	.9	.4	.3	.4	.3	.4
28	2.1	2.8	4.4	1.7	1.3	1.3	.8	.3	.3	.3	.3	.6
29	2.0	.....	5.4	1.6	1.5	1.4	.8	.3	.3	.3	.2	.5
30	1.9	.....	4.0	1.5	1.3	1.8	.9	.3	.3	.3	.2	.....
31	.....	.....	3.3	.....	1.2	.....	.9	.3	.....	.3	.....	.....

NOTE.—River frozen January 31, December 30 and 31.

Daily discharge, in second-feet, of South Fork of Holston River at Bluff City, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,460	1,190	1,900	2,370	8,720	715	1,790	1,100	285	245	285	285
2	2,630	1,190	1,790	2,130	5,800	650	1,480	785	285	212	285	285
3	2,370	1,020	1,900	1,900	3,610	715	1,280	1,380	285	212	245	245
4	1,900	1,020	1,790	1,680	2,500	2,250	1,190	785	285	212	245	245
5	1,790	1,020	1,580	1,480	2,130	3,040	1,020	650	370	245	285	245
6	3,460	1,380	1,580	1,480	1,680	2,130	715	785	325	245	285	245
7	2,630	1,380	3,320	1,480	1,480	1,480	1,020	860	325	245	285	245
8	2,250	1,380	3,320	1,480	1,280	1,190	3,040	715	325	245	285	475
9	1,790	1,280	2,760	1,480	1,380	1,100	2,010	590	325	245	285	530
10	1,480	4,060	5,440	1,480	1,900	1,580	1,380	530	370	212	285	370
11	1,480	5,620	3,910	1,280	3,180	1,280	1,280	475	370	285	285	285
12	1,380	3,180	2,900	1,190	2,130	1,380	1,100	475	325	590	285	285
13	1,280	2,500	2,500	1,190	1,790	1,280	1,380	475	285	530	285	370
14	1,190	1,900	3,610	1,380	1,680	2,010	2,250	420	285	370	212	475
15	1,190	1,900	3,910	1,480	1,280	1,580	1,480	420	285	530	212	420
16	1,480	3,040	3,040	1,380	1,190	1,480	1,280	590	245	650	245	420
17	4,390	3,040	2,500	1,280	1,100	1,190	1,100	1,190	370	475	245	370
18	3,460	2,500	2,250	1,190	1,020	1,680	1,020	650	475	420	245	370
19	1,900	2,010	1,900	1,190	940	1,480	860	650	325	325	245	325
20	2,370	2,130	1,680	1,100	940	1,190	715	530	325	325	245	325
21	1,900	1,790	1,580	1,190	1,280	1,020	715	475	285	285	245	245
22	1,680	1,790	2,130	1,190	1,480	940	650	420	285	285	245	185
23	1,480	1,790	1,900	1,280	1,480	860	650	370	325	285	245	185
24	1,380	3,040	1,480	1,680	1,190	940	715	370	530	370	245	185
25	1,280	4,560	2,010	1,480	1,100	1,280	650	325	530	420	245	370
26	1,380	3,040	3,460	1,280	940	1,020	590	325	370	325	245	530
27	1,790	2,630	2,630	1,280	940	1,020	590	325	285	325	285	325
28	1,580	2,370	4,730	1,190	860	860	530	285	285	285	285	420
29	1,480	.....	6,580	1,100	1,020	940	530	285	285	285	245	370
30	1,380	.....	4,060	1,020	860	1,280	590	285	285	285	245	300
31	1,280	.....	3,040	.....	785	.....	590	285	.....	285	.....	300

NOTE.—The above daily discharges are based on a rating curve that is fairly well defined below 3,300 second-feet.
The discharges for January 31, December 30 and 31, are estimated to allow for ice conditions.

Monthly discharge of South Fork of Holston River at Bluff City, Tenn., for 1909.

[Drainage area, 828 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	4,390	1,190	1,950	2.36	2.72	B.
February	5,620	1,020	2,280	2.75	2.86	B.
March	6,580	1,480	2,810	3.39	3.91	B.
April	2,370	1,020	1,410	1.70	1.90	B.
May	8,720	785	1,860	2.25	2.59	B.
June	3,040	650	1,320	1.59	1.77	B.
July	3,040	530	1,100	1.33	1.53	B.
August	1,380	285	574	.693	.80	B.
September	530	245	331	.400	.45	B.
October	650	212	331	.400	.46	B.
November	285	212	260	.314	.35	C.
December	530	185	330	.399	.46	B.
The year	8,720	185	1,210	1.46	19.80	

HOLSTON RIVER NEAR ROGERSVILLE, TENN.

This station, which is located at the Southern Railway bridge, 1 mile north of Austins Mills and 3 miles south of Rogersville, Tenn., was established by the United States Weather Bureau March 10, 1902, and all gage heights have been furnished by the Weather Bureau. The data from this station are useful in connection with general run-off studies and navigation problems.

The vertical staff gage is attached to the downstream end of the bridge pier nearest the right bank.

The section of river is good for measurements, but the high-decked railroad bridge is difficult and somewhat dangerous to work from. The conditions of flow are practically constant and a good rating has been developed for the low and ordinary stages.

The following discharge measurement was made by W. A. Lamb:

March 16, 1909: Width, 379 feet; area, 2,580 square feet; gage height, 4.55 feet; discharge, 10,400 second-feet.

Daily gage height, in feet, of Holston River near Rogersville, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.5	2.5	3.9	4.4	9.0	2.7	3.6	2.3	1.7	1.5	1.5	1.4
2	4.3	2.4	3.6	4.1	9.8	2.6	3.2	3.3	1.7	1.4	1.5	1.4
3	3.8	2.6	3.4	3.7	6.0	2.5	3.4	3.2	1.7	1.4	1.5	1.4
4	3.5	2.6	3.4	3.5	4.7	4.6	3.0	2.8	1.7	1.4	1.5	1.4
5	3.5	2.6	3.5	3.4	4.2	6.2	2.8	2.5	1.6	1.4	1.4	1.4
6	4.2	2.9	3.6	3.2	3.9	4.7	2.6	2.6	1.8	1.4	1.4	1.4
7	4.5	3.0	4.7	3.5	3.5	4.0	2.6	2.9	1.8	1.4	1.4	1.4
8	4.0	3.3	5.2	3.5	3.3	3.5	3.3	2.4	1.7	1.4	1.4	1.9
9	3.6	3.0	4.7	3.2	3.7	3.3	4.2	2.4	1.7	1.4	1.4	2.1
10	3.3	4.8	6.0	3.2	3.8	4.6	3.6	2.3	1.8	1.4	1.4	2.1
11	3.0	7.4	7.4	3.1	4.8	4.0	3.1	2.2	1.8	1.5	1.4	1.6
12	3.0	5.5	5.4	3.0	4.5	4.0	2.8	2.2	1.9	1.5	1.4	1.5
13	2.9	4.4	4.7	2.9	3.8	3.8	2.6	2.0	1.8	2.3	1.4	2.0
14	2.8	3.9	4.9	2.9	3.6	4.6	4.5	1.9	1.7	2.0	1.4	1.8
15	2.9	3.6	5.2	3.6	3.3	4.3	3.9	2.3	1.6	2.0	1.4	2.4
16	3.2	4.6	4.7	3.3	3.1	3.9	3.2	3.5	1.8	2.2	1.4	2.0
17	5.2	5.1	4.3	3.0	2.9	3.6	2.9	2.6	1.6	2.2	1.4	1.9
18	5.8	4.6	4.0	2.9	2.8	3.6	3.0	3.8	2.0	2.2	1.4	1.6
19	4.6	4.0	3.7	2.8	2.7	3.6	2.6	2.7	2.1	1.8	1.4	1.6
20	4.0	4.1	3.7	2.8	2.6	3.3	2.4	2.4	1.7	1.7	1.4	1.6
21	3.8	4.0	3.5	3.0	3.0	3.0	2.4	2.1	1.7	1.5	1.4	1.5
22	3.5	3.8	3.5	3.0	4.7	2.7	2.2	1.9	1.7	1.5	1.4	1.4
23	3.2	4.3	4.3	3.2	3.8	2.6	2.2	1.9	1.8	1.4	1.4	1.4
24	3.0	4.8	3.8	3.5	3.5	2.8	2.2	1.9	2.1	1.4	1.4	1.9
25	3.0	5.8	4.2	3.3	3.1	3.6	2.2	1.8	2.4	1.4	1.4	1.4
26	2.9	5.5	5.2	3.1	3.0	3.1	2.1	1.8	2.2	1.5	1.4	1.4
27	3.1	4.7	5.0	2.9	2.8	2.8	2.1	1.8	1.9	1.4	1.4	1.9
28	3.2	4.2	5.4	2.9	3.0	2.8	2.1	1.8	1.6	1.4	1.4	2.1
29	3.1	.....	8.6	2.9	2.8	2.7	2.1	1.8	1.6	1.4	1.4	1.9
30	3.0	.....	6.3	2.8	2.7	3.0	2.2	1.8	1.5	1.3	1.4	1.7
31	2.9	.....	5.0	.....	2.6	.....	2.4	1.8	.....	1.3	.....	1.7

Daily discharge, in second-feet, of Holston River near Rogersville, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9,490	3.420	7,370	9,120	27,400	3,900	6,410	2,960	1,700	1,320	1,320	1,140
2	8,760	3,190	6,410	8,050	30,600	3,660	5,220	5,510	1,700	1,140	1,320	1,140
3	7,040	3,660	5,800	6,720	15,400	3,420	5,800	5,220	1,700	1,140	1,320	1,140
4	6,100	3,660	5,800	6,100	10,200	9,860	4,670	4,150	1,700	1,140	1,320	1,140
5	6,100	3,660	6,100	5,800	8,400	16,200	4,150	3,420	1,510	1,140	1,140	1,140
6	8,400	4,410	6,410	5,220	7,370	10,200	3,660	3,660	1,900	1,140	1,140	1,140
7	9,490	4,670	10,200	6,100	6,100	7,710	3,666	4,410	1,900	1,140	1,140	1,140
8	7,710	5,510	12,200	6,100	5,510	6,100	5,510	3,190	1,700	1,140	1,140	2,100
9	6,410	4,670	10,200	5,220	6,720	5,510	8,400	3,190	1,700	1,140	1,140	2,520
10	5 510	10,600	15,400	5,220	7,040	9,860	6,410	2,960	1,900	1,140	1,140	2,520
11	4,670	21,000	21,000	4,940	10,600	7,710	4,940	2,740	1,900	1,320	1,140	1,510
12	4,670	13,400	13,000	4,670	9,490	7,710	4,150	2,740	2,100	1,320	1,140	1,320
13	4,410	9,120	10,200	4,410	7,040	7,040	3,660	2,310	1,900	2,960	1,140	2,310
14	4,150	7,370	11,000	4,410	6,410	9,860	9,490	2,100	1,700	2,310	1,140	1,900
15	4,410	6,410	12,200	6,410	5,510	8,760	7,370	2,960	1,510	2,310	1,140	3,190
16	5,220	9,860	10,200	5,510	4,940	7,370	5,220	6,100	1,900	2,740	1,140	2,310
17	12,200	11,800	8,760	4,670	4,410	6,410	4,410	3,660	1,510	2,740	1,140	2,100
18	14,600	9 860	7,710	4 410	4,150	6,410	4,670	7,040	2,310	2,740	1,140	1,510
19	9,860	7,710	6,720	4,150	3,900	6,410	3,660	3,900	2,520	1,900	1,140	1,510
20	7,710	8,050	6,720	4,150	3,660	5,510	3,190	3,190	1,700	1,700	1,140	1,510
21	7,040	7,710	6,100	4,670	4,670	4,670	3,190	2,520	1,700	1,320	1,140	1,320
22	6,100	7,040	6,100	4,670	10,200	3,900	2,740	2,100	1,700	1,320	1,140	1,140
23	5,220	8,760	8,760	5,220	7,040	3,660	2,740	2,100	1,900	1,140	1,140	1,140
24	4,670	10,600	7,040	6,100	6,100	4,150	2,740	2,100	2,520	1,140	1,140	2,100
25	4,670	14,600	8,400	5,510	4,940	6,410	2,740	1,900	3,190	1,140	1,140	1,140
26	4,410	13,400	12,200	4,940	4,670	4,940	2,520	1,900	2,740	1,320	1,140	1,140
27	4,940	10,200	11,400	4,410	4,150	4,150	2,520	1,900	2,100	1,140	1,140	2,100
28	5,220	8,400	13,000	4,410	4,670	4,150	2,520	1,900	1,510	1,140	1,140	2,520
29	4,940	.....	25,800	4,410	4,150	3,900	2,520	1,900	1,510	1,140	1,140	2,100
30	4,670	.....	16,600	4,150	3,900	4,670	2,740	1,900	1,320	970	1,140	1,700
31	4,410	.....	11,400	.....	3,660	.....	3,190	1,900	.....	970	.....	1,700

NOTE.—These discharges are based on a rating curve that is well defined between 490 and 15,400 second feet.

Monthly discharge of Holston River near Rogersville, Tenn., for 1909.

[Drainage area, 3,060 square miles.]

Month.	Discharge in second-feet.					Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Run-off (depth in inches on drainage area).	
January	14,600	4,150	6,550	2.14	2.47	A.
February	21,000	3,190	8,310	2.72	2.83	A.
March	25,800	5,800	10,300	3.37	3.88	A.
April	9,120	4,150	5,330	1.74	1.94	A.
May	30,600	3,660	7,840	2.56	2.95	A.
June	16,200	3,420	6,470	2.11	2.35	A.
July	9,490	2,520	4,350	1.42	1.64	A.
August	7,040	1,900	3,150	1.03	1.19	A.
September	3,190	1,320	1,890	.618	.69	B.
October	2,960	970	1,500	.491	.57	B.
November	1,320	1,140	1,160	.379	.44	B.
December	3,190	1,140	1,690	.552	.64	B.
The year	30,600	970	4,880	1.59	21.59	

MIDDLE FORK OF HOLSTON RIVER AT CHILHOWIE, VA.

This station, which is located in Chilhowie, Va., at the new iron highway bridge, was established June 8, 1907, to obtain data for use in connection with the investigations of southern Appalachian water resources and for studies of general run-off in the upper Holston drainage. The station was discontinued December 31, 1909.

Discharge measurements have been made from the single-span bridge, where the current is good and the channel conditions favor accurate work. The datum of the chain gage, which is fastened to the upstream side of the bridge, remained unchanged during the maintenance of this station.

Discharge measurements of Middle Fork of Holston River at Chilhowie, Va., in 1907 to 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 8	Warren E. Hall	135	487	4.47	1,780
August 12	B. M. Hall, jr	130	88	1.44	112
August 13	Warren E. Hall	130	90	1.50	140
Do	B. M. Hall, jr., and Warren E. Hall	130	90	1.50	141
September 9	B. M. Hall, jr	127	78	1.39	101
1908.					
February 20	Warren E. Hall	120	202	1.84	320
July 4	F. P. Thomas	117	146	1.43	130
July 7	do	117	150	1.40	146
Do	Warren E. Hall	117	150	1.40	144
1909.					
March 19	W. A. Lamb	115	184	1.70	249
September 24	E. H. Swett	112	117	1.27	92
Do	do	112	116	1.26	90

Daily gage height, in feet, of Middle Fork of Holston River at Chilhowie, Va., for 1908–9.

[W. G. Baylor, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	1.4	1.8	2.2	5.1	1.9	1.6	1.7	1.1	1.2	1.1	1.3	1.3
2	1.5	1.9	2.4	5.2	1.9	1.6	1.6	1.4	1.1	1.1	1.3	1.2
3	1.5	2.3	2.2	4.5	1.8	1.6	1.6	1.3	1.1	1.1	1.3	1.2
4	1.6	2.8	2.0	4.0	1.8	3.2	1.6	1.3	1.1	1.1	1.3	1.2
5	2.8	.....	2.2	3.4	1.8	2.6	1.6	1.2	1.1	1.1	1.3	1.2
6	2.5	.....	3.9	3.4	1.7	2.4	1.6	1.2	1.5	1.1	1.4	1.2
7	2.0	2.9	2.7	3.7	1.7	2.0	1.4	1.1	1.4	1.1	1.4	3.3
8	1.8	2.5	2.5	3.3	1.7	1.8	1.4	1.1	1.4	1.1	1.3	3.5
9	1.5	1.9	2.4	3.0	1.8	1.8	1.4	1.3	1.3	1.1	1.3	3.2
10	1.5	1.8	2.2	2.9	1.6	1.7	1.3	1.7	1.3	1.2	1.3	3.1
11	1.5	1.9	2.1	2.9	1.5	1.7	1.3	1.5	1.2	1.2	1.3	3.1
12	.....	1.8	2.15	2.8	1.5	1.7	1.3	1.4	1.2	1.2	1.3	3.0
13	3.2	2.4	2.1	2.8	1.6	1.6	1.2	1.3	1.2	1.2	1.3	2.9
14	2.9	2.8	2.0	2.8	1.6	1.6	1.2	1.3	1.2	1.2	1.3	2.9
15	2.5	2.9	2.0	2.7	1.5	1.6	1.1	1.2	1.2	1.2	1.2	2.7

[a] Flood January 12, 1908; no gage height recorded. Observer recorded a rise February 5 and 6, 1908, which was probably due to ice, as there was no rise in any of the adjacent streams of the Holston drainage.

Comparison with adjacent streams indicates that gage heights beginning July 1, 1908, were in error. They were arbitrarily corrected as follows: July 1 to September 22, 1.0 foot was subtracted; September 23 to October 9, put at 1.1 feet.

Daily gage height, in feet, of Middle Fork of Holston River at Chilhowie, Va., for 1908–9—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	1.9	2.2	2.0	2.7	1.5	1.5	1.1	1.6	1.2	1.2	1.2	2.6
17	1.6	2.0	2.0	2.7	1.4	1.5	1.5	1.4	1.1	1.2	1.2	2.8
18	1.5	2.0	1.9	2.7	1.5	1.4	1.7	1.2	1.1	1.1	1.1	2.7
19	1.5	1.9	1.9	2.3	1.6	1.4	1.6	1.2	1.1	1.2	1.1	2.6
20	1.7	2.0	1.8	2.0	1.7	1.7	1.5	1.2	1.1	1.2	1.1	2.5
21	1.8	1.9	1.8	1.9	1.7	1.8	1.5	1.1	1.1	1.2	1.1	2.5
22	1.5	1.8	1.8	1.8	1.6	1.7	1.4	1.1	1.1	1.2	1.0	2.4
23	1.4	1.8	1.7	1.7	1.6	2.5	1.4	1.1	1.1	1.1	1.0	2.3
24	1.5	1.7	1.7	1.7	1.8	2.1	1.3	1.4	1.1	1.2	1.0	2.3
25	1.5	1.7	1.8	1.7	2.1	1.9	1.3	1.6	1.1	1.2	1.0	2.2
26	1.5	1.8	1.8	2.7	1.9	1.8	1.3	1.7	1.1	1.2	1.0	2.4
27	1.6	1.8	1.8	2.3	1.8	1.7	1.2	1.6	1.1	1.2	1.0	2.4
28	1.7	1.8	1.8	2.2	1.7	1.7	1.2	1.5	1.1	1.4	1.0	3.6
29	1.9	1.7	1.8	2.0	1.7	1.6	1.1	1.5	1.1	1.5	1.0	3.7
30	1.8	.....	2.2	2.0	1.8	1.6	1.1	1.4	1.1	1.4	1.3	3.5
31	1.8	.....	4.85	.....	1.8	.....	1.1	1.2	.....	1.3	.....	3.3
1909.												
1	2.6	2.5	1.7	1.9	3.4	1.2	1.4	1.3	1.1	1.3	1.0	1.1
2	2.3	2.5	1.7	1.8	2.8	1.2	1.4	2.0	1.1	1.3	1.0	1.1
3	2.2	2.4	1.8	1.8	2.0	1.2	1.3	1.6	1.3	1.3	1.0	1.1
4	2.2	2.5	1.7	1.7	1.8	1.7	1.3	1.4	1.3	1.2	1.0	1.1
5	2.0	2.3	1.9	1.7	1.7	1.6	1.3	1.3	1.2	1.1	1.1	1.1
6	1.9	2.4	2.3	1.7	1.7	1.4	1.3	1.3	1.2	1.1	1.1	1.1
7	1.9	2.2	2.5	1.6	1.7	1.2	1.6	1.3	1.2	1.1	1.1	1.1
8	1.8	2.0	2.2	1.6	1.6	1.2	2.2	1.3	1.2	1.1	1.1	1.2
9	1.7	2.0	2.0	1.5	1.6	1.2	1.8	1.3	1.7	1.1	1.1	1.2
10	1.7	1.8	2.9	1.4	2.8	1.3	1.6	1.4	1.6	1.1	1.1	1.1
11	1.7	1.7	2.3	1.5	2.6	1.3	1.4	1.4	1.5	1.4	1.1	1.1
12	1.7	1.7	2.0	1.5	2.4	1.3	1.3	1.3	1.5	1.4	1.1	1.1
13	1.6	1.6	2.1	1.5	2.0	1.2	1.7	1.3	1.5	1.3	1.1	1.1
14	1.6	1.6	2.4	1.7	2.0	1.2	1.5	1.3	1.4	1.3	1.1	1.3
15	1.5	1.5	2.1	1.7	1.8	1.2	1.4	1.3	1.4	1.3	1.1	1.3
16	2.85	1.5	1.9	1.6	1.6	1.1	1.5	1.2	1.3	1.3	1.1	1.2
17	2.9	1.5	1.8	1.5	1.4	1.1	1.4	1.2	1.3	1.2	1.1	1.2
18	2.7	1.5	1.7	1.5	1.4	1.3	1.3	1.2	1.3	1.2	1.1	1.2
19	2.6	1.8	1.7	1.5	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.2
20	2.6	2.1	1.6	1.4	1.3	1.4	1.3	1.2	1.2	1.2	1.1	1.2
21	2.4	2.0	2.8	1.4	1.3	1.4	1.4	1.2	1.2	1.2	1.1	1.2
22	2.2	1.9	2.2	1.5	2.4	1.3	1.3	1.1	1.2	1.2	1.1	1.2
23	2.0	1.7	1.9	1.7	2.2	1.2	1.3	1.1	1.2	1.3	1.1	1.2
24	2.0	1.7	1.7	1.6	2.0	1.2	1.3	1.1	1.2	1.2	1.1	1.3
25	1.9	2.7	3.0	1.5	1.8	1.2	1.3	1.1	1.2	1.2	1.1	1.3
26	1.9	2.4	2.4	1.4	1.7	1.2	1.3	1.1	1.2	1.2	1.1	1.3
27	1.9	1.9	2.1	1.4	1.4	1.2	1.3	1.1	1.2	1.1	1.1	1.3
28	1.9	1.7	5.1	1.4	1.7	4.3	1.3	1.1	1.4	1.1	1.1	1.3
29	1.8	.....	3.4	1.4	1.8	3.9	1.3	1.1	1.3	1.1	1.1	1.3
30	1.7	.....	2.4	7.4	1.6	3.0	1.3	1.1	1.3	1.0	1.1	1.3
31	1.7	.....	2.0	.....	1.4	.....	1.3	1.1	.....	1.0	.....	1.3

Daily discharge, in second-feet, of Middle Fork of Holston River at Chilhowie, Va., for 1907–1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	.....	.....	.....	.....	.....	.....	208	168	168	132	132	294
2	.....	.....	.....	.....	.....	.....	208	132	132	99	99	250
3	.....	.....	.....	.....	.....	.....	168	168	99	71	71	168
4	.....	.....	.....	.....	.....	.....	168	168	208	132	99	132
5	.....	.....	.....	.....	.....	.....	168	132	132	168	168	208
6	.....	.....	.....	.....	.....	.....	208	168	132	132	132	168
7	.....	.....	.....	.....	.....	.....	208	99	208	208	168	208
8	.....	.....	.....	.....	.....	.....	168	132	132	250	208	294
9	.....	.....	.....	.....	.....	.....	168	168	168	132	250	250
10	.....	.....	.....	.....	.....	484	952	208	132	99	591	208

[a] See note on p. 152.

Daily discharge, in second-feet, of Middle Fork of Holston River at Chilhowie, Va., for 1907–1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
11							294	208	99	132	700	294
12						1,390	1,270	250	208	168	339	168
13							700	168	132	99	294	208
14						3,820	339	208	208	99	208	132
15						1,680	294	168	132	132	250	168
16						867	484	250	208	168	132	208
17						645	339	208	168	99	168	294
18						433	339	250	168	132	208	250
19						385	294	294	99	99	294	208
20						339	385	250	99	71	208	168
21						339	250	168	168	99	132	132
22						339	250	208	208	132	99	99
23						339	208	168		99	168	132
24						339	208	208	591	99	250	168
25						339	168	168	294	132	294	208
26						294	250	168	208	99	208	168
27						250	339	250	168	132	208	208
28						208	208	208	99	168	250	339
29						385	168	132	132	208	339	168
30						294	250	168	99	168	385	208
31							208	132		132		250
1908.[a]												
1	132	294	484	2,160	339	208	250	47	71	47	99	99
2	168	339	591	2,230	339	208	208	132	47	47	99	71
3	168	537	484	1,800	294	208	208	99	47	47	99	71
4	208	811	385	1,510	294	1,040	208	99	47	47	99	71
5	811	830	484	1,150	294	700	208	71	47	47	99	71
6	645	850	1,450	1,150	250	591	208	71	168	47	132	71
7	385	867	755	1,330	250	385	132	47	132	47	132	1,100
8	294	645	645	1,100	250	294	132	47	132	47	99	1,210
9	168	339	591	924	294	294	132	99	99	47	99	1,040
10	168	294	484	867	208	250	99	250	99	71	99	981
11	168	339	433	867	168	250	99	168	71	71	99	981
12		294	458	811	168	250	99	132	71	71	99	924
13	1,040	591	433	811	208	208	71	99	71	71	99	867
14	867	811	385	811	208	208	71	99	71	71	99	867
15	645	867	385	755	168	208	47	71	71	71	71	755
16	339	484	385	755	168	168	47	208	71	71	71	700
17	208	385	385	755	132	168	168	132	47	71	71	811
18	168	385	339	755	168	132	250	71	47	47	47	755
19	168	339	339	537	208	132	208	71	47	71	47	700
20	250	385	294	385	250	250	168	71	47	71	47	645
21	294	339	294	339	250	294	168	47	47	71	47	645
22	168	294	294	294	208	250	132	47	47	71	25	591
23	132	294	250	250	208	645	132	47	47	47	25	537
24	168	250	250	250	294	433	99	132	47	71	25	537
25	168	250	294	250	433	339	99	208	47	71	25	484
26	168	294	294	755	339	294	99	250	47	71	25	591
27	208	294	294	537	294	250	71	208	47	71	25	591
28	250	294	294	484	250	250	71	168	47	132	25	1,270
29	339	250	294	385	250	208	47	168	47	168	25	1,330
30	294		484	385	294	208	47	132	47	132	99	1,210
31	294		2,010		294		47	71		99		1,100
1909.[a]												
1	700	645	250	339	1,150	71	132	99	47	99	25	47
2	537	645	250	294	811	71	132	385	47	99	25	47
3	484	591	294	294	385	71	99	208	99	99	25	47
4	484	645	250	250	294	250	99	132	99	71	25	47
5	385	537	339	250	250	208	99	99	71	47	47	47
6	339	591	537	250	250	132	99	99	71	47	47	47
7	339	484	645	208	250	71	208	99	71	47	47	47
8	294	385	484	208	208	71	484	99	71	47	47	71
9	250	385	385	168	208	71	294	99	250	47	47	71
10	250	294	867	132	811	99	208	132	208	47	47	47

[a] See note on p. 152.

Daily discharge, in second-feet, of Middle Fork of Holston River at Chilhowie, Va., for 1907–1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.												
11	250	250	537	168	700	99	132	132	168	132	47	47
12	250	250	385	168	591	99	99	99	168	132	47	47
13	208	208	433	168	385	71	250	99	168	99	47	47
14	208	208	591	250	385	71	168	99	132	99	47	99
15	168	168	433	250	294	71	132	99	132	99	47	99
16	839	168	339	208	208	47	168	71	99	99	47	71
17	867	168	294	168	132	47	132	71	99	71	47	71
18	755	168	250	168	132	99	99	71	99	71	47	71
19	700	294	250	168	99	99	99	71	71	71	47	71
20	700	433	208	132	99	132	99	71	71	71	47	71
21	591	385	811	132	99	132	132	71	71	71	47	71
22	484	339	484	168	591	99	99	47	71	71	47	71
23	385	250	339	250	484	71	99	47	71	99	47	71
24	385	250	250	208	385	71	99	47	71	71	47	99
25	339	755	924	168	294	71	99	47	71	71	47	99
26	339	591	591	132	250	71	99	47	71	71	47	99
27	339	339	433	132	132	71	99	47	71	47	47	99
28	339	250	2,160	132	250	1,680	99	47	132	47	47	99
29	294	.....	1,150	132	294	1,450	99	47	99	47	47	99
30	250	.....	591	3,750	208	924	99	47	99	25	47	99
31	250	.....	385	.....	132	.....	99	47	.....	25	47	99

NOTE.—These daily discharges are based on a rating curve that is fairly well defined between 70 and 2,100 second-feet. There were floods on days for which no discharge is given and gage was not read.

Monthly discharge of Middle Fork of Holston River at Chilhowie, Va., for 1907–1909.

[Drainage area, 144 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1907.						
June, 19 days	.....	.....	693	4.81	3.40	C.
July	1,270	168	318	2.21	2.55	B.
August	294	99	186	1.29	1.49	B.
September, 29 days	.....	99	172	1.19	1.28	C.
October	250	71	132	.917	1.06	B.
November	700	71	235	1.63	1.82	B.
December	339	99	205	1.42	1.64	B.
1908.						
January, 30 days	.....	132	316	2.19	2.44	C.
February	867	250	457	3.17	3.42	B.
March	2,010	250	492	3.42	3.94	A.
April	2,230	250	846	5.88	6.56	A.
May	433	132	251	1.74	2.01	B.
June	1,040	132	311	2.16	2.41	B.
July	250	47	130	.903	1.04	C.
August	250	47	115	.799	.92	C.
September	168	47	65.8	.457	.51	C.
October	168	47	70.5	.490	.56	C.
November	132	25	71.7	.498	.56	B.
December	1,330	71	699	4.85	5.59	A.
1909.						
January	867	168	419	2.91	3.36	A.
February	755	168	381	2.65	2.76	A.
March	2,160	208	521	3.62	4.17	A.
April	3,750	132	315	2.19	2.44	A.
May	1,150	99	347	2.41	2.78	A.
June	1,680	71	220	1.53	1.71	B.
July	484	99	140	.972	1.12	B.
August	385	47	92.7	.644	.74	B.
September	250	47	102	.708	.79	B.
October	132	25	72.2	.501	.58	C.
November	47	25	44.1	.306	.34	C.
December	99	47	71.5	.497	.57	C.
The year	3,750	25	227	1.58	21.36	

LITTLE TENNESSEE RIVER DRAINAGE BASIN.

DESCRIPTION.

Little Tennessee River with its tributaries drains a large area extending from the Blue Ridge on the south to the Great Smoky Mountains on the north, including the territory between the basins of Pigeon and Hiwassee rivers. Its larger tributaries are the Tuckasegee from the east and the Nantahala from the south, and these streams, with the upper portion of the Little Tennessee as a middle fork, all head on top of the Blue Ridge. After cutting through the northwestern mountain rim with a great amount of fall, the river enters a broad and almost level plain extending to Tennessee River.

The upper or southern part of the basin, lying on the northwest slope of the Blue Ridge, is an elevated plateau with low, rounded granite knobs and few high summits and having a general altitude of more than 3,000 feet above sea level.

Farther downstream, in the interior and toward the northwestern border of the mountain section, the Balsam, Cowee, Nantahala, Cheoah, Unaka, and Great Smoky mountains, with many crests over 6,000 feet high, form the watershed, and from these descend many swift streams which have carved deep, narrow valleys, leaving high and irregular intervening ridges. The lower part of the basin includes some of the most rugged land in the southern Appalachians and contains only a very small part suited for tillage, but in the upper part much of the mountain land is not steep and there are several large and fertile valleys. As a whole, this basin probably contains a larger proportion of original forests and better timber than any basin in the southern Appalachian region. The great mountains on the northwestern border especially are almost entirely in forests.

The soils in the upper part of the basin are derived from granite and are sandy. On Little Tennessee River around and above Franklin, where most of the good farms are located, they comprise deep and fertile red loams, derived from schists. In the narrow valleys around the high mountains, where sandstones, quartzite, and conglomerates prevail, the soils are generally thin, sandy, and agriculturally poor, but on north slopes and in hollows they are well suited to forests.

The mean annual rainfall for the Little Tennessee River basin is about 52 inches.

LITTLE TENNESSEE RIVER NEAR FRANKLIN, N. C.

This station is located at the iron wagon bridge about 1 mile northeast of Franklin, N. C. It was established June 12, 1907, in cooperation with the Forest Service, to supply data regarding the water resources and power sites in the southern Appalachian Mountains.

The station is 1 mile below the mouth of Cullasagee River (see Pl. VI), which is an important tributary. The few mills above the station probably cause a small amount of variation in the flow.

Discharge measurements are made from the bridge, where the river has high banks, permanent, rocky bottom, and swift current, and is about 125 feet wide.

The vertical staff gage is attached to a tree on the left bank about 700 feet above the bridge. Its datum has not been changed.

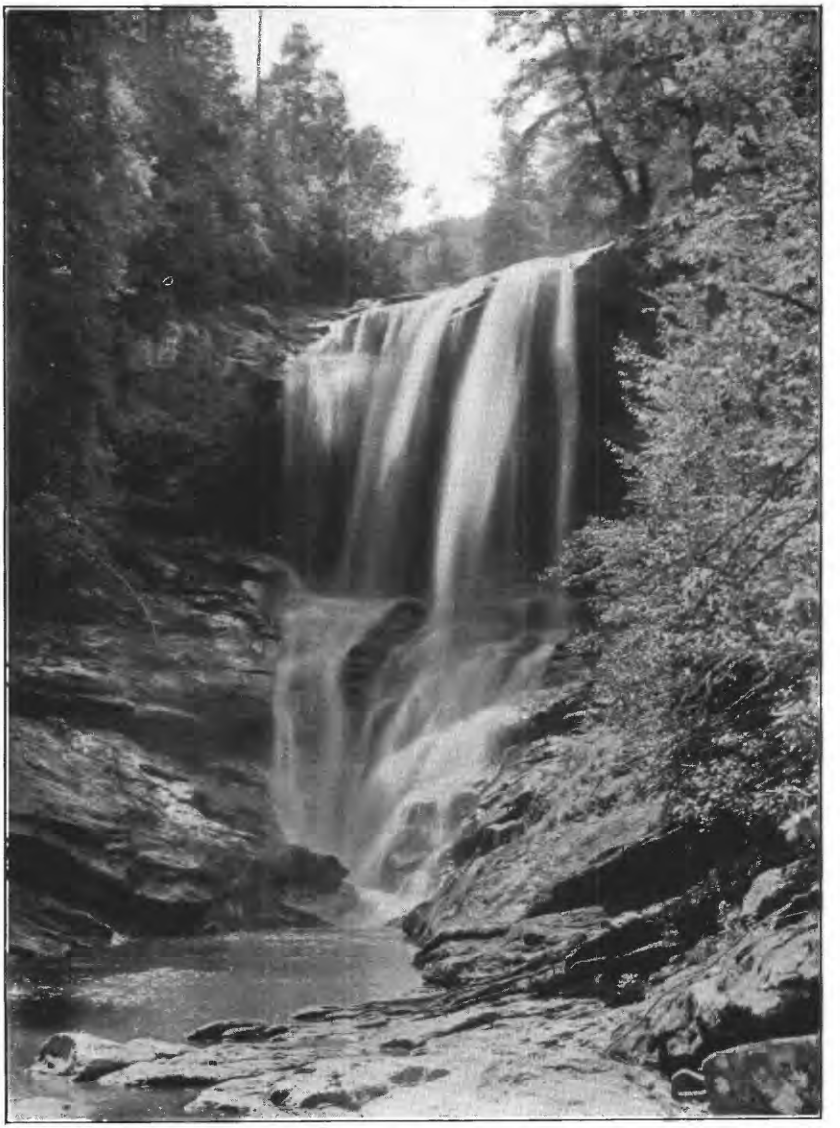
Discharge measurements of Little Tennessee River at Franklin, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 9	M. R. Hall	138	539	4.42	2,380
Do	do	138	521	4.34	2,380
October 30	E. H. Swett	124	218	1.63	462

Daily gage height, in feet, of Little Tennessee River at Franklin, N. C., for 1909.

[T. W. Angel, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	1.9	3.0	3.1	6.0	3.8	3.0	2.4	1.8	1.85	1.6	1.4
2	2.2	1.9	3.0	3.0	4.0	2.95	3.0	2.3	1.7	1.8	1.65	1.4
3	2.05	1.85	2.9	3.0	3.4	4.4	2.95	2.55	1.65	1.8	1.6	1.35
4	2.8	1.8	2.8	2.95	3.0	10.0	2.75	2.6	1.6	1.75	1.6	1.35
5	3.6	1.8	2.75	2.8	3.0	7.1	2.6	2.8	1.65	1.6	1.55	1.35
6	2.8	2.9	2.8	2.7	2.85	5.0	2.95	2.4	1.65	1.6	1.5	1.3
7	2.5	2.4	3.0	2.8	2.75	4.9	2.8	2.3	1.7	1.6	1.5	4.2
8	2.4	2.0	2.8	2.7	2.7	4.4	3.0	2.3	1.65	1.6	1.5	3.2
9	2.3	2.0	2.7	2.85	2.6	4.8	3.4	2.3	1.7	1.5	1.5	2.8
10	2.2	4.9	5.6	2.65	5.7	4.4	3.1	2.25	1.8	1.5	1.5	2.5
11	2.15	3.4	4.3	2.6	4.0	4.0	2.8	2.25	1.7	3.0	1.5	1.85
12	2.1	2.75	3.6	2.5	3.1	3.7	2.75	2.3	1.7	1.9	1.5	6.0
13	2.0	3.8	5.1	3.3	2.9	3.5	2.6	2.35	1.7	1.6	1.5	5.3
14	2.1	3.2	6.8	3.0	2.8	3.4	3.0	2.8	1.65	2.3	1.5	4.2
15	2.4	2.85	4.9	2.95	2.7	3.4	2.7	2.3	1.65	3.2	1.5	3.2
16	2.45	5.1	4.1	2.85	2.6	3.2	2.5	4.8	1.8	2.35	1.5	3.0
17	3.1	4.0	3.6	2.75	2.55	3.5	2.6	2.95	1.75	2.2	1.5	2.8
18	2.7	3.3	3.5	2.65	2.5	3.3	2.4	2.3	1.7	2.1	1.5	2.5
19	2.5	2.95	3.3	2.55	2.5	3.0	2.35	2.25	1.65	1.9	1.5	2.3
20	2.35	3.5	3.4	2.5	7.0	3.0	2.3	2.15	1.6	1.8	1.5	2.2
21	2.3	3.2	3.2	2.5	5.6	3.2	2.25	2.1	1.55	1.8	1.5	2.1
22	2.2	3.6	3.2	2.45	6.4	3.5	2.25	2.1	3.1	1.8	1.5	2.0
23	2.15	4.6	2.95	3.0	6.0	3.4	2.8	2.05	3.5	1.75	1.8	1.85
24	2.2	4.5	2.9	2.7	4.6	3.0	2.3	2.0	3.0	1.75	1.5	1.9
25	2.1	4.1	6.6	2.65	4.2	3.0	2.25	1.9	2.4	1.75	1.5	1.95
26	2.05	3.7	4.1	2.55	3.8	3.7	2.4	1.85	2.2	1.7	1.5	1.8
27	2.0	3.4	3.6	2.4	3.8	3.0	2.25	1.8	2.0	1.7	1.5	1.8
28	1.95	3.2	4.9	2.8	3.5	3.0	2.15	1.8	1.9	1.65	1.5	1.85
29	2.0	.....	3.8	2.55	3.3	3.3	2.1	1.85	1.85	1.65	1.5	1.85
30	2.1	.....	3.5	2.5	3.2	3.2	2.2	1.8	1.85	1.6	1.5	1.85
31	1.9	.....	3.3	.....	3.1	.....	2.2	1.85	.....	1.6	.....	1.9



CULLASAGEE FALLS, CULLASAGEE RIVER, 3 MILES NORTHWEST OF HIGHLANDS, N. C.

Daily discharge, in second-feet, of Little Tennessee River at Franklin, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	895	610	1,280	1,350	.....	1,880	1,280	895	560	585	465	375
2	775	610	1,280	1,280	2,050	1,240	1,280	835	510	560	488	375
3	692	585	1,210	1,280	1,570	2,390	1,240	985	488	560	465	355
4	1,140	560	1,140	1,240	1,280	.....	1,110	1,020	465	535	465	355
5	1,720	560	1,110	1,140	1,280	.....	1,020	1,140	488	465	442	355
6	1,140	1,210	1,140	1,080	1,180	2,930	1,240	895	488	465	420	335
7	955	895	1,280	1,140	1,110	2,840	1,140	835	510	465	420	2,220
8	895	665	1,140	1,080	1,080	2,390	1,280	835	488	465	420	1,420
9	835	665	1,080	1,180	1,020	2,750	1,570	835	510	420	420	1,140
10	775	2,840	.....	1,050	.....	2,390	1,350	805	560	420	420	955
11	748	1,570	2,300	1,020	2,050	2,050	1,140	805	510	1,280	420	585
12	720	1,110	1,720	955	1,350	1,800	1,110	835	510	610	420	.....
13	665	1,880	3,020	1,500	1,210	1,640	1,020	865	510	465	420	.....
14	720	1,420	.....	1,280	1,140	1,570	1,280	1,140	488	835	420	2,220
15	895	1,180	2,840	1,240	1,080	1,570	1,080	835	488	1,420	420	1,420
16	925	3,020	2,140	1,180	1,020	1,420	955	2,750	560	865	420	1,280
17	1,350	2,050	1,720	1,110	985	1,640	1,020	1,240	535	775	420	1,140
18	1,080	1,500	1,640	1,050	955	1,500	895	835	510	720	420	955
19	955	1,240	1,500	985	955	1,280	865	805	488	610	420	835
20	865	1,640	1,570	955	.....	1,280	835	748	465	560	420	775
21	835	1,420	1,420	955	.....	1,420	805	720	442	560	420	720
22	775	1,720	1,420	925	.....	1,640	805	720	1,350	560	420	665
23	748	2,570	1,240	1,280	.....	1,570	1,140	692	1,640	535	560	585
24	775	2,480	1,210	1,080	2,570	1,280	835	665	1,280	535	420	610
25	720	2,140	.....	1,050	2,220	1,280	805	610	895	535	420	638
26	692	1,800	2,140	985	1,880	1,800	895	585	775	510	420	560
27	665	1,570	1,720	895	1,880	1,280	805	560	665	510	420	560
28	638	1,420	2,840	1,140	1,640	1,280	748	560	610	488	420	585
29	665	.....	1,880	985	1,500	1,500	720	585	585	488	420	585
30	720	.....	1,640	955	1,420	1,420	775	560	585	465	420	585
31	610	.....	1,500	.....	1,350	.....	775	585	.....	465	.....	610

NOTE.—These discharges are based on a rating table that is not well defined. Discharges for missing days are above 2,900 second-feet.

LITTLE TENNESSEE RIVER NEAR JUDSON, N. C.

This station is located at the Southern Railway bridge about one-fourth mile from Judson, N. C., and a short distance below the mouth of Sawyer Branch. It was established in June, 1896, for the purpose of obtaining general run-off and water-power data. The station is 2½ miles below the mouth of Nantahala River and about 4 miles above the mouth of Tuckasegee River.

During 1903 the original wire gage was replaced by a standard chain gage having the same location and datum, which was used until June 30, 1905. Since July 1, 1905, a vertical gage bolted to a solid rock on the right bank, about 100 feet above the bridge, has been used. This gage was set to read with the chain gage at a gage height of 3 feet, but owing to the large amount of slope in the river the actual elevation of its zero is 0.50 foot above the datum of the chain gage.

The river bed is rocky and uneven and the current is swift and rough, making measurements difficult at any but low stages. The flow is little affected by artificial control, and conditions are probably constant, although many of the measurements plot wide, owing, it is thought, to the rough bottom and broken current.

Discharge measurements of Little Tennessee River at Judson, N. C., in 1909.

Date.	Hydrographer.	Width	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	M. R. Hall	160	534	4.80	2,850
April 15	do	278	868	4.60	2,850
October 26	E. H. Swett	147	318	3.00	937
October 27	do	147	321	2.99	943

Daily gage height, in feet, of Little Tennessee River at Judson, N. C., for 1909.

[Miss E. G. Enloe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	3.5	4.9	5.0	5.0	4.5	4.6	3.5	3.0	3.0	2.9	2.7
2	3.7	3.4	4.8	4.8	7.6	5.0	4.3	3.5	3.0	2.9	2.9	2.7
3	3.6	3.4	4.6	4.5	5.1	5.6	4.2	4.5	3.0	2.9	2.9	2.7
4	3.9	3.3	4.5	4.5	4.8	9.4	4.1	4.5	3.0	2.9	2.9	2.7
5	5.1	3.3	4.7	4.4	4.5	9.0	4.1	4.2	3.0	2.9	2.9	2.7
6	4.7	3.4	4.8	4.5	4.5	9.8	4.3	4.1	3.0	2.9	2.9	2.7
7	4.3	3.5	5.0	4.5	4.5	8.0	5.5	3.8	3.0	2.9	2.9	2.7
8	4.0	3.8	4.9	4.5	4.4	7.6	5.5	3.8	3.0	2.9	2.8	2.7
9	3.9	3.7	4.8	4.6	5.0	6.0	5.1	3.8	3.0	2.9	2.8	2.7
10	3.8	3.0	8.0	4.5	5.1	5.2	4.5	4.0	3.2	2.9	2.8	2.7
11	3.7	7.4	5.6	4.3	4.3	5.1	4.5	4.0	3.1	3.4	2.8	2.7
12	3.7	4.7	5.2	4.2	4.3	5.1	4.3	4.2	3.0	3.4	2.8	2.7
13	3.0	4.6	9.5	4.4	4.2	5.0	5.6	4.2	3.0	3.4	2.8	6.1
14	3.8	4.7	8.7	5.1	4.1	5.1	5.0	4.0	3.0	3.5	2.8	5.6
15	4.0	4.5	7.0	4.6	4.1	4.7	4.5	4.0	3.1	3.5	2.8	5.5
16	5.8	6.6	6.5	4.6	4.0	4.7	4.2	4.2	4.0	3.5	2.8	5.5
17	6.5	5.6	5.2	4.7	4.1	4.6	4.0	5.2	3.5	3.5	2.8	5.5
18	5.0	6.5	5.1	4.2	4.1	4.5	3.9	3.5	3.2	3.4	2.9	4.6
19	4.2	6.4	5.0	4.1	4.1	4.4	3.8	3.8	3.0	3.4	3.0	4.6
20	4.1	5.9	5.0	4.1	5.0	4.5	3.8	3.8	3.0	3.3	2.9	4.5
21	4.0	5.0	5.0	4.1	7.7	4.5	3.9	3.8	3.3	3.2	2.8	4.3
22	3.9	6.6	4.9	4.0	7.7	4.5	5.1	3.5	3.3	3.2	2.8	4.3
23	3.9	6.8	4.8	4.7	7.8	4.0	3.9	3.5	5.2	3.2	2.8	4.2
24	3.8	5.0	5.0	4.5	6.3	4.0	3.8	3.5	4.3	3.1	2.8	4.1
25	3.9	5.6	6.0	4.1	6.3	4.7	3.7	3.4	4.3	3.1	2.8	3.0
26	3.9	5.7	6.9	4.1	5.7	4.7	3.7	3.4	4.3	3.0	2.8	3.0
27	3.8	4.9	5.5	4.1	5.5	4.8	3.6	3.4	4.3	3.0	2.8	3.3
28	3.5	5.0	6.0	4.1	5.0	4.7	3.5	3.2	4.3	2.9	2.7	3.3
29	3.5	.....	6.0	4.4	4.8	4.9	3.5	3.2	3.3	2.9	2.7	3.0
30	3.5	.....	5.3	4.5	4.7	4.7	3.5	3.1	3.0	2.9	2.7	2.7
31	3.5	.....	5.0	.....	4.5	.....	3.5	3.1	.....	2.9	.....	3.0

Daily discharge, in second-feet, of Little Tennessee River at Judson, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,700	1,390	3,360	3,550	3,550	2,640	2,810	1,390	950	950	875	725
2	1,600	1,300	3,170	3,170	10,900	3,550	2,320	1,390	950	875	875	725
3	1,490	1,300	2,810	2,640	3,750	4,850	2,180	2,640	950	875	875	725
4	1,820	1,200	2,640	2,640	3,170	17,400	2,050	2,640	950	875	875	725
5	3,750	1,200	2,990	2,480	2,640	15,900	2,050	2,180	950	875	875	725
6	2,990	1,300	3,170	2,640	2,640	19,000	2,320	2,050	950	875	875	725
7	2,320	1,390	3,550	2,640	2,640	12,300	4,610	1,700	950	875	875	725
8	1,930	1,700	3,360	2,640	2,480	10,900	4,610	1,700	950	875	800	725
9	1,820	1,600	3,170	2,810	3,550	5,900	3,750	1,700	950	875	800	725
10	1,700	950	12,300	2,640	3,750	3,950	2,640	1,930	1,120	875	800	725
11	1,600	10,200	4,850	2,320	2,320	3,750	2,640	1,930	1,030	1,300	800	725
12	1,600	2,990	3,950	2,180	2,320	3,750	2,320	2,180	950	1,300	800	725
13	950	2,810	17,800	2,480	2,180	3,550	4,850	2,180	950	1,300	800	6,180
14	1,700	2,990	14,800	3,750	2,050	3,750	3,550	1,930	950	1,390	800	4,850
15	1,930	2,640	8,930	2,810	2,050	2,990	2,640	1,930	1,030	1,390	800	4,610
16	5,360	7,690	7,380	2,810	1,930	2,990	2,180	2,180	1,930	1,390	800	4,610
17	7,380	4,850	3,950	2,990	2,050	2,810	1,930	3,950	1,390	1,390	800	4,610
18	3,550	7,380	3,750	2,180	2,050	2,640	1,820	1,390	1,120	1,300	875	2,810
19	2,180	7,070	3,550	2,050	2,050	2,480	1,700	1,700	950	1,300	950	2,810
20	2,050	5,630	3,550	2,050	3,550	2,640	1,700	1,700	950	1,200	875	2,640
21	1,930	3,550	3,550	2,050	11,200	2,640	1,820	1,700	1,200	1,120	800	2,320
22	1,820	7,690	3,360	1,930	11,200	2,640	3,750	1,390	1,200	1,120	800	2,320
23	1,820	8,310	3,170	2,990	11,600	1,930	1,820	1,390	3,950	1,120	800	2,180
24	1,700	3,550	3,550	2,640	6,770	1,930	1,700	1,390	2,320	1,030	800	2,050
25	1,820	4,850	5,900	2,050	6,770	2,990	1,600	1,300	2,320	1,030	800	950
26	1,820	5,100	8,620	2,050	5,100	2,990	1,600	1,300	2,320	950	800	950
27	1,700	3,360	4,610	2,050	4,610	3,170	1,490	1,300	2,320	950	800	1,200
28	1,390	3,550	5,900	2,050	3,550	2,990	1,390	1,120	2,320	875	725	1,200
29	1,390	.....	5,900	2,480	3,170	3,360	1,390	1,120	1,200	875	725	1,200
30	1,390	.....	4,160	2,640	2,990	2,990	1,390	1,030	950	875	725	725
31	1,390	.....	3,550	.....	2,640	.....	1,390	1,030	.....	875	.....	950

NOTE.—These discharges are based on a rating curve that is not well defined.

Monthly discharge of Little Tennessee River at Judson, N. C., for 1909.

[Drainage area, 675 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	7,380	950	2,180	3.23	3.72	B.
February	10,200	950	3,840	5.69	5.92	B.
March	17,800	2,640	5,330	7.90	9.11	B.
April	3,750	1,930	2,550	3.78	4.22	B.
May	11,600	1,930	4,230	6.27	7.23	B.
June	19,000	1,930	5,180	7.67	8.56	B.
July	4,850	1,390	2,390	3.54	4.08	B.
August	3,950	1,030	1,760	2.61	3.01	B.
September	3,950	950	1,370	2.03	2.26	B.
October	1,390	875	1,060	1.57	1.81	B.
November	950	725	820	1.21	1.35	B.
December	6,180	725	1,870	2.77	3.19	B.
The year	19,000	725	2,720	4.02	54.46	

LITTLE TENNESSEE RIVER NEAR M'GHEE, TENN.

This station is located at the Louisville & Nashville Railroad bridge about one-third mile south of McGhee, Tenn., and one-half mile below the mouth of Tellico River. It was established by the

United States Weather Bureau late in 1904, the gage readings beginning November 29 of that year. Since that time discharge measurements have been made by the United States Geological Survey and the daily gage readings have been furnished by the Weather Bureau.

The boxed chain gage is located on the railroad bridge. Owing to a new location of the railroad a new crossing of the river was made 1,000 feet above the old one. The gage was moved to the new bridge December 1, 1905, and was set to read the same as before by raising its datum the exact amount of the slope of river between the points (0.30 foot at gage height 4 feet).

Although the river is navigable up to the station, very valuable water-power sites exist a short distance above. There are no dams of sufficient size to cause any noticeable interference with the natural flow of the stream. The section is about 530 feet wide at ordinary stages. The current is very swift even at low water and is somewhat broken at places, but it is fairly satisfactory for measuring.

The following discharge measurement was made by E. H. Swett.

May 25, 1909: Width, 508 feet; area, 2,860 square feet; gage height, 6.64 feet; discharge, 12,500 second-feet.

Daily gage height, in feet, of Little Tennessee River at McGhee, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.7	3.3	5.7	5.7	13.8	5.4	5.2	4.6	3.3	3.0	2.9	2.6
2	4.4	3.2	5.5	5.5	9.7	5.2	5.4	7.6	3.3	3.0	2.9	2.6
3	4.1	3.6	5.3	5.3	6.8	5.9	4.8	7.0	3.2	3.0	2.8	2.6
4	3.9	3.5	5.2	5.0	5.9	14.1	4.5	6.7	3.1	3.0	2.8	2.7
5	4.9	3.5	5.0	4.9	5.5	14.0	4.3	5.7	3.2	2.9	2.8	2.6
6	6.7	5.2	5.2	4.7	5.2	9.0	4.2	5.2	3.2	2.8	2.7	2.6
7	7.0	4.9	7.0	4.9	4.9	7.4	4.8	4.8	3.2	2.8	2.7	2.8
8	5.0	4.4	5.9	5.1	4.7	6.7	9.2	4.6	3.1	2.8	2.7	6.2
9	4.6	4.2	5.6	4.9	4.7	6.8	10.0	4.3	3.2	2.8	2.7	4.2
10	4.4	9.7	9.6	4.7	5.3	7.6	7.2	4.2	3.3	2.8	2.7	3.6
11	4.2	8.0	8.7	4.5	6.4	6.7	5.9	4.2	3.8	3.3	2.7	3.2
12	4.0	6.2	7.0	4.4	5.1	6.0	5.3	4.1	3.3	4.0	2.7	3.2
13	4.0	5.3	6.8	4.3	4.7	5.8	4.9	4.6	3.1	3.2	2.7	3.3
14	4.0	5.2	13.6	5.8	4.6	6.0	7.7	4.4	3.2	3.2	2.7	7.3
15	4.2	5.2	9.9	4.9	4.4	5.7	5.6	4.2	3.0	5.6	2.7	5.0
16	5.3	11.0	8.0	4.6	4.4	5.3	4.8	4.1	3.1	4.9	2.7	4.3
17	9.7	8.6	7.1	5.4	4.6	5.2	5.6	8.6	3.7	3.8	2.7	3.9
18	6.9	6.7	6.4	4.4	4.4	5.4	4.8	5.2	3.4	3.5	3.0	3.7
19	5.7	6.2	6.0	4.3	4.2	5.4	4.4	4.5	3.2	3.3	2.8	3.6
20	5.1	6.6	6.3	4.3	4.6	4.8	4.2	4.2	3.1	3.1	2.7	3.5
21	4.8	6.3	6.0	4.2	9.1	4.7	4.1	4.0	3.0	3.1	2.7	3.4
22	4.5	6.1	5.7	4.3	8.6	4.8	4.0	3.9	3.1	3.1	2.6	3.2
23	4.3	12.2	5.4	4.3	13.2	4.9	4.6	3.8	6.9	3.1	2.7	3.0
24	4.2	9.2	5.2	5.7	8.3	4.7	6.1	3.6	4.5	3.0	3.2	3.0
25	4.2	9.5	5.8	4.7	6.8	5.2	4.6	3.5	4.0	3.0	2.9	3.5
26	4.0	7.5	7.7	4.4	6.2	4.7	4.2	3.5	3.5	3.0	2.8	3.7
27	3.9	6.7	6.3	4.3	6.1	4.7	4.3	3.5	3.3	3.0	2.8	3.1
28	3.8	6.2	7.1	4.7	5.6	4.9	4.2	3.4	3.2	3.0	2.8	3.4
29	3.7	.....	8.3	4.5	5.3	5.5	4.0	3.4	3.1	3.0	2.8	3.2
30	3.6	.....	6.8	5.0	5.0	5.1	3.9	3.3	3.0	2.9	2.6	3.1
31	3.4	.....	6.1	.....	5.2	.....	5.2	3.4	.....	2.9	.....	2.7

Daily discharge, in second-feet, of Little Tennessee River at McGhee, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,350	3,650	10,300	10,300	38,100	9,420	8,820	7,060	3,650	2,990	2,790	2,250
2	6,500	3,420	9,720	9,720	23,200	8,820	9,420	16,200	3,650	2,990	2,790	2,250
3	5,680	4,380	9,120	9,120	13,700	10,900	7,640	14,300	3,420	2,990	2,600	2,250
4	5,150	4,130	8,820	8,220	10,900	39,200	6,780	13,400	3,200	2,990	2,600	2,420
5	7,930	4,130	8,220	7,930	9,720	38,800	6,220	10,300	3,420	2,790	2,600	2,250
6	13,400	8,820	8,820	7,350	8,820	20,800	5,950	8,820	3,420	2,600	2,420	2,250
7	14,300	7,930	14,300	7,930	7,930	15,600	7,640	7,640	3,420	2,600	2,420	2,600
8	8,220	6,500	10,900	8,520	7,350	13,400	21,500	7,060	3,200	2,600	2,420	11,800
9	7,060	5,950	10,000	7,930	7,350	13,700	24,200	6,220	3,420	2,600	2,420	5,950
10	6,500	23,200	22,900	7,350	9,120	16,200	15,000	5,950	3,650	2,600	2,420	4,380
11	5,950	17,500	19,800	6,780	12,500	13,400	10,900	5,950	4,890	3,650	2,420	3,420
12	5,410	11,800	14,300	6,500	8,520	11,200	9,120	5,680	3,650	5,410	2,420	3,420
13	5,410	9,120	13,700	6,220	7,350	10,600	7,930	7,060	3,200	3,420	2,420	3,650
14	5,410	8,820	37,300	10,600	7,060	11,200	16,600	6,500	3,420	3,420	2,420	15,300
15	5,950	8,820	23,900	7,930	6,500	10,300	10,000	5,950	2,990	10,000	2,420	8,220
16	9,120	27,700	17,500	7,060	6,500	9,120	7,640	5,680	3,200	7,930	2,420	6,220
17	23,200	19,500	14,600	9,420	7,060	8,820	10,000	19,500	4,630	4,890	2,420	5,150
18	14,000	13,400	12,500	6,500	6,500	9,420	7,640	8,820	3,890	4,130	2,990	4,630
19	10,300	11,800	11,200	6,220	5,950	9,420	6,500	6,780	3,420	3,650	2,600	4,380
20	8,520	13,100	12,200	6,220	7,060	7,640	5,950	5,950	3,200	3,200	2,420	4,130
21	7,640	12,200	11,200	5,950	21,200	7,350	5,680	5,410	2,990	3,200	2,420	3,890
22	6,780	11,500	10,300	6,220	19,500	7,640	5,410	5,150	3,200	3,200	2,250	3,420
23	6,220	32,100	9,420	6,220	35,800	7,930	7,060	4,890	14,000	3,200	2,420	2,990
24	5,950	21,500	8,820	10,300	18,500	7,350	11,500	4,380	6,780	2,990	3,420	2,990
25	5,950	22,500	10,600	7,350	13,700	8,820	7,060	4,130	5,410	2,990	2,790	4,130
26	5,410	15,900	16,600	6,500	11,800	7,350	5,950	4,130	4,130	2,990	2,600	4,630
27	5,150	13,400	12,200	6,220	11,500	7,350	6,220	4,130	3,650	2,990	2,600	3,200
28	4,890	11,800	14,600	7,350	10,000	7,930	5,950	3,890	3,420	2,990	2,600	3,890
29	4,630	.....	18,500	6,780	9,120	9,720	5,410	3,890	3,200	2,990	2,600	3,420
30	4,380	.....	13,700	8,220	8,220	8,520	5,150	3,650	2,990	2,790	2,250	3,200
31	3,890	.....	11,500	.....	8,820	.....	8,820	3,890	.....	2,790	.....	2,420

NOTE.—These discharges are based on a rating curve that is well defined between 1,600 and 14,300 second-feet.

Monthly discharge of Little Tennessee River at McGhee, Tenn., for 1909.

[Drainage area, 2,470 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	23,200	3,890	7,620	3.09	3.56	A.
February	32,100	3,420	12,700	5.14	5.35	A.
March	37,300	8,220	13,800	5.59	6.44	A.
April	10,600	5,950	7,630	3.09	3.45	A.
May	38,100	5,950	12,200	4.94	5.70	A.
June	39,200	7,350	12,300	4.98	5.56	A.
July	24,200	5,150	9,020	3.65	4.21	A.
August	19,500	3,650	7,170	2.90	3.34	A.
September	14,000	2,990	4,020	1.63	1.82	A.
October	10,000	2,600	3,570	1.45	1.67	A.
November	3,420	2,250	2,550	1.03	1.15	A.
December	15,300	2,250	4,360	1.76	2.03	A.
The year	39,200	2,250	8,080	3.27	44.28	

CULLASAGEE[a] RIVER AT CULLASAGEE, N. C.

This station, which is located at a wagon bridge at Cullasagee, N. C., 5 miles southeast of Franklin, N. C., and about 1 mile below the mouth of Ellijay Creek, was established June 13, 1907, in coop-

[a] Spelling changed to accord with decision of United States Geographic Board.

eration with the Forest Service, to obtain data concerning the water resources in the southern Appalachian Mountains. The station was discontinued December 31, 1909.

The low-water flow is probably affected to some extent by the operation of mills above. The staff gage is attached to the bridge abutment. Its datum has not been changed. Discharge measurements were made from the wagon bridge, where the section is excellent for the purpose. Owing to the flashy nature of the river high-water measurements have not been obtained to develop the upper portion of the rating curve.

Discharge measurements of Cullasagee River at Cullasagee, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 10	M. R. Hall	53	159	3.15	612
Do	do	53	159	3.15	613
October 30	E. H. Swett	36	77	1.42	125
Do	do	36	77	1.42	130

Daily gage height, in feet, of Cullasagee River at Cullasagee, N. C., for 1909.

[J. M. Moore, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.75	2.6	2.65	3.9	2.7	4.0	1.7	1.5	1.4	1.3	1.25
2	1.9	1.65	2.6	2.6	2.7	2.75	2.85	2 0	1.4	1 4	1 4	1.25
3	.....	1.65	2.5	2.55	2.7	4.3	2.35	2.5	1.35	1.4	1.3	1.25
4	1.9	1.65	2.45	.....	2.65	6.5	2.0	2.5	1.35	1.4	1.3	1.2
5	2.8	1.55	2.3	2.45	2.5	4.2	2.0	2.4	.....	1.35	1.25	1.2
6	2.4	2.1	3.0	2.35	2.5	3.6	2.0	2.3	1.35	1.3	1.25	5.5
7	2.0	2.0	.....	2.5	2.45	3.4	2.75	1.9	1.5	1.35	1.25	4.0
8	2.0	1.7	2.5	2.6	2.4	3.4	2.8	1.9	1.35	1.3	1 25	3 0
9	1 9	2 0	2.2	2.4	2 4	3.1	2.85	1.65	1.35	1.3	1.25	1.8
10	1.9	3.0	3.7	2.2	4.0	3.2	2.6	1.8	1.8	.....	1.25	1.6
11	1.85	2.3	3.0	2.2	3.0	3.0	2.2	1.8	1.35	2.85	1.25	1.5
12	1.85	2.1	2.9	2.1	2.7	3.0	2.2	2.0	1.5	2.8	1.25	4.0
13	1.85	2.0	6.6	4.1	2.6	2.6	2.7	1.95	1.4	1.4	1.3	6.5
14	1.9	1.8	3.8	2.8	2.45	2.5	2.65	2.2	1.3	2.55	1.3	2.6
15	2.1	5.0	3.3	2.6	2.4	2.6	2.1	2.0	1.8	2.3	1.3	2.6
16	2.2	3.7	3.1	2.5	2.4	2.5	2.15	6.0	1.6	2.2	1.25	2.6
17	.....	3.1	3.0	2.45	2.35	2.45	2.0	2.7	1.5	1.8	1.25	2.4
18	2.1	2.8	2.8	2.2	2.3	2.4	1.9	2.4	1.45	1.7	1.5	2.3
19	2.1	4.0	2.85	2.2	2.2	2.0	1.85	2.05	1.45	1.7	1.3	2.4
20	2.0	3.0	2.8	2.1	8.2	2.6	1.8	2.0	1.4	1.65	1.3	2.0
21	1.9	.....	2.75	2.1	4.5	2.55	1.75	1.9	1.4	1.65	1.3	2.0
22	1.9	4.0	2.7	2.05	5.5	2.7	1.7	1.8	5.4	1.65	1.3	1.95
23	1.9	4.0	2.65	3.0	.....	2.6	2.5	1.85	2.5	1.6	1.3	1.8
24	.....	4.0	2.5	2.65	3.6	2.5	1.9	1.7	2.4	1.6	1.3	1.8
25	1.8	3.3	4.0	2.4	3.6	2.4	1.7	1.65	2.4	1.5	1.25	1.95
26	1.75	3.0	3.0	2.2	4.5	2.4	1.7	1.6	1.9	1.5	1.25	1.8
27	1.75	2.8	2.9	2.3	3.3	2.35	1.7	1.5	1.7	1.45	1.25	1.9
28	1.75	2.6	3.4	2.2	3.0	2.3	1.7	1.5	1.6	1.45	1.25	2.0
29	1.75	.....	3.0	2.2	2.8	4.0	1.65	2.5	1.6	1.35	1.25	1.9
30	1.75	.....	2.9	3.0	2.3	4.0	1.75	1.6	1.5	1.3	1.25	1.8
31	.....	.....	2.7	.....	2.3	.....	1.7	1.5	.....	1.3	.....	1.8

Daily discharge, in second-feet, of Cullasagee River at Cullasagee, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	230	199	418	434	.....	451	.....	189	152	136	121	114
2	230	180	418	418	451	468	502	252	136	136	136	114
3	230	180	387	402	451	.....	343	387	128	136	121	114
4	230	180	372	387	434	.....	252	387	128	136	121	108
5	485	161	329	372	387	.....	252	357	128	128	114	108
6	357	276	556	343	387	.....	252	329	128	121	114	.....
7	252	252	472	387	372	710	468	230	152	128	114	.....
8	252	189	387	418	357	710	485	230	128	121	114	556
9	230	252	302	357	357	593	502	180	128	121	114	209
10	230	556	.....	302	.....	631	418	209	209	312	114	170
11	220	329	556	302	556	556	302	209	128	502	114	152
12	220	276	520	276	451	556	302	252	152	485	114	.....
13	220	252	.....	.....	418	418	451	241	136	136	121	.....
14	230	209	.....	485	372	387	434	302	121	402	121	418
15	276	.....	670	418	357	418	276	252	209	329	121	418
16	302	.....	593	387	357	387	289	.....	170	302	114	418
17	289	593	556	372	343	372	252	451	152	209	114	357
18	276	485	485	302	329	357	230	357	144	189	152	329
19	276	.....	502	302	302	252	220	264	144	189	121	357
20	252	252	485	276	.....	418	209	252	136	180	121	252
21	230	.....	468	276	.....	402	199	230	136	180	121	252
22	230	.....	451	264	.....	451	189	209	.....	180	121	241
23	230	.....	434	556	.....	418	387	220	387	170	121	209
24	220	.....	387	434	.....	387	230	189	357	170	121	209
25	209	670	.....	357	.....	357	189	180	357	152	114	241
26	199	556	556	302	.....	357	189	170	230	152	114	209
27	199	485	520	329	670	343	189	152	189	144	114	230
28	199	418	710	302	556	329	189	152	170	144	114	252
29	199	.....	556	302	485	.....	180	387	170	128	114	230
30	199	.....	520	556	329	.....	199	170	152	121	114	209
31	199	.....	451	.....	329	.....	189	152	.....	121	.....	209

NOTE.—These discharges are based on a rating curve that is well defined between 110 and 750 second-feet. Above this the curve has not been developed. Discharges for all missing days are above 750 second-feet.

NANTAHALA RIVER NEAR NANTAHALA, N. C.

This station, which is located at Mathew Cole's footbridge, about 1 mile up the river from Nantahala, N. C., and just above Nelsons Creek, was established May 22, 1907, in cooperation with the Forest Service, though discharge measurements referred to a bench mark had been previously made. A flume for transporting lumber takes its water from a tributary creek several miles above and passes the station. The water in the flume is measured when the station is visited and is usually about 10 to 12 second-feet. This flow is not included with the regular measurements.

The staff gage attached to the right bank abutment has the same datum as the bench marks formerly used. The rough and rocky bed causes broken currents and makes it difficult to determine the proper depth of soundings.

The station was discontinued December 31, 1909.

Discharge measurements of Nantahala River near Nantahala, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	M. R. Hall	65	234	2.32	667
July 19	F. P. Thomas	66	229	1.85	417
Do	do	66	221	1.85	395
July 24	do	66	218	1.80	365
Do	do	66	220	1.82	396
October 26	E. H. Swett	65	175	1.27	222
Do	do	65	175	1.27	216

Daily gage height, in feet, of Nantahala River near Nantahala, N. C., for 1909.

[Mathew Cole, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	1.7	2.5	2.5	3.6	2.45	2.4	1.6	1.3	1.3	1.2	1.0
2	1.8	1.7	2.5	2.5	2.65	2.55	2.2	2.15	1.3	1.3	1.2	1.0
3	1.8	1.7	2.5	2.4	2.4	3.2	2.1	2.0	1.3	1.3	1.2	1.0
4	1.8	1.6	2.45	2.35	2.3	4.4	2.1	1.9	1.3	1.3	1.2	1.0
5	2.75	1.6	2.4	2.3	2.3	3.35	2.0	1.9	1.3	1.2	1.1	1.0
6	2.3	2.2	3.0	2.3	2.3	3.05	2.15	2.0	1.3	1.2	1.0	1.0
7	2.0	1.85	2.6	2.55	2.2	2.9	2.4	2.35	1.3	1.2	1.0	2.85
8	2.0	1.8	2.5	2.4	2.1	2.75	2.7	1.8	1.3	1.2	1.0	2.1
9	2.0	1.9	2.4	2.35	2.1	3.05	2.45	1.8	1.3	1.2	1.0	1.8
10	2.0	3.5	3.45	2.25	3.75	2.85	2.4	1.7	1.5	1.2	1.0	1.45
11	1.9	2.7	2.9	2.2	2.25	2.7	2.3	1.6	1.3	1.85	1.0	1.25
12	1.9	2.5	2.8	2.1	2.2	2.55	2.25	1.55	1.3	1.25	1.0	1.35
13	1.9	2.65	4.4	2.8	2.1	2.6	2.25	1.45	1.3	1.2	1.0	3.0
14	1.9	2.5	4.1	2.4	2.05	2.5	2.3	1.4	1.3	2.65	1.0	2.3
15	2.45	3.15	3.7	2.1	2.0	2.5	2.3	1.4	1.3	2.3	1.0	2.0
16	2.8	3.5	3.3	2.05	2.0	2.5	2.1	2.7	1.7	1.7	1.0	1.6
17	2.8	2.9	3.0	2.0	2.0	2.45	2.0	1.8	1.65	1.5	1.55	1.4
18	2.5	2.65	2.85	2.0	2.0	2.4	1.95	1.6	1.3	1.5	1.35	1.4
17	2.4	2.9	2.8	2.0	2.0	2.35	1.8	1.6	1.3	1.4	1.1	1.3
20	2.25	2.7	2.9	2.0	3.0	2.3	1.8	1.5	1.3	1.4	1.1	1.3
21	2.2	2.5	2.7	1.9	3.25	2.2	1.8	1.5	1.25	1.35	1.0	1.2
22	2.05	3.4	2.65	1.85	3.95	2.2	1.8	1.5	2.55	1.3	1.0	1.2
23	2.1	3.4	2.55	2.45	3.6	2.15	2.25	1.45	1.95	1.3	1.35	1.2
24	1.9	3.65	2.5	2.15	3.0	2.1	1.8	1.4	1.8	1.3	1.1	1.2
25	1.9	3.35	3.95	2.0	2.9	2.25	1.8	1.4	1.6	1.3	1.0	1.6
26	1.8	3.0	2.95	2.0	3.35	2.3	1.7	1.4	1.45	1.3	1.0	1.4
27	1.8	2.9	2.9	2.25	2.95	2.2	1.7	1.4	1.4	1.3	1.0	1.3
28	1.8	2.7	3.4	2.2	2.65	2.3	1.7	1.3	1.4	1.25	1.0	1.2
29	1.7	.....	2.95	2.0	2.45	2.6	1.65	1.3	1.3	1.2	1.0	1.2
30	1.7	.....	2.75	2.25	2.4	2.45	1.6	1.3	1.3	1.2	1.0	1.2
31	1.7	.....	2.5	.....	2.65	.....	1.6	1.3	.....	1.2	.....	1.1

Daily discharge, in second-feet, of Nantahala River near Nantahala, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	385	345	.....	.....	.....	.....	710	310	225	225	199	152
2	385	345	.....	.....	.....	.....	590	562	225	225	199	152
3	385	345	.....	710	710	.....	535	480	225	225	199	152
4	385	310	.....	680	650	.....	535	430	225	225	199	152
5	.....	310	710	650	650	.....	480	430	225	199	175	152
6	650	590	.....	650	650	.....	562	480	225	199	152	152
7	480	408	.....	.....	590	.....	710	680	225	199	152	.....
8	480	385	.....	710	535	.....	.....	385	225	199	152	535
9	480	430	710	680	535	.....	.....	385	225	199	152	385
10	480	.....	.....	620	.....	.....	710	345	280	199	152	266
11	430	.....	.....	590	620	.....	650	310	225	408	152	212
12	430	.....	.....	535	590	.....	620	295	225	212	152	238
13	430	.....	.....	.....	535	.....	620	266	225	199	152	.....
14	430	.....	.....	710	508	.....	650	252	225	.....	152	650
15	.....	.....	.....	535	480	.....	650	252	225	650	152	480
16	.....	.....	.....	508	480	.....	535	.....	345	345	152	310
17	.....	.....	.....	480	480	.....	480	385	328	280	295	252
18	.....	.....	.....	480	480	710	455	310	225	280	238	262
19	710	.....	.....	480	480	680	385	310	225	252	175	225
20	620	.....	.....	480	.....	650	385	280	225	252	175	225
21	590	.....	.....	430	.....	590	385	280	212	238	152	199
22	508	.....	.....	408	.....	590	385	280	.....	225	152	199
23	535	.....	.....	.....	.....	562	620	266	455	225	238	199
24	430	.....	.....	562	.....	535	385	252	385	225	175	199
25	430	.....	.....	480	.....	620	385	252	310	225	152	310
26	385	.....	.....	480	.....	650	345	252	266	225	152	252
27	385	.....	.....	620	.....	590	345	252	252	225	152	225
28	385	.....	.....	590	.....	650	345	225	252	212	152	199
29	345	.....	.....	480	.....	.....	328	225	225	199	152	199
30	345	.....	.....	620	710	.....	310	225	225	199	152	199
31	345	.....	.....	.....	.....	.....	310	225	.....	199	.....	175

NOTE.—These discharges have been obtained from a rating curve that is fairly well defined between discharges 200 and 710 second-feet. Above this the curve has not been developed. Discharges for all missing days are above 710 second-feet.

TUCKASEGEE RIVER NEAR EAST LAPORT, N. C.

This station, which is located at the steel wagon bridge at East Laport, N. C., about 10 miles from Dillsboro, was established May 27, 1907, in cooperation with the Forest Service, and was discontinued December 31, 1909. The station is about 2 miles below the mouth of Caney Fork.

The vertical staff gage is fastened to a post on the left bank, about 75 feet below the bridge.

Discharge measurements have been made from the bridge. The current is good, and the bed is partly rock and should be fairly constant.

Discharge measurements of Tuckasegee River near East Laport, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 28	E. H. Swett	112	189	1.58	288
Do	do	112	191	1.58	284

Wm. A. Lamb

Daily gage height, in feet, of Tuckasegee River near East Laport, N. C., for 1909.

[Will Rogers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.0	2.8	2.9	5.0	4.0	3.0	2.5	1.6	1.9	1.9	1.2
2	2.0	2.0	2.7	2.8	3.5	3.0	2.8	2.4	1.6	1.9	1.9	1.2
3	2.0	2.0	2.6	2.7	3.1	3.4	2.5	2.3	1.6	1.8	1.8	1.2
4	2.0	1.9	2.6	2.6	3.0	8.0	2.5	2.2	1.6	1.7	1.8	1.2
5	4.0	1.9	2.5	2.5	2.9	6.0	2.5	2.2	1.6	1.6	1.8	1.2
6	3.0	2.8	2.5	2.5	2.6	5.0	3.0	2.2	1.6	1.6	1.7	1.2
7	2.6	2.5	2.6	2.4	2.6	4.0	2.8	2.1	1.6	1.6	1.7	2.0
8	2.5	2.0	2.5	2.5	2.5	3.4	2.7	2.0	1.6	1.5	1.7	4.0
9	2.4	2.0	2.5	2.4	2.5	3.9	2.6	4.0	1.6	1.5	1.6	2.0
10	2.2	3.5	5.0	2.4	5.7	3.6	2.5	3.0	1.5	1.5	1.6	2.0
11	2.1	3.0	4.0	2.3	4.0	3.4	2.5	2.9	1.5	4.5	1.6	1.9
12	2.0	2.5	4.0	2.3	3.5	3.3	2.4	2.8	1.5	3.0	1.6	1.9
13	1.9	2.0	5.5	5.0	3.0	3.1	2.4	2.7	1.4	2.9	1.5	6.0
14	1.9	2.0	3.0	3.4	2.9	3.0	2.3	2.6	1.4	2.8	1.5	3.0
15	2.0	2.4	3.6	2.9	2.7	2.9	2.3	2.5	1.4	3.9	1.5	3.0
16	2.5	6.0	3.4	2.7	2.6	2.8	2.2	2.4	1.4	3.8	1.5	2.9
17	3.0	3.5	3.3	2.6	2.6	2.7	2.2	2.3	1.4	3.0	1.4	2.8
18	2.4	3.0	3.2	2.5	2.6	2.7	2.2	2.2	1.4	2.9	1.4	2.7
19	2.3	3.2	3.1	2.5	2.5	2.6	2.0	2.1	1.5	2.8	1.4	2.7
20	2.2	2.8	3.0	2.5	2.8	2.6	2.0	2.0	1.5	2.7	1.4	2.7
21	2.1	2.0	3.0	2.4	5.5	2.9	2.0	2.0	1.5	2.6	1.4	2.6
22	2.0	2.4	2.9	2.4	4.0	2.8	3.0	2.0	6.0	2.5	1.3	2.6
23	2.0	3.0	2.8	2.8	3.9	2.7	2.5	1.9	5.0	2.4	1.3	2.6
24	2.0	3.4	2.7	2.6	3.8	2.7	2.0	1.8	4.5	2.3	1.3	2.5
25	2.0	3.0	5.5	2.5	3.7	2.6	2.0	1.9	3.0	2.2	1.3	2.4
26	1.9	2.9	3.9	2.5	3.6	2.5	2.0	1.8	2.9	2.2	1.3	2.3
27	1.9	2.5	3.0	2.5	3.4	2.7	2.3	1.8	2.8	2.1	1.3	2.3
28	1.8	2.4	3.5	2.5	3.1	2.8	2.2	1.8	2.7	2.1	1.3	2.2
29	1.8	.....	3.4	2.9	3.6	2.9	2.2	1.7	2.7	2.0	1.3	2.2
30	1.9	.....	3.3	2.7	3.5	3.0	2.1	1.7	2.6	2.0	1.3	2.0
31	1.9	.....	3.0	.....	3.0	.....	2.1	1.7	.....	1.9	.....	2.0

Daily discharge, in second-feet, of Tuckasegee River near East Laport, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	460	460	.....	.....	.....	.....	.....	745	295	415	415	203
2	460	460	.....	.....	.....	.....	.....	680	295	415	415	203
3	460	460	.....	.....	.....	.....	745	620	295	370	370	203
4	460	415	.....	.....	.....	.....	745	565	295	330	370	203
5	.....	415	745	745	.....	.....	745	565	295	295	370	203
6	.....	.....	745	745	.....	.....	.....	565	295	295	330	203
7	.....	745	.....	680	.....	.....	.....	510	295	295	330	460
8	745	460	745	745	745	.....	.....	460	295	268	330	.....
9	680	460	745	680	745	.....	.....	.....	295	268	295	460
10	565	.....	.....	680	.....	.....	745	.....	268	268	295	460
11	510	.....	.....	620	.....	.....	745	.....	268	.....	295	415
12	460	745	.....	620	.....	.....	680	.....	268	.....	295	415
13	415	460	.....	.....	.....	.....	680	.....	244	.....	268	.....
14	415	460	.....	.....	.....	.....	620	.....	244	.....	268	.....
15	460	680	.....	.....	.....	.....	620	745	244	.....	268	.....
16	745	.....	.....	.....	.....	.....	565	680	244	.....	268	.....
17	.....	.....	.....	.....	.....	.....	565	620	244	.....	244	.....
18	680	.....	.....	745	.....	.....	565	565	244	.....	244	.....
19	620	.....	.....	745	745	.....	460	510	268	.....	244	.....
20	565	.....	.....	745	.....	.....	460	460	268	.....	244	.....
21	510	460	.....	680	.....	.....	460	460	268	.....	244	.....
22	460	680	.....	680	.....	.....	.....	460	.....	745	223	.....
23	460	.....	.....	.....	.....	.....	745	415	.....	680	223	.....
24	460	.....	.....	.....	.....	.....	460	370	.....	620	223	745
25	460	.....	.....	745	.....	.....	460	415	.....	565	223	680
26	415	.....	.....	745	.....	745	460	370	.....	565	223	620
27	415	745	.....	745	.....	.....	620	370	.....	510	223	620
28	370	680	.....	745	.....	.....	565	370	.....	510	223	565
29	370	.....	.....	.....	.....	.....	565	330	.....	460	223	565
30	415	.....	.....	.....	.....	.....	510	330	.....	460	223	460
31	415	.....	.....	.....	.....	.....	510	330	.....	415	.....	460

NOTE.—Discharges as published are based on a fairly well-defined curve between discharges 185 and 745 second-feet. Discharges for all missing days are above 745 second-feet. The high-water portion of the curve has not yet been developed.

TUCKASEGEE RIVER AT BRYSON, N. C.

This station is located at the highway bridge in the town of Bryson, N. C., one-half mile below the mouth of Deep Creek and about 15 miles above the junction of Tuckasegee River with Little Tennessee River. Oconalufty River, an important tributary, comes in about 8 miles above Bryson. The original station was established in June, 1896, at the Southern Railway bridge, 3 miles above Bryson, but was abandoned early in 1897 on account of poor measuring section. The present station was established November 7, 1897, and has been maintained continuously since that time. Observations at this station are particularly valuable for a number of purposes, including estimates of water power, which is very abundant both above and below the station.

The gage is read twice a day in order to equalize any small variations in flow caused by the operations of power plants.

Discharge measurements are made at the bridge, where the current and other conditions are good. A staff gage is attached to the left bank pier. Its datum has not been changed.

Discharge measurements of Tuckasegee River at Bryson, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 15	M. R. Hall	189	1,020	2.28	2,140
October 27	E. H. Swett	190	842	1.45	850
Do	do	190	842	1.42	861

Daily gage height, in feet, of Tuckasegee River at Bryson, N. C., for 1909.

[J. M. Welch, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	1.65	2.6	2.6	4.6	2.5	2.55	1.95	1.6	1.45	1.35	1.2
2	1.9	1.6	2.55	2.55	3.2	2.35	2.45	2.05	1.55	1.4	1.4	1.2
3	1.8	1.6	2.5	2.5	2.75	3.6	2.25	2.85	1.5	1.4	1.35	1.2
4	1.9	1.5	2.35	2.4	2.55	6.5	2.2	2.7	1.55	1.4	1.3	1.2
5	3.4	1.6	2.3	2.3	2.45	4.3	2.1	2.6	1.5	1.4	1.3	1.2
6	2.55	2.4	2.5	2.25	2.3	3.5	2.5	2.45	1.5	1.4	1.3	1.2
7	2.3	1.7	2.7	2.4	2.2	3.2	3.2	2.15	1.5	1.4	1.3	2.6
8	2.1	1.8	2.55	2.3	2.15	2.95	3.55	2.0	1.5	1.35	1.3	2.3
9	2.0	2.0	2.5	2.25	2.1	3.0	3.8	2.0	1.5	1.3	1.3	1.65
10	1.95	4.5	4.6	2.2	3.35	3.05	3.2	1.95	1.75	1.3	1.3	1.45
11	1.9	2.85	3.3	2.15	3.05	2.75	2.7	1.9	1.55	2.2	1.3	1.45
12	1.85	2.45	3.05	2.1	2.3	2.65	2.5	2.5	1.5	1.6	1.3	1.45
13	1.8	2.3	4.2	3.15	2.2	2.95	2.45	2.0	1.55	1.4	1.3	3.45
14	1.9	2.2	4.4	2.7	2.1	2.65	2.6	2.2	1.45	2.25	1.3	2.45
15	2.0	2.55	3.7	2.3	2.1	2.6	2.3	2.0	1.45	2.0	1.3	2.15
16	2.7	4.2	3.45	2.2	2.15	2.4	2.2	3.6	1.7	1.85	1.3	1.9
17	3.15	3.05	3.05	2.1	2.0	2.65	2.1	2.85	1.7	1.65	1.45	1.75
18	2.55	2.85	2.85	2.1	1.9	2.45	2.0	2.35	1.55	1.6	1.3	1.7
19	2.35	3.1	2.7	2.0	2.0	2.3	2.0	2.1	1.6	1.5	1.3	1.6
20	2.15	2.8	2.9	2.0	4.2	2.2	1.9	2.0	1.5	1.5	1.3	1.6
21	2.0	2.6	2.6	2.0	3.45	2.3	1.9	1.9	1.4	1.5	1.25	1.5
22	1.9	2.55	2.5	2.0	4.4	2.4	2.3	1.8	3.15	1.5	1.25	1.5
23	1.9	3.8	2.4	2.65	3.8	2.3	2.9	1.8	2.3	1.5	1.45	1.4
24	1.9	3.85	2.4	2.15	3.25	2.3	2.05	1.75	2.0	1.5	1.4	1.4
25	1.8	3.45	4.2	2.0	2.9	2.2	2.0	1.7	1.7	1.45	1.3	1.65
26	1.8	3.1	3.1	2.0	2.8	2.35	1.9	1.7	1.6	1.45	1.3	1.5
27	1.75	2.85	2.85	2.0	2.75	2.4	2.05	1.7	1.55	1.4	1.25	1.5
28	1.7	2.65	4.3	2.0	2.55	2.3	1.95	1.6	1.5	1.4	1.25	1.4
29	1.8	.....	3.45	1.9	2.4	2.65	2.35	1.6	1.5	1.4	1.25	1.4
30	1.75	.....	3.1	4.5	2.3	2.5	1.95	1.7	1.5	1.4	1.25	1.25
31	1.6	.....	2.75	.....	2.6	.....	1.9	1.6	.....	1.4	.....	1.4

Daily discharge, in second-feet, of Tuckasegee River at Bryson, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,660	1,160	2,660	2,660	7,530	2,480	2,570	1,580	1,100	920	805	650
2	1,510	1,100	2,570	2,570	3,890	2,220	2,390	1,740	1,040	860	860	650
3	1,370	1,100	2,480	2,480	2,950	4,800	2,050	3,150	980	860	805	650
4	1,510	980	2,220	2,300	2,570	16,100	1,970	2,850	1,040	860	750	650
5	4,330	1,100	2,130	2,130	2,390	6,630	1,810	2,660	980	860	750	650
6	2,570	2,300	2,480	2,050	2,130	4,560	2,480	2,390	980	860	750	650
7	2,130	1,230	2,850	2,300	1,970	3,890	3,890	1,890	980	860	750	2,660
8	1,810	1,370	2,570	2,130	1,890	3,360	4,680	1,660	980	805	750	2,130
9	1,660	1,660	2,480	2,050	1,810	3,460	5,290	1,660	980	750	750	1,160
10	1,580	7,220	7,530	1,970	4,220	3,560	3,890	1,580	1,300	750	750	920
11	1,510	3,150	4,110	1,890	3,560	2,950	2,850	1,510	1,040	1,970	750	920
12	1,440	2,390	3,560	1,810	2,130	2,760	2,480	2,480	980	1,100	750	920
13	1,370	2,130	6,350	3,780	1,970	3,360	2,390	1,660	1,040	860	750	4,440
14	1,510	1,970	6,920	2,850	1,810	2,760	2,660	1,970	920	2,050	750	2,390
15	1,660	2,570	5,040	2,130	1,810	2,660	2,130	1,660	920	1,660	750	1,890
16	2,850	6,350	4,440	1,970	1,890	2,300	1,970	4,800	1,230	1,440	750	1,510
17	3,780	3,560	3,560	1,810	1,660	2,760	1,810	3,150	1,230	1,160	920	1,300
18	2,570	3,150	3,150	1,810	1,510	2,390	1,660	2,220	1,040	1,100	750	1,230
19	2,220	3,670	2,850	1,660	1,660	2,130	1,660	1,810	1,100	980	750	1,100
20	1,890	3,050	3,250	1,660	6,350	1,970	1,510	1,660	980	980	750	1,100
21	1,660	2,660	2,660	1,660	4,440	2,130	1,510	1,510	860	980	700	980
22	1,510	2,570	2,480	1,660	6,920	2,300	2,130	1,370	3,780	980	700	980
23	1,510	5,290	2,300	2,760	5,290	2,130	3,250	1,370	2,130	980	920	860
24	1,510	5,420	2,300	1,890	4,000	2,130	1,740	1,300	1,660	980	860	860
25	1,370	4,440	6,350	1,660	3,250	1,970	1,660	1,230	1,230	920	750	1,160
26	1,370	3,670	3,670	1,660	3,050	2,220	1,510	1,230	1,100	920	750	980
27	1,300	3,150	3,150	1,660	2,950	2,300	1,740	1,230	1,040	860	700	980
28	1,230	2,760	6,630	1,660	2,570	2,130	1,580	1,100	980	860	700	860
29	1,370	.....	4,440	1,510	2,300	2,760	2,220	1,100	980	860	700	860
30	1,300	.....	3,670	7,220	2,130	2,480	1,580	1,230	980	860	700	700
31	1,100	.....	2,950	.....	2,660	.....	1,510	1,100	.....	860	.....	860

NOTE.—These discharges are based on a rating curve that is well defined below 3,500 second-feet.

Monthly discharge of Tuckasegee River at Bryson, N. C., for 1909.

[Drainage area, 662 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	4,330	1,100	1,810	2.73	3.15	B.
February	7,220	980	2,900	4.38	4.56	B.
March	6,920	2,130	3,670	5.54	6.39	B.
April	7,220	1,510	2,240	3.38	3.77	B.
May	7,530	1,510	3,070	4.64	5.35	B.
June	16,100	1,970	3,320	5.02	5.60	B.
July	5,290	1,510	2,340	3.53	4.07	B.
August	4,800	1,100	1,870	2.82	3.25	B.
September	3,780	860	1,190	1.80	2.01	B.
October	2,050	750	1,020	1.54	1.78	B.
November	920	700	762	1.15	1.28	B.
December	4,440	650	1,210	1.83	2.11	B.
The year	16,100	650	2,120	3.20	43.32	

CLINCH RIVER DRAINAGE BASIN.

DESCRIPTION.

Clinch River rises in the Cumberland Mountains in the southwest corner of Virginia, flows southwestward in a course generally parallel to that of the Holston, and enters Tennessee River at Kingston, Tenn. The main stream soon passes to the Appalachian Valley, where its basin closely resembles that of the Holston.

The basin is for the most part mountainous, but the mountains consist chiefly of long parallel ridges, such as the Clinch Mountains, and the highest points, few of which are above 2,000 feet above sea level, do not compare in elevation with the highest points in the French Broad basin and the eastern part of the Holston basin.

Most of the western tributaries of the Clinch—Powell and Emery rivers and other streams—flow from the Cumberland Plateau, and Emery River especially is almost entirely in a coal region, dividing what is known as the Jellico district from the Chattanooga district.

Only one gaging station has been maintained on this branch of the Tennessee—that on Clinch River at Clinchport, Va.

CLINCH RIVER AT CLINCHPORT, VA.

This station, which is located at Clinchport, Va., at the railroad bridge, about 400 feet east of the Virginia & Southwestern Railroad station, was established June 7, 1907, in cooperation with the Forest Service, to obtain data for use in connection with studies of the water resources of the southern Appalachian Mountains. The station is a short distance below the mouth of Stock Creek and about 1½ miles above Copper Creek.

Discharge measurements have been made from the railroad bridge, where the current is rather sluggish during low water and the bed is probably slightly shifting.

The vertical staff gage is spiked to a sycamore on the right bank, about 500 feet upstream from the bridge.

The station was discontinued December 31, 1909.

Discharge measurements of Clinch River at Clinchport, Va., for 1907 to 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 15	Warren E. Hall	202	918	1.30	757
Do	B. M. Hall, jr	202	910	1.30	734
September 7	do	207	810	.81	430
1908.					
February 24	Warren E. Hall	227	1,150	2.10	1,530
July 2	E. P. Thomas	229	971	1.14	664
Do	Warren E. Hall	229	971	1.14	655
1909.					
September 22	E. H. Swett	227	823	.70	275

Daily gage height, in feet, of Clinch River at Clinchport, Va., for 1909.

[C. R. Lane and J. W. Morrison, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	1.4	2.9	3.1	9.0	1.0	2.8	2.3	0.8	0.6	0.6	0.4
2	3.0	1.3	2.5	2.7	8.5	1.3	2.5	3.2	.8	.6	.6	.4
3	2.6	1.6	2.3	2.5	6.7	1.1	2.3	3.0	.7	.6	.6	.4
4	2.3	1.5	2.4	2.2	4.3	3.3	1.5	2.3	.6	.6	.6	.4
5	2.4	1.5	2.4	2.0	3.8	2.8	1.4	1.6	.5	.5	.6	.4
6	2.9	1.7	3.9	1.9	3.0	2.3	1.3	1.6	.5	.5	.6	.4
7	2.7	2.0	4.5	1.9	2.6	1.9	1.4	1.5	.5	.5	.6	.4
8	2.4	2.2	4.4	2.0	2.4	1.6	1.3	1.5	.7	.5	.6	.5
9	2.2	2.2	3.7	1.8	2.1	3.3	3.5	1.4	.7	.5	.5	.5
10	2.0	6.3	5.9	1.7	2.7	4.8	3.0	1.2	.7	.5	.5	.5
11	1.8	6.6	7.7	1.6	3.2	3.5	2.3	1.1	.7	.5	.5	.5
12	1.7	4.4	5.0	1.5	3.0	3.3	2.1	1.0	.9	.5	.5	.5
13	1.6	3.4	4.0	1.4	2.7	3.0	2.5	1.0	.7	.5	.5	.8
14	1.6	2.9	4.5	1.5	2.3	6.5	5.3	*a* 1.0	.6	.5	.4	.8
15	2.9	2.7	4.2	1.5	2.1	5.6	4.1	*a* 1.0	.6	.6	.4	.8
16	4.0	3.8	3.7	1.5	1.9	4.2	2.9	2.5	.6	.6	.4	.6
17	6.2	4.5	3.2	1.4	1.8	3.8	5.9	2.5	.8	.6	.4	.6
18	5.3	3.8	2.8	1.3	1.7	3.5	3.9	2.3	.7	.6	.4	.5
19	4.1	3.2	2.5	1.2	1.5	3.2	2.4	2.1	.6	.6	.4	.5
20	3.3	3.7	2.3	1.2	1.5	2.0	2.0	2.6	.6	.6	.4	.5
21	2.8	3.4	2.2	1.4	1.7	2.1	1.6	1.3	.6	.6	.4	.5
22	2.4	3.5	2.1	1.9	1.6	1.9	1.5	1.0	.8	.6	.4	.5
23	2.2	5.0	2.5	2.8	1.5	2.3	1.4	1.0	.8	.6	.4	.5
24	2.0	3.6	2.3	4.0	1.4	2.6	1.4	.8	.8	.6	.4	.5
25	1.8	6.5	3.6	3.5	1.4	3.2	1.3	*a* 1.1	.7	.6	.4	.5
26	1.8	5.3	6.2	2.8	1.3	2.6	1.2	*a* 1.1	.6	.6	.4	.5
27	2.1	4.1	4.7	2.5	1.4	2.0	1.3	.8	.6	.6	.4	.5
28	2.1	3.4	5.8	2.2	1.2	2.3	1.3	*a* 1.0	.6	.6	.4	.5
29	2.0	.....	6.8	2.0	1.2	2.1	1.2	.8	.6	.6	.4	.5
30	1.9	.....	4.9	2.3	1.1	2.4	1.2	.8	.6	.6	.4	.5
31	1.8	.....	3.8	.....	1.1	.....	1.4	.8	.....	.6	.....	.5

a Gage height estimated.

Daily discharge, in second-feet, of Clinch River at Clinchport, Va., for 1907–1909.

Day.*a*	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	.....	.....	.....	.....	1,310	1,010	420	545	360	1,310
2	.....	.....	.....	.....	.....	.....	920	.....	480	480	480	1,100
3	.....	.....	.....	.....	.....	.....	755	1,010	680	420	2,050	1,010
4	.....	.....	.....	.....	.....	.....	680	835	835	420	1,310	920
5	.....	.....	.....	.....	.....	.....	610	610	545	480	920	835
6	.....	.....	.....	.....	.....	.....	545	835	480	545	755	755
7	.....	.....	.....	.....	.....	1,420	680	1,310	420	545	680	680
8	.....	.....	.....	.....	.....	1,780	610	1,100	545	610	680	610
9	.....	.....	.....	.....	.....	.....	545	1,100	480	610	610	610
10	.....	.....	.....	.....	.....	.....	545	1,420	420	545	.....	755
11	.....	.....	.....	.....	.....	.....	610	920	1,010	480	.....	1,200
12	.....	.....	.....	.....	.....	.....	680	755	835	420	.....	.....
13	.....	.....	.....	.....	.....	.....	1,010	680	755	420	.....	2,050
14	.....	.....	.....	.....	.....	.....	1,660	1,200	680	420	.....	1,660
15	.....	.....	.....	.....	.....	.....	1,420	835	545	360	1,780	1,540
16	.....	.....	.....	.....	.....	.....	1,010	680	480	360	1,310	1,780
17	.....	.....	.....	.....	.....	.....	920	755	420	360	1,100	1,540
18	.....	.....	.....	.....	.....	.....	755	.....	420	305	1,200	1,420
19	.....	.....	.....	.....	.....	.....	680	.....	360	305	.....	1,310
20	.....	.....	.....	.....	.....	.....	610	1,660	360	305	.....	1,100
21	.....	.....	.....	.....	.....	1,780	545	1,540	360	305	.....	1,010
22	.....	.....	.....	.....	.....	1,660	480	1,100	755	305	1,780	920
23	.....	.....	.....	.....	.....	1,310	420	1,010	1,540	305	1,540	1,660
24	.....	.....	.....	.....	.....	1,310	420	920	1,780	305	.....	.....
25	.....	.....	.....	.....	.....	1,420	1,110	920	1,540	305	.....	.....
26	.....	.....	.....	.....	.....	1,100	1,010	835	1,010	250	.....	.....
27	.....	.....	.....	.....	.....	1,010	835	835	755	305	.....	1,910
28	.....	.....	.....	.....	.....	835	1,100	680	610	360	.....	1,660
29	.....	.....	.....	.....	.....	680	755	610	610	305	2,050	1,420
30	.....	.....	.....	.....	.....	.....	1,660	545	545	305	1,540	.....
31	.....	.....	.....	.....	.....	.....	1,310	480	.....	305	.....	.....

a See footnote at end of 1909 table.

Daily discharge, in second-feet, of Clinch River at Clinchport, Va., for 1907–1909—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	.....	1,660	.....	.....	1,420	1,310	680	420	305	250	835	835
2	.....	.....	.....	.....	1,310	920	680	360	305	250	610	1,200
3	.....	1,910	.....	.....	1,310	835	610	305	250	250	545	1,200
4	.....	1,660	.....	.....	1,310	755	545	305	250	250	420	835
5	.....	1,780	.....	.....	1,200	1,010	545	305	305	200	420	835
6	.....	.....	.....	.....	1,310	2,050	545	305	.....	200	360	755
7	.....	.....	.....	.....	1,780	1,310	680	420	.....	200	360	2,050
8	.....	.....	.....	.....	.....	1,010	1,010	420	1,780	200	305	.....
9	.....	.....	.....	2,050	.....	835	680	545	1,100	200	305	.....
10	1,780	.....	.....	1,780	2,050	755	610	610	755	360	305	.....
11	1,540	.....	.....	1,660	1,660	755	545	1,010	610	610	360	1,660
12	.....	.....	.....	1,780	1,420	680	480	610	545	420	920	.....
13	.....	.....	.....	2,050	1,200	610	420	480	480	360	1,100	.....
14	.....	.....	.....	1,780	1,100	545	420	420	420	305	835	.....
15	.....	.....	.....	1,660	920	610	1,010	360	420	305	755	.....
16	.....	.....	.....	1,540	920	.....	545	420	360	305	680	1,660
17	.....	.....	.....	1,420	835	2,050	680	420	360	250	680	1,310
18	.....	.....	.....	1,310	835	1,200	545	680	360	200	680	1,100
19	2,050	.....	.....	1,310	835	835	545	920	305	200	755	1,010
20	1,780	.....	.....	1,310	1,310	680	480	680	305	200	755	1,010
21	1,660	.....	.....	1,200	.....	1,010	420	610	305	200	755	1,010
22	1,540	1,910	.....	1,100	.....	1,100	360	1,310	305	200	680	1,100
23	1,540	1,660	.....	1,010	1,910	.....	360	1,660	305	250	610	.....
24	1,420	1,540	.....	920	1,660	.....	305	1,100	250	360	545	.....
25	1,310	1,420	.....	1,100	1,540	.....	360	755	250	545	545	.....
26	1,200	1,660	.....	.....	1,420	1,540	360	545	250	420	480	.....
27	1,780	.....	.....	.....	1,310	1,100	360	480	250	360	480	.....
28	.....	.....	.....	.....	1,310	920	360	420	250	360	420	.....
29	.....	1,910	.....	1,910	1,420	755	360	420	250	480	420	.....
30	.....	.....	.....	1,540	.....	755	610	420	250	610	480	.....
31	1,660	.....	1,910	.....	1,910	.....	545	360	.....	755	.....	.....
1909.												
1	.....	750	.....	.....	.....	455	.....	1,680	330	225	255	134
2	.....	670	1,920	.....	.....	670	1,920	.....	330	225	225	134
3	.....	925	1,680	1,920	.....	525	1,680	.....	275	225	225	134
4	1,680	835	1,800	1,560	.....	.....	835	1,680	225	225	225	134
5	1,800	835	1,800	1,340	.....	.....	750	925	178	178	225	134
6	.....	1,020	.....	1,230	.....	1,680	670	925	178	178	225	134
7	.....	1,340	.....	1,230	.....	1,230	750	835	178	178	225	134
8	1,800	1,560	.....	1,340	1,800	925	670	835	275	178	225	178
9	1,560	1,560	.....	1,120	1,450	.....	.....	750	275	178	178	178
10	1,340	.....	.....	1,020	.....	.....	.....	595	275	178	178	178
11	1,120	.....	.....	925	.....	.....	1,680	525	275	178	178	178
12	1,020	.....	.....	835	.....	.....	1,450	455	390	178	178	178
13	925	.....	.....	750	.....	.....	1,920	455	275	178	178	330
14	925	.....	.....	835	1,680	.....	.....	455	225	178	134	330
15	.....	.....	.....	835	1,450	.....	.....	455	225	225	134	330
16	.....	.....	.....	835	1,230	.....	.....	1,920	225	225	134	225
17	.....	.....	.....	750	1,120	.....	.....	1,920	330	225	134	225
18	.....	.....	.....	670	1,020	.....	.....	1,680	275	225	134	178
19	.....	.....	1,920	595	835	.....	1,800	1,450	225	225	134	178
20	.....	.....	1,680	595	835	1,340	1,340	.....	225	225	134	178
21	.....	.....	1,560	750	1,020	1,450	925	670	225	225	134	178
22	1,800	.....	1,450	1,230	925	1,230	835	455	330	225	134	178
23	1,560	.....	1,920	.....	835	1,680	750	455	330	225	134	178
24	1,340	.....	1,680	.....	750	.....	750	330	330	225	134	178
25	1,120	.....	.....	.....	750	.....	670	525	275	225	134	178
26	1,120	.....	.....	.....	670	.....	595	525	225	225	134	178
27	1,450	.....	.....	1,920	750	1,340	670	330	225	225	134	178
28	1,450	.....	.....	1,560	595	1,680	670	455	225	225	134	178
29	1,340	.....	.....	1,340	595	1,450	595	330	225	225	134	178
30	1,230	.....	.....	1,680	525	1,800	595	330	225	225	134	178
31	1,120	.....	.....	.....	525	.....	750	330	.....	225	.....	178

NOTE.—These discharges are based on rating curves which are applicable as follows: June 7, 1907, to December 31, 1908, well defined between discharges 200 and 1,600 second-feet; January 1, to December 31, 1909, not well defined. For all missing days June 7, 1907, to December 31, 1908, the discharge was greater than 2,100 second-feet. For all missing days January 1, to December 31, 1909, the discharge was greater than 1,900 second-feet.

HIWASSEE RIVER DRAINAGE BASIN.

DESCRIPTION.

Hiwassee River rises in the mountains of the Blue Ridge in western North Carolina and northern Georgia, takes a northwesterly direction, breaks through the Unaka Mountains, and enters Tennessee River 36 miles above Chattanooga, after flowing for 41 miles through a level country.

Nottely and Ocoee rivers, important tributaries, head in the Blue Ridge in Georgia. The Nottely enters the Hiwassee a short distance below Murphy, N. C., but the Ocoee has cut for itself a separate channel through the mountain border and enters the Hiwassee about 6 miles below Savannah Ford, which is the head of navigation. The lower mountain channels of both Hiwassee and Ocoee are exceedingly narrow, with high, precipitous banks, and the fall of both streams is very large.

The Hiwassee River basin occupies the southwestern portion of the Appalachian Mountains northwest of the Blue Ridge, and is therefore the southern extremity of the great mountain drainage area whose southeastern border is the top of the Blue Ridge, extending solid without a single crosscutting stream south of Roanoke River in Virginia.

The altitude of this tract, separated from the Little Tennessee basin by a mountainous divide, extending from the Blue Ridge to the Unaka Mountains, ranges between 1,500 and 5,000 feet. Spurs from 5 to 20 miles long reach from the eastern divide toward the river, and deep valleys extend from the river far into the mountains. The mountain sides are steep and in many places rocky, and the creek valleys, several of which are important, have considerable areas of alluvial flats and rolling foothills.

HIWASSEE RIVER NEAR HAYESVILLE, N. C.

This station is located at the iron wagon bridge known as Barnard Bridge, 2½ miles east of Hayesville. It was established May 20, 1907, in cooperation with the Forest Service, and has been continued to supply general run-off and water-power data. The station is about 1 mile below the mouth of Shooting Creek and 4 miles above Tusquitee Creek, both of which are important tributaries. Only slight, if any, variations are due to controlled flow.

The gage is a vertical rod attached to a maple tree on the left bank about 200 feet above the bridge. Its datum has not been changed. Discharge measurements are made from the single-span bridge, where the current is swift and the bed is composed largely of rock and is permanent.

The station was discontinued December 31, 1909.

Discharge measurements of Hiwassee River near Hayesville, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	M. R. Hall	90	182	1.79	549
July 22	F. P. Thomas	87	147	1.42	440
October 23	E. H. Swett	88	128	1.07	249

Daily gage height, in feet, of Hiwassee River near Hayesville, N. C., for 1909.

[Mrs. V. A. Barnard, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	1.3	2.05	2.25	5.4	2.1	1.9	1.4	1.1	1.0	1.0	0.9
2	1.35	1.3	2.25	2.1	3.3	2.0	1.85	2.1	1.05	1.0	1.0	.9
3	1.3	1.3	2.0	2.0	2.7	2.6	1.8	1.6	1.0	.95	.95	.9
4	1.3	1.25	1.9	1.95	2.5	7.9	1.7	1.7	1.0	.95	.95	.9
5	2.65	1.25	1.85	1.9	2.2	3.9	1.65	1.5	1.0	.95	.95	.9
6	2.0	1.75	2.1	1.8	2.15	3.1	1.7	1.45	1.0	1.0	.95	.85
7	1.75	1.45	2.1	2.1	2.1	2.7	2.3	1.8	1.0	.95	.95	2.5
8	1.6	1.4	1.95	1.9	2.0	2.7	2.0	1.5	1.0	.95	.9	1.6
9	1.5	1.35	1.85	2.0	1.95	2.5	2.1	1.4	1.05	.9	.9	1.35
10	1.4	3.25	4.7	1.9	4.4	2.8	1.95	1.5	1.4	.9	.9	1.2
11	1.4	2.2	3.65	1.8	2.5	2.5	1.8	1.4	1.05	2.05	.9	1.15
12	1.4	1.9	2.5	1.7	2.2	2.35	1.7	1.35	1.05	1.1	.9	1.1
13	1.4	2.4	10.8	3.1	2.1	2.25	1.65	1.5	1.0	1.0	.9	3.8
14	1.4	2.1	6.0	2.65	2.0	2.2	2.0	1.35	.95	2.0	.9	2.25
15	2.75	2.2	4.2	2.3	1.9	2.0	1.75	1.7	1.05	2.4	.9	1.75
16	2.0	3.45	3.35	2.1	1.95	2.0	1.5	1.4	1.1	1.5	.9	1.5
17	2.35	2.75	3.0	2.0	1.9	2.05	1.6	1.4	1.05	1.3	1.2	1.4
18	2.0	2.2	2.7	1.9	1.85	2.2	1.55	1.3	1.1	1.2	1.0	1.1
19	1.85	2.5	2.5	1.9	1.8	1.95	1.5	1.25	1.05	1.15	.9	1.1
20	1.7	2.4	2.5	1.85	6.2	1.9	1.5	1.2	1.0	1.1	.9	1.05
21	1.6	2.2	2.3	1.85	4.9	1.9	1.45	1.2	1.0	1.1	.9	1.15
22	1.55	4.0	2.2	1.8	7.0	2.2	1.4	1.15	3.3	1.1	.9	1.15
23	1.5	3.5	2.1	3.2	4.2	2.1	2.3	1.15	1.65	1.05	1.2	1.15
24	1.5	3.5	2.05	2.1	3.3	2.05	1.45	1.1	1.5	1.1	.95	1.15
25	1.5	2.8	4.0	1.95	2.75	1.95	1.4	1.1	1.3	1.1	.95	1.95
26	1.45	2.5	2.6	2.05	2.6	1.9	1.35	1.1	1.25	1.05	.9	1.1
27	1.4	2.35	2.4	1.9	2.65	2.0	1.5	1.1	1.1	1.05	.9	1.15
28	1.35	2.2	4.4	2.2	2.45	2.0	1.4	1.1	1.1	1.05	.9	1.25
29	1.4	.....	2.6	2.05	2.35	2.0	1.35	1.1	1.05	1.0	.9	1.15
30	1.4	.....	2.5	2.0	2.1	2.1	1.4	1.1	1.05	1.0	.9	1.15
31	1.3	.....	2.3	.....	2.2	.....	1.3	1.1	.....	1.0	.....	2.6

Daily discharge, in second-feet, of Hiwassee River near Hayesville, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	430	370	.....	.....	.....	.....	.....	430	274	236	236	204
2	400	370	.....	.....	.....	.....	.....	.....	255	236	236	204
3	370	370	.....	.....	.....	.....	.....	.....	236	220	220	204
4	370	344	.....	.....	.....	.....	.....	.....	236	220	220	204
5	.....	344	.....	.....	.....	.....	.....	500	236	220	220	204
6	.....	.....	.....	.....	.....	.....	.....	465	236	236	220	190
7	.....	465	.....	.....	.....	.....	.....	.....	236	220	220	.....
8	.....	430	.....	.....	.....	.....	.....	500	236	220	204	.....
9	500	400	.....	.....	.....	.....	.....	430	255	204	204	400
10	430	.....	.....	.....	.....	.....	.....	500	430	204	204	318
11	430	.....	.....	.....	.....	.....	.....	430	255	.....	204	296
12	430	.....	.....	.....	.....	.....	.....	400	255	274	204	274
13	430	.....	.....	.....	.....	.....	.....	500	236	236	204	.....
14	430	.....	.....	.....	.....	.....	.....	400	220	.....	204	.....
15	.....	.....	.....	.....	.....	.....	.....	.....	255	.....	204	.....
16	.....	.....	.....	.....	.....	.....	500	430	274	500	204	500
17	.....	.....	.....	.....	.....	.....	.....	430	255	370	318	430
18	.....	.....	.....	.....	.....	.....	.....	370	274	318	236	274
19	.....	.....	.....	.....	.....	.....	500	344	255	296	204	274
20	.....	.....	.....	.....	.....	.....	500	318	236	274	204	255
21	.....	.....	.....	.....	.....	.....	465	318	236	274	204	296
22	.....	.....	.....	.....	.....	.....	430	296	.....	274	204	296
23	500	.....	.....	.....	.....	.....	.....	296	.....	255	318	296
24	500	.....	.....	.....	.....	.....	465	274	500	274	220	296
25	500	.....	.....	.....	.....	.....	430	274	370	274	220	.....
26	465	.....	.....	.....	.....	.....	400	274	344	255	204	274
27	430	.....	.....	.....	.....	.....	500	274	274	255	204	296
28	400	.....	.....	.....	.....	.....	430	274	274	255	204	344
29	430	.....	.....	.....	.....	.....	400	274	255	236	204	296
30	430	.....	.....	.....	.....	.....	430	274	255	236	204	296
31	370	.....	.....	.....	.....	.....	370	274	.....	236	204	.....

NOTE.—These discharges are based on a rating curve that is well defined between discharges 152 and 500 second-feet. The high-water portion of the curve has not been developed. Discharges for all missing days are above 500 second-feet.

HIWASSEE RIVER AT MURPHY, N. C.

This station is located at the highway bridge in Murphy, N. C., about 80 feet above the Louisville & Nashville Railroad bridge. It is one-half mile above the mouth of Valley River. The station was established July 26, 1896, and the record is continuous except for a short period from August 8 to October 19, 1897. The records are valuable for water-power estimates, as well as other run-off problems. The natural flow is little, if any, affected either by diversions or dams above.

Prior to 1903 a wire gage located at the bridge was used. This was broken a number of times, introducing uncertainties in the gage height records. Since January 1, 1903, a chain gage fastened to the bridge has been used. There has been no change in the gage datum since October 20, 1897. At the measuring section the current is good and fairly regular, but the bed, which is rock, is uneven and soundings require careful work. Backwater from Valley River is not apt to disturb the rating, though such an effect is possible.

Discharge measurements of Hiwassee River at Murphy, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	M. R. Hall	178	518	6.37	1,260
April 13	do	175	691	7.37	2,530
Do	do	175	727	7.53	2,800
July 17	F. P. Thomas	174	498	6.15	1,130
Do	do	174	502	6.10	1,070
July 23	do	176	605	6.73	1,790
Do	do	176	575	6.57	1,550
October 25	E. H. Swett	164	329	5.36	463
Do	do	164	329	5.36	472

Daily gage height, in feet, of Hiwassee River at Murphy, N. C., for 1909.

[Miss Willie Mingus, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.0	5.85	6.6	6.75	10.5	6.55	6.3	5.6	5.45	5.3	5.25	5.25
2	5.95	5.8	6.6	6.65	7.8	6.4	6.25	7.6	5.35	5.5	5.25	5.25
3	5.9	5.75	6.5	6.55	7.2	7.2	6.1	6.1	5.3	5.3	5.25	5.25
4	5.85	5.7	6.4	6.5	7.0	10.2	6.05	6.0	5.4	5.3	5.2	5.25
5	7.0	5.7	6.35	6.4	6.8	8.2	6.0	5.6	5.4	5.25	5.2	5.25
6	6.65	6.6	6.6	6.4	6.7	7.4	6.05	5.85	5.4	5.4	5.2	5.25
7	6.35	6.0	6.7	6.7	6.55	7.2	8.2	6.1	5.3	5.3	5.25	5.85
8	6.25	5.9	6.65	6.4	6.55	7.1	6.7	5.85	5.4	5.25	5.25	6.45
9	6.1	5.85	6.45	6.6	6.45	7.1	7.0	5.8	5.5	5.2	5.25	5.85
10	6.0	8.8	8.8	6.4	8.8	7.3	6.4	5.9	5.65	5.25	5.25	5.65
11	5.95	7.1	7.4	6.35	6.85	6.9	6.35	5.7	5.5	5.6	5.25	5.55
12	5.9	6.65	7.1	6.3	6.0	6.7	6.2	5.8	5.4	5.4	5.25	5.5
13	5.85	6.7	10.8	6.3	6.5	6.65	6.1	6.1	5.4	5.25	5.25	6.65
14	5.9	6.8	10.2	6.9	6.4	6.5	7.4	5.75	5.3	5.55	5.25	6.6
15	6.3	6.85	8.4	6.3	6.3	6.7	6.25	6.6	5.3	8.0	5.25	6.1
16	6.75	8.9	7.7	6.5	6.4	6.4	6.1	5.8	5.8	6.0	5.25	5.9
17	7.7	7.5	7.4	6.4	6.35	6.45	6.2	5.8	5.7	5.7	5.4	5.75
18	6.9	7.1	7.1	6.35	6.25	6.75	6.0	5.7	5.8	5.6	5.35	5.7
19	6.55	6.9	7.0	6.3	6.2	6.35	5.95	5.6	5.4	5.5	5.25	5.65
20	6.4	6.9	7.1	6.25	8.3	6.25	5.9	5.6	5.4	5.45	5.25	5.6
21	6.25	6.7	6.9	6.2	9.3	6.3	5.8	5.5	5.35	5.45	5.25	5.55
22	6.15	7.0	6.7	6.2	10.3	6.8	5.8	5.5	5.45	5.4	5.25	5.5
23	6.1	8.1	6.6	6.75	8.6	6.5	6.25	5.45	6.6	5.4	5.35	5.55
24	6.0	8.0	6.6	6.7	7.7	6.55	5.95	5.45	6.0	5.45	5.35	5.6
25	6.0	7.5	9.1	6.45	7.3	6.4	5.8	5.45	5.6	5.4	5.3	6.05
26	5.95	7.1	7.4	6.45	7.2	6.4	5.75	5.4	5.5	5.35	5.25	5.85
27	5.9	7.0	7.0	6.4	7.0	6.6	5.85	5.4	5.45	5.35	5.25	5.8
28	5.85	6.8	8.4	7.0	6.8	6.5	5.8	5.35	5.4	5.3	5.25	5.65
29	5.85	.....	7.4	7.0	6.7	6.5	5.75	5.4	5.4	5.25	5.25	5.6
30	5.85	.....	7.1	6.55	6.6	6.65	5.9	5.4	5.3	5.25	5.25	5.4
31	5.75	.....	6.9	.....	6.65	.....	5.8	5.4	.....	5.25	.....	5.8

Daily discharge, in second-feet, of Hiwassee River at Murphy, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	950	818	1,600	1,800	9,550	1,540	1,250	620	518	425	385	385
2	905	775	1,600	1,660	3,470	1,360	1,200	3,110	455	550	385	385
3	860	735	1,480	1,540	2,430	2,430	1,040	1,040	425	425	385	385
4	818	695	1,360	1,480	2,130	8,800	995	950	485	425	350	385
5	2,130	695	1,300	1,360	1,860	4,250	950	620	485	398	350	385
6	1,660	1,600	1,600	1,360	1,730	2,760	995	818	485	485	350	385
7	1,300	950	1,730	1,730	1,540	2,430	4,250	1,040	425	425	385	842
8	1,200	860	1,660	1,360	1,540	2,280	1,730	818	485	398	385	1,440
9	1,040	818	1,420	1,600	1,420	2,280	2,130	775	550	370	385	842
10	950	5,510	5,510	1,360	5,510	2,590	1,360	860	658	398	385	680
11	905	2,280	2,760	1,300	1,920	1,990	1,300	695	550	620	385	602
12	860	1,660	2,280	1,250	950	1,730	1,140	775	485	435	385	565
13	818	1,730	10,300	1,250	1,480	1,660	1,040	1,040	485	398	385	1,670
14	860	1,860	8,800	1,990	1,360	1,480	2,760	735	425	585	385	1,610
15	1,250	1,920	4,660	1,250	1,250	1,730	1,200	1,600	425	3,850	385	1,070
16	1,800	5,730	3,290	1,480	1,360	1,360	1,040	775	775	975	385	885
17	3,290	2,930	2,760	1,360	1,300	1,420	1,140	775	695	720	490	760
18	1,990	2,280	2,280	1,300	1,200	1,800	950	695	775	640	455	720
19	1,540	1,990	2,130	1,250	1,140	1,300	905	620	485	565	385	680
20	1,360	1,990	2,280	1,200	4,450	1,200	860	620	485	528	385	640
21	1,200	1,730	1,990	1,140	6,630	1,250	775	550	455	528	385	602
22	1,090	2,130	1,730	1,140	9,050	1,860	775	550	518	490	385	565
23	1,040	4,050	1,600	1,800	5,080	1,480	1,200	518	1,600	490	455	602
24	950	3,850	1,600	1,730	3,290	1,540	905	518	950	528	455	640
25	950	2,930	6,170	1,420	2,590	1,360	775	518	620	490	420	1,020
26	905	2,280	2,760	1,420	2,430	1,360	735	485	550	455	385	842
27	860	2,130	2,130	1,360	2,130	1,600	818	485	518	455	385	800
28	818	1,860	4,660	2,130	1,860	1,480	775	455	485	420	385	680
29	818	.....	2,760	2,130	1,730	1,480	735	485	485	385	385	640
30	818	.....	2,280	1,540	1,600	1,660	860	485	425	385	385	490
31	735	.....	1,990	.....	1,660	.....	775	485	.....	385	.....	890

NOTE.—These discharges are based on rating curves applicable as follows: January 1 to October 15, well defined between 370 and 3,800 second-feet; October 16 to December 31, well defined above 400 second-feet.

Monthly discharge of Hiwassee River at Murphy, N. C., for 1909.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	3,290	735	1,180	2.88	3.32	A.
February	5,730	695	2,100	5.12	5.33	A.
March	10,300	1,300	2,920	7.12	8.21	A.
April	2,130	1,140	1,490	3.63	4.05	B.
May	9,550	950	2,760	6.73	7.76	A.
June	8,800	1,200	2,050	5.00	5.58	A.
July	4,250	735	1,210	2.95	3.40	A.
August	3,110	455	791	1.93	2.22	A.
September	1,600	425	572	1.40	1.56	A.
October	3,850	370	602	1.47	1.70	B.
November	490	350	393	.959	1.07	B.
December	1,670	385	742	1.81	2.09	B.
The year	10,300	350	1,400	3.41	46.29	

HIWASSEE RIVER AT RELIANCE, TENN.

This station is located at the Louisville & Nashville Railroad bridge at Reliance, Tenn. It is 2 miles above Spring Creek and 1 mile below Lost Creek. It was established August 17, 1900, to obtain water power and general run-off data. The water power possibilities between Reliance and Murphy, N. C., are very great.

At ordinary stages the section is a fairly good one. The water is held back by a ledge of rock below and is rather sluggish at low stages. At one end of this ledge is a small corn mill, but it does not appear probable that the use of water power by this mill could affect the gage readings. It is possible, however, that at low water there is some effect, and also that the observed changes in rating may be due to variable heights of the temporary dam at the mill.

There has been no change in the datum of the staff gage, which is attached to a tree at the right ferry landing, 150 feet above the bridge.

Discharge measurements of Hiwassee River at Reliance, Tenn., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	E. H. Swett	340	2,480	3.11	4,970
May 27	do	340	2,540	3.26	5,610
July 28	F. P. Thomas	349	2,330	2.07	2,420

Daily gage height, in feet, of Hiwassee River at Reliance, Tenn., for 1909.

[C. V. Higdon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	1.8	2.75	3.0	6.6	2.85	2.5	2.0	1.55	1.4	1.4	1.3
2	2.0	1.85	2.75	2.85	4.5	2.55	2.4	2.85	1.5	1.35	1.4	1.3
3	1.85	1.8	2.7	2.7	3.5	3.4	2.3	2.5	1.5	1.3	1.4	1.3
4	1.95	1.7	2.6	2.65	3.2	7.2	2.2	2.4	1.45	1.3	1.4	1.3
5	2.0	1.7	2.45	2.55	3.1	5.2	2.2	2.3	1.5	1.3	1.35	1.3
6	3.0	2.5	2.6	2.45	2.95	4.3	2.2	2.1	1.5	1.35	1.35	1.25
7	2.5	2.3	3.3	2.55	2.85	3.4	2.4	2.05	1.45	1.35	1.35	1.7
8	2.25	2.2	2.8	2.75	2.65	3.1	4.0	2.1	1.45	1.3	1.35	3.4
9	2.25	2.1	2.6	2.65	2.5	3.3	3.8	2.0	1.7	1.3	1.35	2.2
10	2.0	6.2	5.2	2.55	3.2	3.5	3.1	2.1	1.65	1.25	1.35	1.9
11	1.95	3.8	4.0	2.45	3.1	3.5	2.7	2.0	1.6	1.45	1.3	1.65
12	1.85	3.0	3.4	2.35	2.5	3.0	2.7	2.0	1.6	1.3	1.3	1.5
13	1.8	2.85	4.4	2.4	2.55	3.2	2.5	2.25	1.5	1.3	1.3	2.35
14	1.85	3.2	10.0	2.6	2.45	2.9	3.8	2.1	1.45	2.3	1.3	3.2
15	2.25	3.3	5.2	2.5	2.4	3.1	2.8	1.9	1.5	4.0	1.3	2.5
16	3.5	8.1	4.3	2.5	2.5	2.85	2.5	2.2	1.55	3.0	1.3	2.1
17	4.8	4.4	3.4	2.45	2.4	2.75	2.4	1.95	1.65	1.95	1.4	1.9
18	3.3	3.5	3.4	2.35	2.35	3.0	2.3	1.8	1.6	1.8	1.5	1.8
19	2.8	3.1	3.2	2.35	2.3	2.75	2.2	1.8	1.65	1.65	1.4	1.75
20	2.5	3.4	3.2	2.3	2.4	2.5	2.15	1.7	1.45	1.6	1.35	1.7
21	2.3	2.95	3.1	2.3	4.8	2.5	2.1	1.7	1.4	1.55	1.4	1.7
22	2.2	2.95	3.0	2.25	7.7	2.75	2.05	1.7	1.4	1.5	1.4	1.65
23	2.1	5.6	2.8	2.4	5.9	2.65	2.6	1.65	2.6	1.5	1.4	1.6
24	2.05	4.2	2.7	3.25	4.0	2.6	2.7	1.6	2.25	1.45	1.35	1.55
25	2.0	4.0	3.0	2.5	3.5	2.6	2.6	1.6	1.8	1.4	1.35	1.9
26	1.95	3.5	3.6	2.6	3.2	2.55	2.1	1.55	1.6	1.4	1.3	2.2
27	1.9	3.2	3.2	2.5	3.2	3.0	2.0	1.55	1.5	1.4	1.3	2.1
28	1.85	2.95	3.4	2.6	3.2	3.6	2.15	1.5	1.5	1.4	1.3	2.0
29	1.85	.....	3.8	2.9	2.75	2.7	2.0	1.5	1.4	1.4	1.35	1.8
30	1.9	.....	3.3	2.75	2.65	2.7	1.9	1.5	1.4	1.4	1.35	1.8
31	1.8	.....	3.0	.....	3.0	.....	1.9	1.75	.....	1.4	.....	1.9

Daily discharge, in second-feet, of Hiwassee River at Reliance, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,480	1,840	4,160	4,910	19,300	4,450	3,460	2,260	1,360	1,110	1,110	960
2	2,260	1,940	4,160	4,450	10,300	3,600	3,200	4,450	1,270	1,040	1,110	960
3	1,940	1,840	4,010	4,010	6,590	6,240	2,950	3,460	1,270	960	1,110	960
4	2,160	1,640	3,730	3,870	5,560	22,000	2,710	3,200	1,190	960	1,110	960
5	2,260	1,640	3,330	3,600	5,230	13,200	2,710	2,950	1,270	960	1,040	960
6	4,910	3,460	3,730	3,330	4,760	9,550	2,710	2,480	1,270	1,040	1,040	890
7	3,460	2,950	5,900	3,600	4,450	6,240	3,200	2,370	1,190	1,040	1,040	1,640
8	2,830	2,710	4,300	4,160	3,870	5,230	8,400	2,480	1,190	960	1,040	6,240
9	2,830	2,480	3,730	3,870	3,460	5,900	7,660	2,260	1,640	960	1,040	2,710
10	2,260	17,600	13,200	3,600	5,560	6,590	5,230	2,480	1,540	890	1,040	2,050
11	2,160	7,660	8,400	3,330	5,230	6,590	4,010	2,260	1,450	1,190	960	1,540
12	1,940	4,910	6,240	3,080	3,460	4,910	4,010	2,260	1,450	960	960	1,270
13	1,840	4,450	9,940	3,200	3,600	5,560	3,460	2,830	1,270	960	960	3,080
14	1,940	5,560	34,900	3,730	3,330	4,600	7,660	2,480	1,190	2,950	960	5,560
15	2,830	5,900	13,200	3,460	3,200	5,230	4,300	2,050	1,270	8,400	960	3,460
16	6,590	26,100	9,550	3,460	3,460	4,450	3,460	2,710	1,360	4,910	960	2,480
17	11,600	9,940	6,240	3,330	3,200	4,160	3,200	2,160	1,540	2,160	1,110	2,050
18	5,900	6,590	6,240	3,080	3,080	4,910	2,950	1,840	1,450	1,840	1,270	1,840
19	4,300	5,230	5,560	3,080	2,950	4,160	2,710	1,840	1,540	1,540	1,110	1,740
20	3,460	6,240	5,560	2,950	3,200	3,460	2,600	1,640	1,190	1,450	1,040	1,640
21	2,950	4,760	5,230	2,950	11,600	3,460	2,480	1,640	1,110	1,360	1,110	1,640
22	2,710	4,760	4,910	2,830	24,200	4,160	2,370	1,640	1,110	1,270	1,110	1,540
23	2,480	15,000	4,300	3,200	16,300	3,870	3,730	1,540	3,730	1,270	1,110	1,450
24	2,370	9,160	4,010	5,730	8,400	3,730	4,010	1,450	2,830	1,190	1,040	1,360
25	2,260	8,400	4,910	3,460	6,590	3,730	3,730	1,450	1,840	1,110	1,040	2,050
26	2,160	6,590	6,940	3,730	5,560	3,600	2,480	1,360	1,450	1,110	960	2,710
27	2,050	5,560	5,560	3,460	5,560	4,910	2,260	1,360	1,270	1,110	960	2,480
28	1,940	4,760	6,240	3,730	5,560	6,940	2,600	1,270	1,270	1,110	960	2,260
29	1,940	.....	7,660	4,600	4,160	4,010	2,260	1,270	1,110	1,110	1,040	1,840
30	2,050	.....	5,900	4,160	3,870	4,010	2,050	1,270	1,110	1,110	1,040	1,840
31	1,840	.....	4,910	.....	4,910	.....	2,050	1,740	.....	1,110	.....	2,050

NOTE.—These discharges are based on a rating curve that is fairly well defined between 820 and 6,600 second-feet.

Monthly discharge of Hiwassee River at Reliance, Tenn., for 1909.

[Drainage area, 1,180 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	11,600	1,840	3,050	2.58	2.97	A.
February	26,100	1,640	6,420	5.44	5.66	A.
March	34,900	3,330	6,990	5.92	6.82	A.
April	5,730	2,830	3,660	3.10	3.46	A.
May	24,200	2,950	6,470	5.48	6.32	A.
June	22,000	3,460	5,780	4.90	5.47	A.
July	8,400	2,050	3,570	3.03	3.49	A.
August	4,450	1,270	2,140	1.81	2.09	A.
September	3,730	1,110	1,460	1.24	1.38	B.
October	8,400	890	1,590	1.35	1.56	B.
November	1,270	960	1,040	.881	.98	B.
December	6,240	890	2,070	1.75	2.02	A.
The year	34,900	890	3,690	3.12	42.22	

TUSQUITEE CREEK NEAR HAYESVILLE, N. C.

This station was established May 20, 1907, in cooperation with the Forest Service. It is at the wagon bridge about 3 miles northeast of Hayesville and 2½ miles above the mouth of the creek, which is a tributary to Hiwassee River. The low water is probably affected to a small extent by mills above.

Discharge measurements are made from the wooden wagon bridge where the current is somewhat rough and the bottom of the stream is rocky and not liable to change. The vertical staff gage is attached to the bridge pier on the left bank. The station was discontinued December 31, 1909.

Discharge measurements of Tusquitee Creek near Hayesville, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	M. R. Hall	34	69.2	1.71	122
July 21	F. P. Thomas	34	67	1.52	85
Do	do	34	69	1.52	88
Do	do	34	68	1.52	82
October 23	E. H. Swett	31	56	1.19	44
Do	do	31	56	1.19	44

Daily gage height, in feet, of Tusquitee Creek near Hayesville, N. C., for 1909.

[T. C. Moore, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.7	1.45	1.95	2.0	2.9	1.85	1.7	1.5	1.2	1.15	1.1	1.1
2	1.6	1.4	2.0	2.0	2.4	1.8	1.65	2.1	1.2	1.15	1.2	1.1
3	1.55	1.4	1.85	1.9	2.1	2.85	1.6	1.6	1.2	1.15	1.15	1.2
4	1.6	1.4	1.8	1.9	2.0	3.8	1.6	1.8	1.2	1.1	1.15	1.15
5	2.2	1.35	1.8	1.85	1.95	2.7	1.55	1.6	1.2	1.1	1.1	1.15
6	2.0	1.6	2.1	1.8	1.9	2.4	1.6	1.5	1.2	1.15	1.1	1.15
7	1.9	1.5	1.9	2.0	1.85	2.2	2.1	1.5	1.25	1.1	1.2	2.8
8	1.75	1.45	1.9	1.8	1.8	2.1	2.1	1.5	1.2	1.1	1.15	1.8
9	1.65	2.1	1.85	1.8	1.8	2.45	2.25	1.5	1.2	1.1	1.15	1.5
10	1.6	3.0	2.7	1.8	2.0	2.1	2.0	1.55	1.35	1.1	1.15	1.4
11	1.55	2.7	2.3	1.75	1.9	2.2	1.8	1.5	1.25	1.4	1.1	1.35
12	1.55	2.2	2.1	1.7	1.8	2.0	1.8	1.5	1.3	1.15	1.1	1.35
13	1.5	2.45	5.0	1.95	1.75	1.95	1.75	1.5	1.2	1.1	1.1	1.6
14	1.5	2.0	3.7	1.85	1.7	1.85	2.0	1.45	1.2	2.4	1.1	1.55
15	2.15	2.7	2.9	1.8	1.7	1.85	1.85	1.4	1.2	1.8	1.1	1.45
16	2.5	2.8	2.7	1.8	2.0	1.8	1.8	1.6	1.3	1.3	1.1	1.4
17	2.8	2.4	2.4	1.75	1.7	1.8	1.8	1.5	1.45	1.3	1.55	1.4
18	2.3	2.2	2.3	1.75	1.65	1.9	1.7	1.4	1.3	1.3	1.3	1.35
19	2.0	2.3	2.1	1.7	1.65	1.8	1.65	1.4	1.25	1.25	1.15	1.35
20	1.9	2.2	2.1	1.65	2.6	1.75	1.6	1.4	1.2	1.2	1.15	1.3
21	1.8	1.95	2.0	1.6	2.5	2.85	1.6	1.35	1.2	1.2	1.1	1.3
22	1.75	2.9	2.0	1.7	4.0	1.85	1.6	1.35	1.7	1.2	1.1	1.25
23	1.7	2.5	1.9	2.4	3.0	1.8	2.1	1.35	1.4	1.2	1.4	1.3
24	1.7	2.85	1.85	1.9	2.5	1.85	1.6	1.3	1.35	1.25	1.2	1.3
25	1.6	2.7	2.9	1.8	2.25	1.75	1.55	1.3	1.25	1.2	1.2	1.7
26	1.55	2.65	2.4	1.85	2.1	1.75	1.5	1.3	1.25	1.2	1.15	1.5
27	1.5	2.6	2.1	2.3	2.1	1.7	1.5	1.3	1.2	1.2	1.15	1.45
28	1.5	2.0	2.5	2.0	2.0	1.75	1.5	1.25	1.2	1.15	1.1	1.4
29	1.55	.....	2.45	1.9	1.95	1.75	1.45	1.25	1.2	1.1	1.1	1.35
30	1.5	.....	2.2	2.6	1.9	1.7	1.4	1.25	1.15	1.1	1.1	1.3
31	1.45	.....	2.1	.....	1.9	.....	1.45	1.25	.....	1.1	.....	1.4

Daily discharge, in second-feet, of Tusquitee Creek near Hayesville, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	117	77	175	188	.....	150	117	84	46	41	36	36
2	99	70	188	188	.....	138	108	.....	46	41	46	36
3	92	70	150	162	.....	.....	99	99	46	41	41	46
4	99	70	138	162	188	.....	99	138	46	36	41	41
5	.....	64	138	150	175	.....	92	99	46	36	36	41
6	188	99	.....	138	162	.....	99	84	46	41	36	41
7	162	84	162	188	150	.....	.....	84	52	36	46	.....
8	128	77	162	138	138	.....	.....	84	46	36	41	138
9	108	.....	150	138	138	.....	.....	84	46	36	41	84
10	99	.....	.....	138	188	.....	188	92	64	36	41	70
11	92	.....	.....	128	162	.....	138	84	52	70	36	64
12	92	.....	.....	117	138	188	138	84	57	41	36	64
13	84	.....	.....	175	128	175	128	84	46	36	36	99
14	84	188	.....	150	117	150	188	77	46	.....	36	92
15	.....	.....	.....	138	117	150	150	70	46	138	36	77
16	.....	.....	.....	138	188	138	138	99	57	57	36	70
17	.....	.....	.....	128	117	138	138	84	77	57	92	70
18	.....	.....	.....	128	108	162	117	70	57	57	57	64
19	188	.....	.....	117	108	138	108	70	52	52	41	64
20	162	.....	.....	108	.....	128	99	70	46	46	41	57
21	138	175	188	99	.....	.....	99	64	46	46	36	57
22	128	.....	188	117	.....	150	99	64	117	46	36	52
23	117	.....	162	.....	.....	138	.....	64	70	46	70	57
24	117	.....	150	162	.....	150	99	57	64	52	46	57
25	99	.....	.....	138	.....	128	92	57	52	46	46	117
26	92	.....	.....	150	.....	128	84	57	52	46	41	84
27	84	.....	.....	.....	.....	.....	117	84	57	46	46	41	77
28	84	188	.....	188	188	128	84	52	46	41	36	70
29	92	.....	.....	162	175	128	77	52	46	36	36	64
30	84	.....	.....	.....	162	117	70	52	41	36	36	57
31	77	.....	.....	.....	162	.....	77	52	.....	36	.....	70

NOTE.—These discharges were obtained from a rating curve that is well defined between discharges 28 and 190 second-feet. The high water portion of the curve has not been developed. Discharges for all missing days are above 190 second-feet.

VALLEY RIVER AT TOMOTLA, N. C.

This station is located at a footbridge about 250 feet below a public road ford at Tomotla, N. C. It is 5 miles above Murphy, N. C., and about one-fourth mile above Rodgers Creek. It was established June 29, 1904. The records are probably of more value as showing the amount of water entering Hiwassee River below the Murphy station than for estimates of power in Valley River.

Some water is used in lumber flumes, but is returned to the river above the station. Considerable daily fluctuation occurs, on account of which the gage is read twice a day. The gage is a sloping section bolted to solid rock under the right bank end of the footbridge, continued as a vertical staff attached to the bridge abutment at the same point. The datum of the gage has not been changed.

Discharge measurements have been made from the single-span footbridge, where the section is good for measurements and conditions of flow constant. The station was discontinued December 31, 1909.

Discharge measurements of Valley River at Tomotla, N. C., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	M. R. Hall	57	147	1.90	262
July 20	F. P. Thomas	59	136	1.68	215
Do	do	59	137	1.68	210
Do	do	59	136	1.68	205
July 26	do	58	134	1.60	188
Do	do	58	133	1.60	187
Do	do	58	132	1.60	193
October 25	E. H. Swett	56	102	1.20	97
Do	do	56	102	1.20	99

Daily gage height, in feet, of Valley River at Tomotla, N. C., for 1909.

[J. T. Hayes, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.3	2.55	2.4	3.4	2.1	1.85	1.6	1.25	1.1	1.1	1.1
2	1.9	1.3	2.7	2.3	2.9	2.0	1.8	1.6	1.2	1.1	1.1	1.1
3	1.55	1.3	2.7	2.25	2.25	3.2	1.8	1.6	1.2	1.1	1.1	1.1
4	1.75	1.3	2.45	2.2	2.0	5.5	1.8	1.85	1.2	1.1	1.1	1.1
5	2.6	1.3	2.25	2.1	2.0	3.6	1.8	1.6	1.2	1.15	1.1	1.1
6	2.2	2.4	2.4	2.1	1.95	2.9	2.25	1.65	1.2	1.2	1.1	1.1
7	1.95	2.3	2.85	2.35	1.9	2.55	3.8	1.6	1.2	1.1	1.1	3.0
8	1.85	1.9	2.6	2.1	1.9	2.45	3.3	1.6	1.2	1.0	1.1	2.8
9	1.8	2.6	2.3	2.05	2.0	4.0	2.95	1.6	1.2	1.0	1.1	2.2
10	1.7	6.0	3.7	2.0	2.6	2.65	2.3	1.6	1.5	1.0	1.1	1.5
11	1.65	3.4	4.8	1.95	1.95	2.5	2.1	1.6	1.45	1.0	1.1	1.45
12	1.7	2.8	4.0	1.9	1.9	2.4	2.1	1.6	1.4	2.2	1.1	1.4
13	1.7	3.2	3.4	1.9	1.9	2.4	2.35	1.85	1.35	2.5	1.1	3.2
14	1.8	2.75	7.7	2.05	1.9	2.35	2.2	1.9	1.3	1.9	1.1	2.65
15	2.1	6.8	5.1	2.0	1.75	2.15	2.0	1.8	1.3	1.8	1.1	2.0
16	3.6	6.8	3.9	1.9	1.7	2.0	1.9	1.7	1.4	1.6	1.1	1.7
17	3.9	4.0	3.4	1.8	1.7	2.0	1.8	1.65	1.3	1.55	1.1	1.55
18	2.9	3.2	2.65	1.75	1.7	2.15	1.75	1.6	1.35	1.45	1.1	1.5
19	2.1	3.2	2.6	1.7	2.0	1.95	1.7	1.6	1.8	1.3	1.1	1.5
20	2.0	2.9	2.85	1.7	2.8	1.9	1.65	1.5	1.8	1.3	1.1	1.5
21	2.05	2.55	2.65	1.7	3.6	1.9	1.6	1.5	2.25	1.3	1.1	1.45
22	1.9	3.8	2.45	2.2	5.9	2.1	1.8	1.5	3.8	1.2	1.1	1.4
23	1.85	4.5	2.2	1.95	4.8	2.2	2.8	1.5	3.3	1.2	1.1	1.4
24	1.8	4.4	2.0	1.9	4.0	2.4	1.85	1.4	2.95	1.2	1.25	1.4
25	1.75	3.7	3.0	1.9	3.2	2.35	1.7	1.4	2.3	1.2	1.2	1.4
26	1.7	3.0	3.8	1.9	2.65	2.45	1.65	1.4	1.55	1.2	1.1	1.4
27	1.65	2.85	3.6	1.9	2.5	2.6	1.6	1.3	1.2	1.15	1.1	1.4
28	1.65	2.55	3.5	1.8	2.4	2.2	1.6	1.3	1.1	1.1	1.1	1.4
29	1.65	.....	2.9	2.15	2.25	2.0	1.6	1.3	1.1	1.1	1.1	1.4
30	1.6	.....	2.65	4.0	2.1	1.9	1.6	1.35	1.1	1.1	1.1	1.5
31	1.45	.....	2.45	.....	2.1	.....	1.6	1.3	.....	1.1	.....	1.45

Daily discharge, in second-feet, of Valley River at Tomotla, N. C., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	278	122	510	450	895	345	262	191	112	84	84	84
2	278	122	570	415	655	310	247	191	102	84	84	84
3	178	122	570	398	398	795	247	191	102	84	84	84
4	232	122	470	380	310	2,260	247	262	102	84	84	84
5	530	122	398	345	310	1,000	247	191	102	93	84	84
6	380	450	450	345	294	655	398	204	102	102	84	84
7	294	415	632	432	278	510	1,120	191	102	84	84	700
8	262	278	530	345	278	470	845	191	102	68	84	610
9	247	530	415	328	310	1,240	678	191	102	68	84	380
10	218	2,610	1,060	310	530	550	415	191	166	68	84	166
11	204	895	1,770	294	294	490	345	191	154	68	84	154
12	218	610	1,240	278	278	450	345	191	143	380	84	143
13	218	795	895	278	278	450	432	262	132	490	84	795
14	247	590	3,870	328	278	432	380	278	122	278	84	550
15	345	3,200	1,980	310	232	362	310	247	122	247	84	310
16	1,000	3,200	1,180	278	218	310	278	218	143	191	84	218
17	1,180	1,240	895	247	218	310	247	204	122	178	84	178
18	655	795	550	232	218	362	232	191	132	154	84	166
19	345	795	530	218	310	294	218	191	247	122	84	166
20	310	655	632	218	610	278	204	166	247	122	84	166
21	328	510	650	218	1,000	278	191	166	398	122	84	154
22	278	1,120	470	380	2,540	345	247	166	1,120	102	84	143
23	262	1,560	380	294	1,770	380	610	166	845	102	84	143
24	247	1,500	310	278	1,240	450	262	143	678	102	112	143
25	232	1,060	700	278	795	432	218	143	415	102	102	143
26	218	700	1,120	278	550	470	204	143	178	102	84	143
27	204	632	1,000	278	490	530	191	122	102	93	84	143
28	204	510	950	247	450	380	191	122	84	84	84	143
29	204	.....	655	362	398	310	191	122	84	84	84	143
30	191	.....	550	1,240	345	278	191	132	84	84	84	166
31	154	.....	470	.....	345	.....	191	122	.....	84	.....	154

NOTE.—These discharges are based on a rating curve that is well defined below 490 second-feet.

Monthly discharge of Valley River at Tomotla, N. C., for 1909.

[Drainage area, 106 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,180	154	327	3.08	3.55	A.
February	3,200	122	902	8.51	8.86	B.
March	3,870	310	851	8.03	9.26	B.
April	1,240	218	343	3.24	3.62	A.
May	2,540	218	552	5.21	6.01	A.
June	2,260	278	524	4.94	5.51	A.
July	1,120	191	335	3.16	3.64	A.
August	278	122	183	1.73	1.99	A.
September	1,120	84	222	2.09	2.33	A.
October	490	68	133	1.25	1.44	A.
November	112	84	85.5	.807	.90	B.
December	795	84	220	2.08	2.40	A.
The year	3,870	68	390	3.68	49.51	

OCOEE RIVER AT COPPERHILL, TENN.[a]

This station is located at a suspension footbridge just below McCays Ferry at Copperhill, Tenn., near the Georgia-Tennessee boundary and one-half mile below the railroad bridge of the Louis-

[a] The name of this town was formerly McCays.

ville & Nashville Railroad. It is one-half mile above the mouth of Fightingtown Creek. It was established March 21, 1903. The records are especially valuable for estimates of water power, there being a great amount of fall in the river below. Gage readings are made twice a day in order to equalize fluctuations due to mills above, which, however, are very slight.

No change has occurred in the datum of the staff gage, which is located at the right end of the bridge. The lower section is a sloping timber. Discharge measurements are made from the suspension footbridge, where the section is excellent. Swinging or shaking of the bridge during discharge measurements may cause some error, but this is not thought to be serious.

Discharge measurements of Ocoee River at Copperhill, Tenn., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 15	F. P. Thomas	158	562	1.68	924
July 16	do	158	564	1.67	928
October 21	E. H. Swett	150	389	.84	458

Daily gage height, in feet, of Ocoee River at Copperhill, Tenn., for 1909.

[Arch Ballew, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	1.2	2.5	2.7	6.6	2.0	2.1	1.3	1.1	0.8	0.7	0.6
2	1.15	1.2	2.5	2.65	2.95	2.0	2.0	2.15	.9	.75	.7	.6
3	1.15	1.2	2.5	2.5	2.85	4.3	1.95	2.3	.9	.75	.7	.6
4	1.3	1.2	2.3	2.4	2.65	6.0	1.9	1.65	.9	.72	.7	.6
5	2.35	1.45	2.2	2.35	2.5	2.65	1.8	1.55	.95	.72	.7	.6
6	1.85	2.1	2.4	2.3	2.4	2.65	1.8	1.4	.95	.72	.7	.6
7	1.55	1.55	2.3	2.55	2.3	2.35	2.7	1.45	.9	.72	.7	2.45
8	1.4	1.4	2.3	2.4	2.25	2.6	3.0	1.3	1.1	.72	.65	2.1
9	1.3	2.5	2.4	2.55	2.2	3.3	2.45	1.35	1.0	.7	.65	1.1
10	1.3	5.0	5.0	2.35	2.8	2.5	2.05	1.3	1.2	.65	.65	1.0
11	1.3	2.65	3.2	2.2	2.35	2.55	1.85	1.3	1.0	1.6	.65	.9
12	1.2	2.2	3.0	2.2	2.2	2.4	1.8	1.25	.95	1.6	.65	.9
13	1.2	3.4	10.2	2.4	2.1	2.35	1.9	1.4	1.1	.72	.65	3.2
14	1.4	2.8	6.2	2.45	2.05	2.2	2.0	1.4	.8	2.6	.65	2.2
15	2.6	4.0	4.6	2.3	2.1	2.5	1.7	1.3	.8	2.8	.65	1.3
16	3.0	5.0	3.9	2.2	2.35	2.25	1.7	1.2	.8	1.25	.65	1.25
17	2.7	3.5	3.6	2.1	2.1	2.55	1.7	1.2	1.2	1.0	.75	1.1
18	2.15	2.9	3.4	2.1	1.9	2.35	1.6	1.1	.85	.9	.75	1.1
19	1.85	3.0	3.3	2.1	1.9	2.1	1.5	1.1	.9	.85	.65	1.0
20	1.7	2.75	3.4	2.0	3.1	2.0	1.5	1.1	.8	.82	.65	.95
21	1.6	2.4	3.2	2.0	3.6	2.1	1.5	1.0	.8	.8	.65	.9
22	1.5	3.6	2.9	2.0	4.0	2.1	1.55	1.0	1.2	.8	.65	.9
23	1.5	4.0	2.75	3.4	3.0	2.2	2.05	1.0	2.1	.75	.8	.9
24	1.5	3.8	2.7	2.5	2.6	2.2	1.6	.95	1.2	.75	.85	.95
25	1.5	3.3	4.4	2.4	2.45	2.3	1.4	.95	1.1	.75	.7	1.15
26	1.4	2.95	3.0	2.4	2.3	2.45	1.4	.9	.9	.7	.65	1.15
27	1.3	2.8	2.85	2.2	2.45	2.6	1.55	.9	.8	.7	.65	1.0
28	1.3	2.7	3.6	2.3	2.25	2.8	1.45	.9	.8	.7	.6	1.0
29	1.4	.....	3.3	2.3	2.1	2.85	1.4	.9	.8	.7	.6	.9
30	1.35	.....	2.95	2.25	2.05	2.65	1.4	1.1	.8	.7	.6	.9
31	1.2	.....	2.75	.....	2.1	.....	1.35	1.1	.....	.7	.....	.9

Daily discharge, in second-feet, of Ocoee River at Copperhill, Tenn., for 1909.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	640	640	1,440	1,580	4,960	1,120	1,180	695	590	445	400	360
2	615	640	1,440	1,540	1,760	1,120	1,120	1,220	490	422	400	360
3	615	640	1,440	1,440	1,680	2,770	1,090	1,320	490	422	400	360
4	695	640	1,320	1,380	1,540	4,330	1,060	900	490	409	400	360
5	1,350	780	1,250	1,350	1,440	1,540	990	840	515	409	400	360
6	1,020	1,180	1,380	1,320	1,380	1,540	990	750	515	409	400	360
7	840	840	1,320	1,480	1,320	1,350	1,580	780	490	409	400	1,410
8	750	750	1,320	1,380	1,280	1,510	1,790	695	490	409	380	1,180
9	695	1,440	1,380	1,480	1,250	2,000	1,410	722	540	400	380	590
10	695	3,360	3,360	1,350	1,650	1,440	1,150	695	640	380	380	540
11	695	1,540	1,930	1,250	1,350	1,480	1,020	695	540	870	380	490
12	640	1,250	1,790	1,250	1,250	1,380	990	668	515	870	380	490
13	640	2,080	8,920	1,380	1,180	1,350	1,060	750	590	409	380	1,930
14	750	1,650	4,530	1,410	1,150	1,250	1,120	750	445	1,510	380	1,250
15	1,510	2,530	3,020	1,320	1,180	1,440	930	695	445	1,650	380	695
16	1,790	3,360	2,450	1,250	1,350	1,280	930	640	445	668	380	668
17	1,580	2,150	2,220	1,180	1,180	1,480	930	640	640	540	422	580
18	1,220	1,720	2,080	1,180	1,060	1,350	870	590	468	490	422	590
19	1,020	1,790	2,000	1,180	1,060	1,180	810	590	490	468	380	540
20	930	1,620	2,080	1,120	1,860	1,120	810	590	445	454	380	515
21	870	1,380	1,930	1,120	2,220	1,180	810	540	445	445	380	490
22	810	2,220	1,720	1,120	2,530	1,180	840	540	640	445	380	490
23	810	2,530	1,620	2,080	1,790	1,250	1,150	540	1,180	422	445	490
24	810	2,380	1,580	1,440	1,510	1,250	870	515	640	422	468	515
25	810	2,000	2,850	1,380	1,410	1,320	750	515	590	422	400	615
26	750	1,760	1,790	1,380	1,320	1,410	750	490	490	400	380	615
27	695	1,650	1,680	1,250	1,410	1,510	840	490	445	400	380	540
28	695	1,580	2,220	1,320	1,280	1,650	780	490	445	400	360	540
29	750	.....	2,000	1,320	1,180	1,680	750	490	445	400	360	490
30	722	.....	1,760	1,280	1,150	1,540	750	590	445	400	360	490
31	640	.....	1,620	.....	1,180	.....	722	590	.....	400	.....	490

NOTE.—These discharges are based on a rating curve that is well defined between 400 and 2,200 second-feet.

Monthly discharge of Ocoee River at Copperhill, Tenn., for 1909.

[Drainage area 374 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,790	615	873	2.33	2.69	A.
February	3,360	640	1,650	4.41	4.59	A.
March	8,920	1,250	2,180	5.83	6.72	A.
April	2,080	1,120	1,350	3.61	4.03	A.
May	4,960	1,060	1,540	4.12	4.75	A.
June	4,330	1,120	1,530	4.09	4.56	A.
July	1,790	722	995	2.66	3.07	A.
August	1,320	490	678	1.81	2.09	A.
September	1,180	445	538	1.44	1.61	A.
October	1,650	400	535	1.43	1.65	A.
November	468	360	391	1.05	1.17	A.
December	1,930	360	626	1.67	1.92	A.
The year	8,920	360	1,070	2.87	38.85	

MISCELLANEOUS MEASUREMENTS IN OHIO RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in the Ohio River basin during 1909:

Miscellaneous measurements in Ohio River basin in 1909.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Feb. 26	Miami River	Ohio River	Hamilton, Ohio	7.82	19,400
Aug. 9	Embarrass River	Wabash River	At highway bridge south of Hugo, Ill.	(a)	26
Mar. 13	French Broad River	Tennessee River	U. S. Weather Bureau Station at Dandridge, Tenn.	4.15	16,400
Mar. 17	Nolichucky River	French Broad River	U. S. Weather Bureau station at Birdsbridge, Tenn., 4 miles below former U. S. Geological Survey station at Jones Bridge, near Greenville, Tenn.	1.85	3,050
Sept. 17	do	do	do	1.22	2,230
Mar. 20	North Fork of Holston River.	Holston River	At abandoned U. S. Geological Survey gaging station, at Saltville, Va.	(b)	345
Mar. 22	Holston River	Tennessee River	At Virginia & Southwestern R. R. bridge, 1 mile east of Mendota, Va.	c 4.28	2,550
Sept. 20	do	do	do	c. 80	179
Do	do	do	do	c. 80	176
Sept. 21d	Clinch River	do	At Speers Ferry, Va	.20	333
Sept. 27	Hiwassee River	do	At new Polk County highway bridge, 1 mile southwest of Wetmore, Tenn., and 6 miles below Reliance station.	e. 40	1,340

a Reference point is file mark on rivet above handrail, 62 feet from face left abutment, upstream side of bridge. Distance to water surface, 22.71 feet.
b Water surface 21.24 feet below top of downstream end of second floor beam from left bank.
c U. S. Weather Bureau gage, 1½ miles below the bridge, and about half a mile below Mendota.
d Made by wading at ford 300 feet below U. S. Weather Bureau gage.
e Gage on middle pier.

SUMMARIES OF DISCHARGE PER SQUARE MILE.

The following tables of summaries of discharge per square mile are given to allow of ready comparison of relative rates of run-off from different areas in the Ohio River drainage basin.

They show in a general way the seasonal distribution of run-off and the effect of snow, ground, surface, and artificial storage. But the most important fact worth noting is the almost entire lack of uniformity or agreement between any two streams. It indicates that the discharge of each stream is a law unto itself, and that all projects dependent upon stream flow, if they are to be developed along the safest and most economical lines, must be based on records of stream flow collected with great care over a long series of years as near the location of the project under consideration as possible.

Summary of discharge, in second-feet per square mile, for Ohio River basin for 1909.

Station.	Drainage area.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Allegheny River at Red House, N. Y.	1,640	2.49	4.88	3.02	3.32	4.57	1.74	0.36	0.16	0.11	0.33	0.54	0.39	1.83
Allegheny River at Kittanning, Pa.	8,690	2.90	4.21	2.97	3.04	3.65	1.38	.37	.16	.11	.21	.39	.67	1.67
Kiskiminitas River at Avonmore, Pa.	1,750	1.53	3.42	3.20	3.81	2.05	1.43	.24	.22	.12	.29	.19	.87	1.45
Blacklick Creek at Blacklick, Pa.	403	2.04	4.12	3.50	3.60	2.27	1.66	.38	.22	.09	.21	.22	.48	1.57
Cheat River near Morgantown, W. Va.	1,380	2.07	4.07	3.18	4.57	1.72	3.43	.79	.99	1.07	1.57	.87	.82	2.10
Youghiogheny River at Confluence, Pa.	435	1.77	4.39	3.15	4.28	1.58	3.06	.33	.66	.43	.82	.55	.85	1.82
Casselman River at Confluence, Pa.	450	1.37	3.51	3.07	3.91	1.38	1.89	.33	.75	.18	.55	.37	.87	1.51
Laurel Hill Creek at Confluence, Pa.	118	2.50	5.45	4.81	5.04	2.10	3.13	.28	1.00	.22	.46	.35	1.37	2.23
New River at Radford, Va.	2,720	2.53	2.10	2.06	1.95	3.21	2.32	1.31	1.05	.80	.93	.59	.83	1.64
Greenbrier River at Alderson, W. Va.	1,340	2.87	3.04	3.01	2.81	2.41	.84	.57	.32	.15	.30	.35	.90	1.46
Embarrass River near Oakland, Ill.	535	....	....	....	....	....	....	....	....	....	....	.33	.65	....
Embarrass River at St. Marie, Ill.	1,540	....	....	....	....	....	....	....	....	....	....	.24	.65	....
East Branch White River at Shoals, Ind.	4,900	.09	1.22	2.24	1.39	1.90	1.25	1.23	.34	.14	.23	.41	1.04	.96
Skillet Fork near Wayne City, Ill.	481	.02	2.91	2.45	3.12	.40	.70	.39	.06	.09	.07	.48	1.32	1.00
French Broad River at Rosman, N. C.	66	4.53	7.33	6.29	5.41	8.35	13.4	....	....	....	....	....	....	....
Tennessee River at Knoxville, Tenn.	8,990	1.90	2.90	3.62	1.79	2.74	2.61	1.79	1.22	.72	.59	.33	.56	1.73
Tennessee River at Chattanooga, Tenn.	21,400	2.47	3.92	4.28	2.42	3.44	3.48	2.45	1.68	.87	.78	.53	.93	2.27
Davidson River near Davidson River, N. C.	41	3.02	4.98	4.59	3.63	6.71	6.27	....	....	....	....	....	....	....
North Fork of Mills River at Pinkbed, N. C.	24	3.33	4.54	5.17	4.17	5.71	6.79	....	....	....	....	....	....	....
South Fork of Mills River near Sitton, N. C.	40.5	3.19	4.54	4.67	3.56	5.36	7.28	....	....	....	....	....	....	....
Pigeon River at Newport, Tenn.	655	2.38	4.23	5.27	2.41	3.53	3.63	2.73	2.27	1.24	1.26	.82	1.26	2.59
South Fork of Holston River near Chilhowie, Va.	108	2.29	2.74	3.11	1.56	2.09	1.38	1.21	.64	.42	.47	.37	.43	1.39
South Fork of Holston River at Bluff City, Tenn.	828	2.36	2.75	3.39	1.70	2.25	1.59	1.33	.69	.40	.40	.31	.40	1.46
Holston River near Rogersville, Tenn.	3,060	2.14	2.72	3.37	1.74	2.56	2.11	1.42	1.03	.62	.49	.38	.55	1.59
Middle Fork of Holston River at Chilhowie, Va.	144	2.91	2.65	3.62	2.19	2.41	1.53	.97	.64	.71	.50	.31	.50	1.58
Little Tennessee River at Judson, N. C.	675	3.23	5.69	7.90	3.78	6.27	7.67	3.54	2.61	2.03	1.57	1.21	2.77	4.02
Little Tennessee River at McGhee, Tenn.	2,470	3.09	5.14	5.59	3.09	4.94	4.98	3.65	2.90	1.63	1.45	1.03	1.76	3.27
Tuckasegee River at Bryson, N. C.	662	2.73	4.38	5.54	3.38	4.64	5.02	3.53	2.82	1.80	1.54	1.15	1.83	3.20
Hiwassee River at Murphy, N. C.	410	2.88	5.12	7.12	3.63	6.73	5.00	2.95	1.93	1.40	1.47	.96	1.81	3.41
Hiwassee River at Reliance, Tenn.	1,180	2.58	5.44	5.92	3.10	5.48	4.90	3.03	1.81	1.24	1.35	.88	1.75	3.12
Valley River at Tomotla, N. C.	106	3.08	8.51	8.03	3.24	5.21	4.94	3.16	1.73	2.09	1.25	.81	2.08	3.68
Ocoee River at Copperhill, Tenn.	374	2.33	4.41	5.83	3.61	4.12	4.09	2.66	1.81	1.44	1.43	1.05	1.67	2.87

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