DEPARTMENT OF THE INTERIOR

WATER-SUPPLY

AND

IRRIGATION PAPERS

OF THE

UNITED STATES GEOLOGICAL SURVEY

No. 49

OPERATIONS AT RIVER STATIONS, 1900.—PART III

WASHINGTON
GOVERNMENT PRINTING OFFICE
1901

IRRIGATION REPORTS.

The following list contains titles and brief descriptions of the principal reports relating to water supply and irrigation, prepared by the United States Geological Survey since 1890:

1890.

First Annual Report of the United States Irrigation Survey, 1890; octavo, 123 pp.

Printed as Part II, Irrigation, of the Tenth Annual Report of the United States Geological Survey, 1888–89. Contains a statement of the origin of the Irrigation Survey, a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation, and report of work done during 1890.

1891.

Second Annual Report of the United States Irrigation Survey, 1891; octavo, 395 pp.

Published as Part II, Irrigation, of the Eleventh Annual Report of the United States Geological Survey, 1889–90. Contains a description of the hydrography of the arid region and of the engineering operations carried on by the Irrigation Survey during 1890; also the statement of the Director of the Survey to the House Committee on Irrigation, and other papers, including a bibliography of irrigation literature. Illustrated by 29 plates and 4 figures.

Third Annual Report of the United States Irrigation Survey, 1891; octavo, 576 pp.

Printed as Part II of the Twelfth Annual Report of the United States Geological Survey, 1890–91. Contains "Report upon the location and survey of reservoir sites during the fiscal year ended June 30, 1891," by A. H. Thompson; "Hydrography of the arid regions," by F. H. Newell; "Irrigation in India," by Herbert M. Wilson. Illustrated by 93 plates and 190 figures.

Bulletins of the Eleventh Census of the United States upon irrigation, prepared by F. H. Newell: quarto.

No. 35, Irrigation in Arizona; No. 60, Irrigation in New Mexico; No. 85, Irrigation in Utah; No. 107, Irrigation in Wyoming; No. 153, Irrigation in Montana; No. 157, Irrigation in Idaho; No. 163, Irrigation in Nevada; No. 178, Irrigation in Oregon; No. 193, Artesian wells for irrigation; No. 198, Irrigation in Washington.

1892.

Irrigation of western United States, by F. H. Newell; extra census bulletin No. 23, September 9, 1892; quarto, 22 pp.

Contains tabulations showing the total number, average size, etc., of irrigated holdings, the total area and average size of irrigated farms in the subhumid regions, the percentage of number of farms irrigated, character of crops, value of irrigated lands, the average cost of irrigation, the investment and profits, together with a résumé of the water supply and a description of irrigation by artesian wells. Illustrated by colored maps showing the location and relative extent of the irrigated areas.

1893.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, Part III, Irrigation, 1893; octavo, 486 pp.

Consists of three papers: "Water supply for irrigation," by F. H. Newell; "American irrigation engineering" and "Engineering results of the Irrigation Survey," by Herbert M. Wilson; "Construction of topographic maps and selection and survey of reservoir sites," by A. H. Thompson. Illustrated by 77 plates and 119 figures.

A geological reconnoissance in central Washington, by Israel Cook Russell, 1893; octavo, 108 pp., 15 plates. Bulletin No. 108 of the United States Geological Survey; price, 15 cents.

Contains a description of the examination of the geologic structure in and adjacent to the drainage basin of Yakima River and the great plains of the Columbia to the east of this area, with special reference to the occurrence of artesian waters.

1894.

Report on agriculture by irrigation in the western part of the United States at the Eleventh Census, 1890, by F. H. Newell, 1894; quarto, 283 pp.

Consists of a general description of the condition of irrigation in the United States, the area irrigated, cost of works, their value and profits; also describes the water supply, the value of water, of artesian wells, reservoirs, and other details; then takes up each State and Territory in order, giving a general description of the condition of agriculture by irrigation, and discusses the physical conditions and local peculiarities in each county.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, in two parts; Part II, Accompanying papers, 1894; octavo, 597 pp.

Contains papers on "Potable waters of the eastern United States," by W J McGee; "Natural mineral waters of the United States," by A. C. Peale; "Results of stream measurements," by F. H. Newell. Illustrated by maps and diagrams.

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UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

OPERATIONS AT RIVER STATIONS, 1900

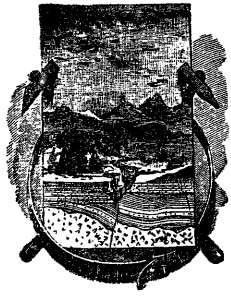
A REPORT OF THE

DIVISION OF HYDROGRAPHY

OF THE

UNITED STATES GEOLOGICAL SURVEY

PART III



WASHINGTON

GOVERNMENT PRINTING OFFICE

1901

CONTENTS.

OPERATIONS AT RIVER STATIONS, 1900.

PART III.

MEASUREMENTS AT RIVER STATIONS.[1]

MISCELLANEOUS MEASUREMENTS OF STREAMS IN SOUTHERN APPALACHIAN REGION.

A hydrographic investigation of the southern Appalachian region was made during the field season of 1900. A detailed report of the work will appear in a later publication. During the progress of the investigation a large number of measurements were made of various streams, as shown in the following tables. The tables are arranged in geographic order, commencing with the more northerly streams, which drain into the Atlantic Ocean, and ending with those which belong to the Gulf drainage.

Miscellaneous discharge measurements of Yadkin River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
June 21	Yadkin River	Wilkesboro, N. C.	N. C. Curtis	26.73	780.0
June 23	do	do	do	26.14	1,737.0
July 4	do	do	do	26.83	663.0
July 12	do	do	do	27.05	488.2
Aug. 6	do	do	do	27.20	386.0
Oct. 1	do	do	do	27.20	369.1
Nov. 4	do	do	do	26.22	1,331.0
June 20	do	Second ford below Patterson's mill, North Carolina.	do	13.3	182.0
July 14	do	do	do	13.5	100.3
Aug. 7	do	do	do	13.4	76.2
Sept. 26	do	do	do	13.53	43.0
June 20	Elk Creek	One-fourth mile above ford, N. C.	do	2.4	119.0
July 13	do	do	do	2.43	61.0
Aug. 6	do	do	do	2.60	37.0
Sept. 26	do	do	do	2.61	30.0
June 21	Stony Creek	Footbridge at Colberts, North Carolina.	do	2.65	78.4
July 13	do	do	do	2.70	80.5
Aug. 6	do	do	do		50.0
Sept. 26	do	do	do	2.87	31.10
June 21	Louis Fork of Yadkin River.	Footbridge on Mount Pleasant road, North Carolina.	do	3.10	127.0
July 13	do	do	do	3.23	99.0
Aug. 6	do	do	do	3.30	69.0
Sept. 26	do	do	do	3.33	63.0

[1] Continued from Water-Supply Paper No. 48.

Miscellaneous discharge measurements of Yadkin River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
June 23	Reddie River	North Wilkesboro, N. C	N. C. Curtis	24.73	218.1
July 12	do	do	do	25.15	98.1
Aug. 4	do	do	do		93.0
Oct. 1	do	do	do	25.25	60.2
June 23	Mulberry River	Trestle of Greensboro and Wilkesboro division of Southern R. R., North Carolina.	do	21.93	108.4
July 3	do	do	do	22.25	50.3
Aug. 4	do	do	do	22.50	39.25
Sept. 27	do	do	do	22.42	61.2
Nov. 2	do	do	do		55.0
June 25	Roaring River	Greensboro and Wilkesboro R. R. bridge, North Carolina.	do	23.68	520.2
July 9	do	do	do	25.45	161.4
Aug. 4	do	do	do	25.75	117.0
Sept. 27	do	do	do	25.13	109.0
Nov. 2	do	do	do	24.27	197.0
Sept. 27	Big Bugaboo Creek	Ford of road from Roaring River to Elkin, N. C.	do	1.28	30.0
June 25	Big Elkin River	Greensboro and Wilkesboro R. R. bridge, North Carolina.	do	24.53	65.0
July 9	do	do	do	25.95	29.0
Aug. 4	do	do	do		24.0
Sept. 27	do	do	do	26.22	27.0
June 26	Mitchell River	do	do	21.63	393.1
July 10	do	do	do	24.00	139.2
Aug. 3	do	do	do	24.25	119.0
Sept. 28	do	do	do	24.25	160.0
Nov. 1	do	do	do	23.89	216.0
June 26	Fisher River	Greensboro and Wilkesboro R. R. trestle, North Carolina.	do	20.93	549.0
July 10	do	do	do	23.38	172.0
Aug. 3	do	do	do	23.60	126.0
Sept. 28	do	do	do	23.72	119.0
Nov. 1	do	do	do	23.70	235.0
June 27	Ararat River	do	do	23.9	801.0
July 11	do	do	do	26.0	317.1
Aug. 2	do	do	do	26.25	265.44
Sept. 29	do	do	do	26.46	243.0
Oct. 31	do	do	do	25.66	307.0

Miscellaneous discharge measurements of Catawba River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
June 28	Catawba River	Oldfort, N. C	H. A. Pressey	10.10	53.0
Aug. 20	do	do	N. C. Curtis	12.70	11.0
Sept. 20	do	do	do	12.78	12.0
June 28	Mill Creek	do	H. A. Pressey	3.85	85.0
Aug. 20	do	do	N. C. Curtis	6.73	27.0
Sept. 20	do	do	do		13.0
June 28	Jarrett Creek	Near Oldfort, N. C	H. A. Pressey		17.0
Do	Curtis Creek	Two hundred feet above ford of Oldfort road, North Carolina.	do		82.11
Aug. 20	do	do	N. C. Curtis		16.50
June 28	Crib Creek	Near ford of main road, North Carolina.	H. A. Pressey	4.9	28.03
Aug. 28	do	do	N. C. Curtis		10.0
June 28	Clear Creek	Two hundred feet above ford of main road, North Carolina.	H. A. Pressey		25.25
Aug. 28	do	do	N. C. Curtis		12.0
June 14	Buck Creek	One-eighth mile above mouth at main ford, North Carolina.	H. A. Pressey		51.91
Aug. 20	do	do	N. C. Curtis	5.35	41.4
July 3	North Fork of Catawba River.	First ford above mouth, North Carolina.	H. A. Pressey		240.2
Aug. 18	do	do	N. C. Curtis		67.3
Sept. 21	do	do	do	3.18	61.69

Miscellaneous discharge measurements of Catawba River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
June 15	Turkey Cove Creek.	Just above second ford, North Carolina.	L. V. Branch	5.75	21.48
June 26	do	do	do	5.30	164.8
June 14	Muddy Creek	Bridgewater, N. C	H. A. Pressey	5.80	161.9
June 16	do	do	L. V. Branch	4.1	618.0
July 10	do	do	do	6.0	119.2
Aug. 17	do	do	N. C. Curtis	6.43	98.6
Sept. 21	do	do	do	6.34	101.7
June 14	Paddy Creek	Near Bridgewater, N. C	H. A. Pressey	11.8	19.78
June 16	do	do	L. V. Branch	5.4	203.67
July 10	do	do	do	11.55	11.5
Aug. 17	do	do	N. C. Curtis	12.35	7.0
June 21	Linville River	Linville, N. C	H. A. Pressey	14.83	21.0
June 24	do	do	do	14.23	90.22
June 14	Cane Creek	Lowest ford of main Morganton road, North Carolina.	do	5.72	18.58
June 18	do	do	L. V. Branch	5.85	28.45
Aug. 17	do	do	N. C. Curtis	6.3	7.2
June 14	Silver Creek	Near Morganton, N. C	L. V. Branch	6.84	124.0
Aug. 10	do	do	N. C. Curtis	8.30	48.4
Sept. 24	do	do	do	8.20	56.0
June 13	Upper Creek	One-fourth mile above mouth, North Carolina.	E. W. Myers	2.2	182.4
July 6	do	do	L. V. Branch	2.3	50.0
Aug. 8	do	do	N. C. Curtis		85.05
Sept. 24	do	do	do		60.0
June 20	do	Ford at Henderson's mill, North Carolina.	H. A. Pressey	12.9	20.42
Do	do	Upper Creek Falls, North Carolina.	do		27.0
Do	Steel Creek	Footbridge 100 yards above mouth, North Carolina.	do	3.20	100.21
Sept. 25	Johns River	Collettsville, N. C	N. C. Curtis	4.77	40.0
Nov. 6	do	do	do	4.47	133.0
Sept. 25	Mulberry Creek	At mouth, North Carolina	do	7.85	17.0
Nov. 6	do	do	do	7.95	39.0
Do	Wilson Creek	do	do	0.75	208.0
June 13	Lower Creek	Two miles above mouth, North Carolina.	E. W. Myers	14.58	209.0
July 6	do	do	L. V. Branch		132.0
Aug. 8	do	do	N. C. Curtis		69.0
Sept. 24	do	do	do	15.38	56.0

Miscellaneous discharge measurements of Broad River (of the Carolinas) and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Aug. 28	Broad River	Ford 1 mile above mouth of Second Broad River, North Carolina.	H. A. Pressey	5.95	649.0
Aug. 25	do	McClure's bridge, North Carolina.	N. C. Curtis	23.43	220.0
Oct. 18	do	do	do	22.67	434.0
Aug. 22	do	Near mouth of Buffalo Creek, North Carolina.	do	15.2	57.1
Oct. 6	do	do	do	14.59	145.4
Aug. 21	do	Bridge at Batcave post-office, N. C.	do		50.1
Do	do	do	do	10.15	48.0
Oct. 6	do	do	do	10.45	62.4
Aug. 21	Hickory Nut Creek	At mouth, North Carolina	do	4.80	15.2
Do	Reedy Patch Creek	do	do	5.75	13.0
Aug. 22	Buffalo Creek	Fifteen yards below main ford, North Carolina.	do	4.10	17.0
Do	Cove Creek	Bridge at Rutherfordton road, North Carolina.	do	18.65	69.3
Oct. 6	do	do	do	18.16	86.0
Aug. 25	Mountain Creek	Near mouth, North Carolina	do	6.83	55.3
Oct. 8	do	do	do	6.48	70.2
Aug. 25	Maple Creek	do	do	7.70	8.4

Miscellaneous discharge measurements of Broad River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Aug. 25	Green River	Cox's bridge, North Carolina	N. C. Curtis	22.9	299.0
Oct. 8	do	do	do	22.6	255.4
Sept. 3	do	Near Saluda, on Howard Gap road, North Carolina.	do	17.7	74.1
Do	Cove Creek	Near mouth, North Carolina	do	5.40	19.2
Aug. 31	White Oak Creek	One-half mile above mouth, North Carolina.	do	4.65	64.0
Aug. 23	Second Broad River	One and one-half miles east of Forest City, N. C.	do	20.8	153.3
Oct. 5	do	do	do	20.32	188.3
Aug. 24	do	Bridge on Rutherfordton-Morganton road, North Carolina.	do	7.35	55.0
Oct. 4	do	do	do	7.00	64.0
Aug. 24	Cane Creek	One mile above mouth, North Carolina.	do	5.43	17.0
Aug. 23	Cathey Creek	At mouth, North Carolina	do	3.35	42.0
Do	Hollins Creek	do	do	5.8	14.3
Aug. 24	Robersons Creek	do	do		24.0
Aug. 23	Puzzle Creek	Near mouth, North Carolina	do	6.70	10.0
Aug. 30	First Broad River	do	do	17.7	285.3
Oct. 10	do	do	do	16.2	266.4

Miscellaneous discharge measurements of South Saluda Creek and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Sept. 7	South Saluda Creek	Freeman Bridge, below mouth of Middle Saluda Creek, North Carolina.	N. C. Curtis	14.1	223.0
Oct. 14	do	do	do	14.1	171.0
Sept. 7	do	Two miles above mouth of Middle Saluda Creek, North Carolina.	do	6.0	188.0
Oct. 14	do	do	do	6.0	134.0
Sept. 7	Middle Saluda Creek	One mile above mouth, North Carolina.	do	11.75	68.0
Oct. 13	do	do	do		55.0
Sept. 7	North Saluda Creek	Iron bridge at Marietta, N. C.	do	14.7	58.2
Oct. 13	do	do	do	14.17	80.0
Sept. 6	do	Bridge on Lima-Cleveland Mills road, North Carolina.	do	12.9	56.1
Do	do	Two miles below Humphrey's store, North Carolina.	do	14.2	26.1
Do	Fall Creek	Bridge on road to Lima, N. C.	do		a15.0

a Estimated.

Miscellaneous discharge measurements of Tugaloo River tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Dec. 21	South Prong of Panther Creek.	Near Turnerville, Ga	J. C. Conn	8.8
Do	Panther Creek	do	do	33.5
Do	Tiger Creek	Nine miles north of Tallulah Falls, Ga.	do	18.2
Dec. 22	do	Six miles south of Clayton, Ga	do	11.8
Do	Scott Creek	Clayton, Ga	do	9.0
Do	Timpson Creek	Five miles from Clayton, Ga	do	12.2
Dec. 23	Tallulah River	Burton, Ga	do	263.1
Dec. 24	Stekoa Creek	One mile east of Clayton, Ga	do	9.9
Do	Chattooga River	Rogers Ford, Georgia	do	273.5

Miscellaneous discharge measurements of Broad River (of Georgia) and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Dec. 19	Grove Creek	Maysville, Ga	J. C. Conn	29.4
Do.	Hickory Level Creek	do	do	20.3
Dec. 20	Little Hudson Creek	Homer, Ga	do	147.3
Do.	Little Nails Creek	do	do	9.1
Dec. 26	North Broad River	Three and one-half miles south of Toccoa, Ga.	do	7.8
Do.	Davis Creek	Four miles south of Toccoa, Ga	do	2.3
Do.	Leatherwood Creek.	Eight and one-half miles south of Toccoa, Ga.	do	8.3
Do.	Little Leatherwood Creek.	Ten miles south of Toccoa, Ga	do	6.5
Do.	Middle Broad River.	Ten miles northeast of Homer, Ga	do	96.6
Do.	Little Hudson River	One mile north of Homer, Ga	do	82.0
Dec. 27	Hickory Level Creek	Three miles south of Maysville, Ga	do	26.5
Do.	Grove Creek	Two and one-half miles northeast of Maysville, Ga.	do	28.5

Miscellaneous discharge measurements of Savannah River tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
June 30	Hollow Creek	Kathwood, S. C	B. M. Hall		123.0
May 2	South Broad River	Near Carlton, Ga	Max Hall	3.20	200.0
Oct. 18	Broad River	Baker's ferry, about 25 miles below Carlton, Ga.	do	2.20	949.0

Miscellaneous discharge measurements of Oconee River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Aug. 27	Oconee River	Carey, Ga	W. E. Hall	2.37	1,199.0
Dec. 27	do	do	Max Hall	3.00	1,566.0
Dec. 28	do	Milledgeville, Ga	do	3.44	2,349.0
Dec. 18	Appalachee River	Dacula, Ga	J. C. Conn		11.4
Dec. 19	Cedar Creek	Hoschton, Ga	do		27.3
Do.	Walnut River	Pendergrass, Ga	do		66.8
Do.	Middle Oconee River	do	do		70.3
Do.	Hurricane Creek	Dry Pond, Ga	do		6.5
Do.	North Oconee River.	do	do		72.8
Dec. 27	do	do	do		103.8
Do.	Hurricane Creek	do	do		3.2
Do.	Middle Oconee River	Pendergrass, Ga	do		61.4

Miscellaneous discharge measurements of Ocmulgee River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Oct. 10	Yellow River	Near Stone Mountain, Ga	Max Hall	112.0
Dec. 18	Stone Mountain Creek.	Stone Mountain, Ga	J. C. Conn	18.1
Do.	Haynes Creek	Snellville, Ga	do	2.0
Do.	Big Creek	Tripp, Ga	do	3.9
Do.	Shoal Creek	Bramlett Shoals, Georgia	do	9.3
Do.	Alcovy River	do	do	33.7
Dec. 28	do	do	do	34.5
Do.	Shoal Creek	do	do	8.5
Do.	Yellow River	Annistown, Ga	do	151.7

Miscellaneous discharge measurements of Chattahoochee River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Aug. 20	Cane Creek	Near Dahlonega, Ga	W. E. Hall and H. G. Stokes.	28.6
Do.	Yahoola Creek	do	do	66.0
Do.	Chestatee River	do	do	287.0
Do.	Singleton ditch	do	do	1.8
Do.	Yahoola ditch	do	do	30.4
Do.	Yahoola Creek	Five miles above Dahlonega, Ga	do	22.7
Do.	Cane Creek	Five miles north of Dahlonega, Ga	do	13.3
Do.	Wards Creek	At mouth, Georgia	do	5.0
Aug. 21	Charles Creek	Near Louisville, Ga	do	9.0
Do.	Tates Creek	One mile above mouth, Georgia	do	8.0
Do.	Mill Creek	Near mouth, Georgia	do	5.0
Do.	Turner Creek	do	do	20.0
Do.	Shoal Creek	Above mining ditch, Georgia	do	23.0
Do.	Chestatee River	Below Turner Creek, Georgia	do	69.0
Aug. 22	Town Creek	Six miles above mouth, Georgia	do	23.0
Do.	do	Two miles above mouth, Georgia	do	57.0
Do.	Loud ditch	Near Henesey, Ga	do	7.3
Do.	Jennies Creek	Near Pleasant Retreat, Ga	do	21.7
Do.	E. Tessantee Creek	At mouth, Georgia	do	70.2
Do.	Tessantee River	Near Pleasant Retreat, Ga	do	142.0
Do.	Shoal Creek	Near mouth, Georgia	do	9.7
Aug. 23	Dukes Creek	Two miles above mouth, Georgia	do	55.0
Do.	Chattahoochee River	Nacoochee, Ga	do	80.5
Do.	Santee Creek	At mouth, Georgia	do	69.0
Do.	Soque River	Porter Mills, Georgia	do	212.0
Do.	Flat Shoals Creek	Johnson's mill, near West Point, Ga.	Max Hall	113.0
Aug. 24	Little River Creek	Near Land, Georgia	W. E. Hall and H. G. Stokes.	12.3
Dec. 21	Glades Creek	Five miles northeast of Demorest, Ga.	J. C. Conn	62.9
Do.	Hazel Creek	Demorest, Ga	do	92.7

Miscellaneous discharge measurements of Etowah River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Aug. 14	Little River	Arnold's mill, Georgia	W. E. Hall and H. G. Stokes.	56.3
Do.	Smithwick Creek	Between Arnold's mill, Georgia, and Creighton, Ga.	do	8.0
Do.	Buzzard Flopper Creek.	do	do	8.0
Do.	Board Tree Creek	do	do	8.0
Do.	Sittingdown Creek	Creighton, Ga	do	54.4
Aug. 15	Etowah River	Near Hightower, Ga	do	664.0
Do.	Cogburns Creek	do	do	12.0
Do.	Yellow Creek	Near mouth, Georgia	do	45.7
Do.	Amicalola River	About 3 miles above mouth, Georgia	do	241.0
Aug. 16	Spriggs Creek	One mile below Summerour place, Georgia.	do	21.3
Do.	Little Amicalola Creek.	Below Amicalola Falls, Georgia	do	4.3
Do.	Big Amicalola Creek	Near Afton post-office, Ga	do	83.0
Aug. 17	Spriggs Creek	Near Juno post-office, Ga	do	27.7
Do.	Carder Creek	Near mouth, Georgia	do	16.2
Do.	Parks Creek	do	do	16.0
Do.	Pigeon Creek	Near Dawsonville, Ga	do	7.6
Do.	Shoal Creek	do	do	34.6
Do.	Etowah River	Near Auraria, Ga	do	257.0
Do.	West Amicalola Creek.	Langston Ford, Georgia	B. M. Hall	15.9
Do.	Crane Creek	Below Amicalola Falls, Georgia	do	6.5
Aug. 18	Carder Creek	Near Emma, Ga	do	9.0
Do.	Spriggs Creek	At Spriggs Ford, Georgia	do	14.0
Do.	Parks Creek	Near Parks place, Georgia	do	7.3
Do.	Mill Creek	Near mouth, Georgia	W. E. Hall and H. G. Stokes.	34.0
Do.	Nimblewill Creek	One mile above mouth, Georgia	do	40.6
Do.	Etowah River	Below mouth of Nimblewill Creek, Georgia.	do	132.0
Aug. 21	Montgomery Creek	Near Randa, Ga	do	10.4
Sept. 25	Etowah River	Near Cartersville, Ga	Max Hall	a1,235.0
Do.	Petits Creek	do	do	16.0
Do.	Pumpkin Vine Creek	do	do	60.5
Nov. 15	Town Creek	Alice, Ga	O. P. Hall	6.7

a Gage height, 2 feet.

Miscellaneous discharge measurements of Coosawattee River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Aug. 13	Sugar Creek	Near Ramsey, Ga	O. P. Hall	4.0
Aug. 17	Clontz Creek	Southern's ford, Georgia	B. M. Hall	17.8
Oct. 18	Talking Rock Creek	Near Carters, Ga	O. P. Hall	91.0
Do.	Harris Creek	Goble, Ga	do	3.4
Do.	Worley Creek	At mouth, Georgia	do	6.5
Do.	Crawfords Creek	do	do	5.0
Oct. 19	Tails Creek	do	do	27.0
Do.	Flat Creek	do	do	19.0
Oct. 20	Cartecay River	Ellijay, Ga	do	165.0
Do.	Ellijay River	do	do	129.0
Do.	Cox Creek	do	do	2.2
Do.	Mill Creek	Near Ellijay, Ga	do	3.0
Do.	Clonegar Creek	Five miles above Ellijay, Ga	do	3.0
Do.	Clear Creek	One mile above mouth, Georgia	do	7.5
Do.	Turkey Creek	One mile above mouth of Clear Creek, Georgia.	do	12.9
Oct. 22	Lick Log Creek	Cartecay, Ga	do	16.3
Oct. 24	Anderson Creek	One mile above mouth, Georgia	do	70.0
Do.	Tickanetley River	One mile above mouth of Anderson Creek, Georgia.	do	101.0
Do.	Pumpkin Creek	Near Tickanetley, Ga	do	29.8
Do.	Downing Creek	One and one-half miles above forks, Georgia.	do	23.6
Do.	Rawlston Creek	Near mouth, Georgia	do	27.5
Do.	Branch of Cartecay River.	Entering Cartecay River, 9 miles above Ellijay, Ga.	do	4.6
Do.	Scrongetown Creek	Near mouth, 7 miles above Ellijay, Ga.	do	7.7
Oct. 25	Owltown Creek	At mouth, 3 miles above Ellijay, Ga.	do	15.0
Do.	Big Turniptown Creek.	Above mouth of Little Turniptown Creek, Georgia.	do	17.4
Do.	Little Turniptown Creek.	One mile above mouth, Georgia	do	1.9
Do.	White Path Creek	At railroad crossing, Georgia	do	5.3
Do.	Branch of Briar Creek.	Whitepath, Ga	do	.8
Do.	Briar Creek	One and one-half miles north of Whitepath, Ga.	do	3.0
Do.	Rock Creek	One mile above mouth, Georgia	do	32.5
Do.	Cherry Log Creek	Near mouth, Georgia	do	21.9
Oct. 26	Boardtown Creek	do	do	28.1
Do.	Parks Creek	At Boardtown road, Georgia	do	2.4
Do.	Branch of Kells Creek.	Near mouth, Georgia	do	1.5
Do.	Kells Creek	Above mouth, Georgia	do	10.6
Do.	Branch of Ellijay River.	Near mouth, Georgia	do	3.0
Do.	Ellijay River	At bridge 1¼ miles above Ellijay, Ga	do	175.7
Oct. 27	Cartecay River	At railroad bridge at Ellijay, Ga	do	263.2
Do.	Mountaintown Creek.	Above fork at Ratcliff, Ga	do	37.3
Do.	Middle Prong of Mountaintown Creek.	Near mouth, Georgia	do	17.9
Do.	West Prong of Mountaintown Creek.	Above mouth of Middle Prong, Georgia.	do	23.2

Miscellaneous discharge measurements of Conasauga River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
May 15	Conasauga River	Near Resaca, Ga	O. P. Hall	420.0
Aug. 13	Rock Creek	Ramsey, Ga	do	7.4
Sept. 7	do	do	do	4.2
Aug. 13	Holly Creek	Near Fort Mountain, Georgia	do	13.8
Sept. 6	do	do	do	13.5
Aug. 13	Mill Creek	Dunn, Ga	do	3.0
Aug. 14	Sumach Creek	North Prong at Long Bridge, Georgia	do	3.2
Do.	do	South Prong at Long Bridge, Georgia	do	3.6
Sept. 6	do	do	do	4.1
Do.	do	North Prong at Long Bridge, Georgia	do	3.4
Aug. 14	Conasauga River	Alaculsy, Ga	do	16.2
Sept. 6	do	do	do	10.7
Aug. 14	Jacks River	Near Alaculsy, Ga	do	30.6
Sept. 5	do	do	do	24.8
Aug. 15	Sheets Creek	do	do	2.0

Miscellaneous discharge measurements of Coosa River tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Aug. 15	Talladega Creek	Kymulga, Ala	J. R. Hall	107.0
Aug. 16	Tallesschatchee Creek	Childersburg, Ala	do	102.0
Aug. 17	Hatchett Creek	Goodwater, Ala	do	84.0

Miscellaneous discharge measurements of Tallapoosa River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec. ft.*
Apr. 7	Tallapoosa River	Muscadine, Ala	J. C. Conn	475.0
Aug. 2	Longahatchee Creek	Meader's bridge, Alabama	J. R. Hall	125.0
Aug. 3	Blue Creek	Susanna, Ala	do	34.0
Aug. 28	Elkhatchee Creek	Island Home, Ala	do	40.0
Aug. 30	Timber Cut Creek	Welche's ferry, Alabama	do	18.6
Nov. 1	Tallapoosa Creek	Cherokee Bluff, Alabama	do	3,650.0
Dec. 12	Chattasafkee Creek	Dadeville, Ala	do	35.0
Do	Sandy Creek	Near Dadeville, Ala	do	145.0

Miscellaneous discharge measurements of New River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
July 18	South Fork of New River.	Riverside, N. C	N. C. Curtis	11.85	165.0
Oct. 25	do	do	do	11.00	741.1
July 23	Flannery Fork	Ford of Boone-Blowing Rock road, North Carolina.	do	6.35	10.4
Oct. 24	do	do	do	5.35	107.0
July 23	Middle Fork	Ford of Boone-Aho road, North Carolina.	do	5.70	24.4
Oct. 24	do	do	do		234.0
July 23	East Fork	do	do	5.70	10.4
Oct. 24	do	do	do	5.10	109.0
July 18	Meat Camp Creek	One-fourth mile below Moretz, N. C.	do	9.00	35.3
Oct. 25	do	do	do	8.65	89.0
July 24	Elk Creek	Elk crossroads, North Carolina.	do	8.00	10.0
July 18	Old Field Creek	do	do	6.1	19.4
July 24	Gap Creek	One-eighth mile above mouth, North Carolina.	do	4.85	23.4
July 19	Beaver Creek	At mouth, North Carolina	do	6.00	22.4
July 27	Mulberry Creek	Near mouth, North Carolina	do	5.1	109.0
Do	Prather Creek	One and one-half miles below Scottville, N. C.	do	8.6	25.0
July 21	North Fork of New River.	One mile below Creston, N. C.	do	6.7	49.3
Oct. 26	do	do	do	6.0	194.0
July 20	do	One-half mile from Creston, N. C., on road to Solitude, N. C.	do	2.65	32.2
Do	Three Top Creek	Creston, N. C	do	6.75	130.0
July 21	do	do	do	7.25	37.0
July 20	Big Laurel Creek	One hundred yards above mouth, North Carolina.	do	6.40	26.2
Oct. 26	do	do	do	6.30	80.4
July 20	Buffalo Creek	One-eighth mile above mouth, North Carolina.	do	5.43	44.0
Oct. 26	do	do	do		67.0
July 25	Horse Creek	One-fourth mile above mouth, North Carolina.	do	6.6	34.3
Oct. 27	do	do	do	6.05	140 0
July 25	Helton Creek	Below Peasley's mill, North Carolina.	do	4.28	30.0
Oct. 27	do	do	do		105.0
July 28	Wilson Creek	Two miles above mouth, Virginia.	do	6.3	35.1
Oct. 28	do	do	do	6.1	78.0

Miscellaneous discharge measurements of New River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
July 29	Fox Creek	One-fourth mile above mouth, Virginia.	N. C. Curtis		85.6
Oct. 28	do	do	do		144.0
July 31	Peach Bottom Creek	Two hundred yards above mouth, Virginia.	do	4.9	21.4
Oct. 29	do	do	do		36.0
July 31	Little River	Ford of Independence-Oldtown road, Virginia.	do	9.1	199.0
Oct. 29	do	do	do		318.2
July 30	Elk Creek	Two hundred yards above mouth, Virginia.	do	4.0	57.68

Miscellaneous discharge measurements of French Broad River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Sept. 7	French Broad River.	One half mile above Hot Springs, N. C.	L. V. Branch	19.35	938.0
Sept. 12	do	Alexander, N. C	E. W. Myers	17.15	840.0
Oct. 29	do	do	L. V. Branch	16.27	2,068.0
Sept. 18	do	Fanning Bridge, North Carolina.	N. C. Curtis	16.22	1,161.0
Oct. 17	do	do	do	16.95	614.0
Sept. 17	do	Penrose, N. C	do	19.8	1,160.0
Sept. 13	do	Near Carson Creek, N. C.	do	13.8	266.5
Oct. 15	do	do	do	13.9	206.5
Sept. 14	do	Eastatoe Bridge, North Carolina.	do	12.4	113.0
Oct. 15	do	do	do	11.21	102.4
Sept. 14	North Fork of French Broad River.	Two hundred yards above mouth of West Fork, North Carolina.	do		100.6
Oct. 15	do	do	do	13.2	51.8
Sept. 16	do	Bridge on Brevard-Webster road, North Carolina.	do	14.98	107.48
Do	do	Ford on road between Tucker and Shoal creeks, North Carolina.	do	7.3	75.0
Sept. 14	West Fork of French Broad River.	Near mouth, North Carolina	do	2.20	149.0
Oct. 15	do	do	do		62.0
Sept. 14	Middle Fork of French Broad, River.	Bridge 20 yards above ford, North Carolina.	do	5.35	77.0
Do	South Fork of French Broad River.	Footbridge at ford of main road, North Carolina.	do	10.3	71.0
Oct. 15	East Fork of French Broad River.	Near mouth, North Carolina	do	10.2	46.0
Sept. 16	Tucker Creek	Two hundred yards above mouth, North Carolina.	do	4.61	28.0
Sept. 13	Cathey Creek	Ford of Brevard-Jeptha road, North Carolina.	do	6.7	30.2
Sept. 17	King Creek	Brevard road, North Carolina.	do	4.71	15.46
Do	Davidson River	Near mouth, North Carolina	do	16.45	151.7
Oct. 16	do	do	do	16.75	70.20
Sept. 17	Little River	Three-fourths mile above mouth, North Carolina.	do	13.66	182.8
Oct. 16	do	do	do	14.35	69.2
Sept. 17	Boylston Creek	Near mouth, North Carolina	do	5.35	28.6
Do	Mills River	Bridge on Old Haywood road, North Carolina.	do	13.11	211.64
Oct. 17	do	do	do	13.4	94.0
Sept. 18	Mud Creek	Near mouth, North Carolina	do	5.11	108.0
Do	Caney Creek	Bridge on Westfall's place, North Carolina.	do	10.1	60.0
Do	Avery Creek	Bridge on road from Mills River to Asheville, N. C.	do	6.56	11.31
Sept. 19	Hominy Creek	Asheville, N. C	do	15.1	80.0
Oct. 17	do	do	do	15.4	24.0
Sept. 19	Swannanoa River	Biltmore, N. C	do	2.91	76.33

Miscellaneous discharge measurements of French Broad River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Sept. 20	North Fork of Swannanoa River.	Three miles above Swannanoa post-office, N. C.	N. C. Curtis	16.07	21.45
Do.	Flat Creek	Two miles below Black Mountain Station, N. C.	do	4.05	22.83
Sept. 12	Beaver Dam Creek	Fifty yards above mouth, North Carolina.	E. W. Myers	5.09	1.46
Oct. 30	do	do	L. V. Branch	5.08	4.10
Sept. 16	Lees Creek	Olivette, N. C	E. W. Myers	11.15	3.95
Oct. 30	do	do	L. V. Branch	10.95	2 29
Sept. 12	Newfound Creek	At mouth, North Carolina	E. W. Myers	17.75	9.41
Sept. 16	do	Three-fourths mile above mouth, North Carolina.	do	10.19	34.16
Oct. 30	do	do	L. V. Branch	10.44	20.23
Sept. 12	Reams Creek	At mouth, North Carolina	E. W. Myers	12.1	4.89
Oct. 30	do	do	L. V. Branch		9.0
Sept. 11	Flat Creek	do	E. W. Myers	18.05	5.33
Oct. 29	do	do	L. V. Branch	17.43	5.0
Sept. 12	Sandy Mush Creek	Bailey, N. C	E. W. Myers	9.73	21.72
Sept. 17	do	do	do	9.43	55.23
Oct. 30	do	do	L. V. Branch	9.53	45.0
Sept. 16	Turkey Creek	Blackwell Springs, N. C	E. W. Myers	7.97	35.24
Oct. 30	do	do	L. V. Branch	8.32	16.24
Sept. 17	Big Ivy River	One-eighth mile below mouth of Bull Creek, North Carolina.	E. W. Myers	2.55	47.59
Oct. 29	do	do	L. V. Branch	2.72	41.72
Sept. 8	Little Pine Creek	One hundred yards above mouth, North Carolina.	do	5.84	3.33
Oct. 31	do	do	do	5.76	6.0
Sept. 8	Pawpaw Creek	One mile above mouth, North Carolina.	do	4.6	0.35
Sept. 10	Walnut Creek	At mouth, North Carolina	do	23.24	1.36
Oct. 31	do	do	do	2.35	2.24
Sept. 8	Big Pine Creek	One hundred yards above mouth, North Carolina.	do	6.07	4.85
Oct. 31	do	do	do	6.01	4.45
Sept. 8	Laurel Creek	Two hundred yards above mouth, North Carolina.	do	16.13	49.0
Sept. 18	do	do	E. W. Myers	15.77	55.0
Sept. 7	Spring Creek	Near Hot Springs, N. C	L. V. Branch	2.00	15.0
Nov. 1	do	do	do	2.07	16.0
Sept. 7	Shutin Creek	do	do	2.61	0.45

Miscellaneous discharge measurements of Nolichucky River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec. ft.*
Aug. 23	Nolichucky River	Erwin, Tenn	L. V. Branch	20.67	770.0
Sept. 4	do	do	do	21.53	411.0
Aug. 24	Toe River	Near Huntdale, N. C	do	15.89	381.0
Oct. 17	do	do	do	16.12	301.0
July 2	North Toe River	Sprucepine, N. C	H. A. Pressey		323.0
Aug. 26	do	do	L. V. Branch	18.20	105.0
Oct. 21	do	do	do	18.37	78.0
Oct. 25	do	do	do	17.15	570.0
Aug. 27	do	Plumtree, N. C	do	7.55	79.0
Do.	do	At ford of Linville-Cranberry road, North Carolina.	do	3.6	18.0
Do.	Kentucky Fork of North Toe River.	At mouth, North Carolina	do	2.85	9.7
Do.	White Oak Creek	do	do	2.26	3.36
Aug. 28	Horse Creek	do	E. Graves	5.55	9.03
Oct. 24	do	do	L. V. Branch	5.15	40.53
Aug. 27	Squirrel Creek	One-fourth mile above mouth, North Carolina.	do	3.12	11.2
Do.	Roaring Creek	At mouth, North Carolina	do	7.89	15.57
Do.	Plum Tree Creek	Plumtree, N. C	do	2.99	8.09
Do.	Henson Creek	At mouth, North Carolina	do	6.94	4.8
Aug. 26	Threemile Creek	Near old post-office at Elsie, N. C.	do	5.38	2.63
Oct. 21	do	do	do	5.30	3.57
Aug. 26	Beaver Creek	Near Sprucepine, N. C	do	4.50	3.29
Oct. 21	do	do	do	4.29	3.08
Aug. 26	Grassy Creek	Sprucepine, N. C	do	5.21	6.09

Miscellaneous discharge measurements of Nolichucky River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Oct. 20	Grassy Creek	Sprucepine, N. C	L. V. Branch	5.13	9.15
Aug. 26	Bear Creek	Flatrock, N. C	do	3.76	4.67
Oct. 20	do	do	do	3.70	3.73
Aug. 25	Snow Creek	Wing, N. C	do	3.03	2.0
Do	Crabtree Creek	Ford of Burnsville-Sprucepine road, North Carolina.	do	7.97	15.2
Oct. 20	do	do	do	7.91	14.55
Aug. 25	Brush Creek	Lower ford of Burnsville-Sprucepine road, North Carolina.	do	1.39	4.37
Oct. 20	do	do	do	1.51	.72
Aug. 24	Cane Creek	One-half mile above mouth, North Carolina.	do	9.20	11.78
Oct. 19	do	do	do	9.26	9.92
Sept. 3	Pigeon Creek	At mouth, North Carolina	do	5.86	1.65
Oct. 19	do	do	do	5.85	1.26
Sept. 3	Jack Creek	do	do	6.09	8.71
Oct. 19	do	do	do	6.10	6.83
Aug. 24	Big Rock Creek	Ford of Huntdale-Bakersville road, North Carolina.	do	2.42	51.3
Oct. 19	do	do	do	2.64	24.5
Aug. 24	Pigeon Roost Creek	At mouth, North Carolina	do	7.39	14.5
Oct. 19	do	do	do	7.47	4.12
Aug. 23	Hollow Poplar Creek	Ford of Erwin-Bakersville road, North Carolina.	do	8.15	5.98
Oct. 16	do	do	do	8.26	2.61
Aug. 23	South Indian Creek	Near Erwin, Tenn	do	5.38	52.3
Sept. 4	do	do	do	5.49	33.2
Sept. 19	do	do	E. W. Myers	5.40	53.0
Aug. 23	Martin Creek	do	L. V. Branch	1.59	7.55
Sept. 4	do	do	do	1.68	6.45
Aug. 22	North Indian Creek	Erwin, Tenn	do	3.95	51.0
Sept. 4	do	do	do	4.19	22.0
Sept. 19	do	do	E. W. Myers	4.05	29.7
Oct. 16	do	do	L. V. Branch	4.18	26.13
Aug. 22	do	Unicoi, Tenn	do	4.58	37.9
Do	Rock Creek	One hundred yards above mouth, Tennessee.	do	3.69	6.37
July 1	South Toe River	Ford of Micaville-Sprucepine road, North Carolina.	H. A. Pressey	.....	220.8
Aug. 25	do	do	L. V. Branch	8.08	79.8
Aug. 30	do	do	do	7.98	86.23
Oct. 27	do	do	do	7.23	282.9
Aug. 31	do	One mile above mouth of Three Fork Creek, North Carolina.	do	4.34	26.0
Oct. 26	do	do	do	3.30	101.0
Aug. 31	Three Fork Creek	One-fourth mile above mouth, North Carolina.	do	1.49	9.49
Do	Rock Creek	Ford of Micaville-Marion road, North Carolina.	do	1.96	6.92
Oct. 26	do	do	do	1.62	28.68
Aug. 31	Middle Creek	do	do	3.94	3.78
Oct. 26	do	do	do	3.64	9.29
Aug. 31	Colbert Creek	do	do	3.87	2.51
Oct. 26	do	do	do	3.50	7.24
Aug. 30	Locust Creek	At mouth, North Carolina	do	1.98	3.83
Oct. 26	do	do	do	1.87	7.96
Aug. 30	Whiteoak Creek	do	do	4.66	4.40
Oct. 26	do	do	do	4.28	19.86
Aug. 30	Brown Creek	Ford of Micaville-Marion road, North Carolina.	do	3.02	4.94
Oct. 26	do	do	do	2.85	9.43
Aug. 30	Little Crabtree Creek.	Just above lower ford of Micaville-Sprucepine road, North Carolina.	do	4.28	17.54
Oct. 27	do	do	do	4.23	21.67
Aug. 30	Cane Branch	Ford of Micaville-Marion road, North Carolina.	do	3.92	2.93
Oct. 26	do	do	do	3.78	8.59
Aug. 24	Caney River	Huntdale, N. C	do	3.69	89.9
Sept. 3	do	do	do	3.82	62.77
Oct. 17	do	do	do	3.83	58.3
Sept. 1	do	Near Big Tom Wilson's, North Carolina.	do	1.33	17.11
Oct. 18	do	do	do	1.34	13.9
Sept. 1	Elk Fork Creek	do	do	1.24	4.78
Oct. 18	do	do	do	1.28	1.49
Sept. 1	Cattail Branch	Near Burnsville, N. C	do	2.78	2.77
Oct. 18	do	do	do	2.64	4.69

Miscellaneous discharge measurements of Nolichucky River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Sept. 1	Bowlen Creek	Near Burnsville, N. C.	L. V. Branch	5.03	3.45
Oct. 18	do	do	do	4.97	4.02
Sept. 2	Price Creek	do	do	2.48	9.46
Oct. 18	do	do	do	2.53	8.35
Sept. 2	Bald Creek	do	do	4.56	16.25
Oct. 18	do	do	do	4.56	9.97
Sept. 2	Elk Shoal Creek	At mouth, North Carolina	do	1.63	1.29
Do	Bald Mountain Creek.	One mile above mouth, North Carolina.	do	3.43	19.7
Oct. 17	do	do	do	3.55	10.6
Sept. 2	Little Bald Mountain Creek.	At mouth, North Carolina	do	4.91	2.12
Oct. 17	do	do	do	4.90	2.61
Sept. 2	Big Creek	do	do	2.83	5.67
Oct. 17	do	do	do	2.89	2.0

Miscellaneous discharge measurements of South Fork of Holston River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
July 23	South Fork of Holston River.	Below mouth of Middle Fork, Virginia.	L. V. Branch	3.06	228.0
Oct. 3	do	do	E. W. Myers	3.21	199.0
July 28	do	Below mouth of Laurel Fork, Virginia.	do	2.60	652.0
Oct. 3	do	do	do	3.39	149.0
July 28	do	Above mouth of Laurel Fork, Virginia.	do	1.51	101.0
Oct. 3	do	do	do	.....	48.0
July 27	do	Rye Valley, Virginia	do	6.96	20.0
Oct. 1	do	do	do	.....	5.0
July 27	Jim Scot Branch	At mouth, Virginia	do	.....	4.12
Oct. 1	do	do	do	.....	0.5
July 27	Pomer Creek	do	do	2.1	39.0
Oct. 1	do	do	do	2.29	5.0
July 27	Hogtrough Creek	Lower ford of main road, Virginia.	do	.87	9.0
Oct. 2	do	do	do	.....	1.0
July 27	St. Clair Creek	At mouth, Virginia	do	5.76	8.27
Oct. 2	do	do	do	5.94	2.0
July 27	Grose Creek	do	L. V. Branch	3.88	2.0
Oct. 2	do	do	.....	(a)	.....
July 27	Mill Creek	One mile above mouth, Virginia.	do	4.32	18.0
Oct. 2	do	do	E. W. Myers	4.43	13.03
July 28	Rush Creek	Ford 100 yards above mouth, Virginia.	L. V. Branch	3.63	4.20
Oct. 2	do	do	E. W. Myers	.....	2.0
July 28	Laurel Fork of Holston River.	One-half mile below Damascus, Va.	L. V. Branch	3.56	351.0
Oct. 3	do	do	E. W. Myers	4.61	88.14
July 29	do	Near Laurel bloomery, Tennessee.	do	5.12	61.0
Do	do	One-half mile above Laurel bloomery, Tennessee.	do	2.06	23.0
Do	Atcheson Creek	Near head of Laurel, Tenn	do	1.82	4.32
Do	White Top Creek	At mouth, Virginia	do	5.47	100.0
Oct. 2	do	do	do	5.72	34.3
July 28	Beaver Dam Creek	Damascus, Va	do	11.36	189.0
Oct. 3	do	do	do	12.26	32.4
July 23	Fifteenmile Creek	At mouth, Virginia	L. V. Branch	4.45	7.37
Sept. 27	do	do	E. W. Myers	4.23	10.46
July 21	Denton Valley Creek	do	L. V. Branch	5.73	6.0
Sept. 27	do	do	E. W. Myers	5.73	4.04
July 21	Wolf Creek	Lower ford of main road up the river, Virginia.	do	2.35	7.0
July 23	do	do	L. V. Branch	2.36	7.0
Sept. 27	do	do	E. W. Myers	2.21	12.24
July 21	Spring Creek	One mile above mouth, Virginia.	L. V. Branch	.90	13.0
Sept. 27	do	do	E. W. Myers	.....	10.0

a Almost dry.

Miscellaneous discharge measurements of South Fork of Holston River, etc.—Cont'd.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
July 21	Jacobs Creek	At mouth, Tennessee	L. V. Branch	9.1	2.07
Sept. 27	do	do	E. W. Myers		2.0
July 21	Sharp Creek	do	do	5.36	1.16
Sept. 26	do	do	do	5.33	1.19
July 20	Fishdam Creek	do	do	5.25	5.85
Sept. 26	do	do	L. V. Branch	5.26	2.47
July 20	Jonah Creek	do	do	11.06	4.0
Sept. 25	do	do	E. W. Myers	11.42	4.0
July 20	Riddle Creek	do	do	12.19	2.0
Sept. 25	do	do	do	11.13	3.0
Do	Thomas Creek	Below railroad bridge, Tennessee.	do		2.46
July 29	Sinking Creek	At mouth, Tennessee	do	4.92	11.0
Sept. 25	do	do	do	4.42	9.09
July 20	do	One-half mile above Paperville, Tenn.	L. V. Branch	3.6	3.48
Sept. 25	Hatcher Creek	One-half mile above mouth, Tennessee.	E. W. Myers	5.92	0.34
July 24	Middle Holston	Five miles above mouth, Virginia.	do	5.96	172.0
Sept. 28	do	do	do	6.21	100.0
July 25	Middle Fork of Holston River.	Sevenmile ford, Virginia	L. V. Branch	13.00	71.23
Do	do	Above mouth of Bear Creek, Virginia.	do	6.23	18.0
Oct. 1	do	do	do	7.69	11.0
July 25	Bear Creek	At mouth, Virginia	do	6.99	2.01
Oct. 1	do	do	E. W. Myers	6.90	3.0
July 25	Staleys Creek	Marion, Va	L. V. Branch	9.26	14.32
Do	Hungry Mother Creek.	Ford of main road from Marion, Va.	do	1.18	2.45
Oct. 1	do	do	E. W. Myers	1.17	2.36
July 25	Byars Creek	At mouth, Virginia	L. V. Branch	1.52	4.0
Sept. 29	do	do	E. W. Myers	1.58	2.24
July 25	Walker Creek	Fifty yards above mouth, Virginia.	do	4.90	3.0
Sept. 29	do	do	do	4.89	9.0
July 23	Huttons Branch	At mouth, Virginia	L. V. Branch	4.45	5.0
Sept. 29	do	do	E. W. Myers	4.43	5.0
Do	Halls Creek	do	do	1.73	17.36
Do	Cedar Creek	do	do		3.42
July 24	Hogthief Creek	One-half mile above mouth, Virginia.	L. V. Branch	5.0	5.0
Sept. 29	do	do	E. W. Myers		5.0

Miscellaneous discharge measurements of Watauga River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
July 16	Watauga River	Elizabethton, Tenn	E. W. Myers	15.87	450.0
Aug. 2	do	do	L. V. Branch	15.77	593.0
Aug. 16	do	do	do	16.03	403.0
Oct. 5	do	do	E. W. Myers	16.03	348.0
Nov. 7	do	do	L. V. Branch	15.27	993.0
Dec. 28	do	do	E. W. Myers	15.68	533.0
Dec. 31	do	do	Ernest Graves	15.22	973.0
July 16	do	Watauga Falls, N. C	N. C. Curtis		79.0
Aug. 10	do	do	L. V. Branch	6.62	53.0
Oct. 7	do	do	E. W. Myers	6.52	66.0
Aug. 11	do	One mile above Shull's mill, North Carolina.	L. V. Branch	4.05	19.0
Oct. 7	do	do	E. W. Myers	3.78	23.0
Aug. 10	Boone Fork of Watauga River.	Shull's mill, North Carolina	L. V. Branch	2.3	12.0
Oct. 7	do	do	E. W. Myers	2.11	13.0
Aug. 11	Moody Mill Creek	At mouth, North Carolina	L. V. Branch	3.2	4.0
Aug. 10	Laurel Creek (upper).	do	do	2.62	10.0
Oct. 7	do	do	E. W. Myers	2.87	6.0
Aug. 10	Dutch Creek	Valle Cruces, N. C	L. V. Branch	7.42	11.0
Oct. 7	do	do	E. W. Myers	7.37	6.0
Aug. 10	Cove Creek	At mouth, North Carolina	L. V. Branch	5.24	12.0
Oct. 7	do	do	E. W. Myers	5.15	14.0

Miscellaneous discharge measurements of Watauga River, etc.—Continued.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
Aug. 12	Cove Creek	Above mouth of Brushy Fork, North Carolina.	L. V. Branch	4.31	23.0
Do	Brushy Fork of Cove Creek.	At mouth, North Carolina	do	2.06	5.19
Do	Rockhouse Creek	do	do	2.17	16.3
Oct. 18	do	do	E. W. Myers		0.8
Aug. 10	Laurel Creek (lower)	do	L. V. Branch	10.62	4.0
Oct. 7	do	do	E. W. Myers		3.09
Aug. 9	Beaver Dam Creek	Near Leander, N. C	L. V. Branch	5.59	7.0
Oct. 6	do	do	E. W. Myers		8.0
Aug. 9	Beech Creek	Above mouth of Fogey Creek, North Carolina.	L. V. Branch	5.6	7.3
Oct. 6	do	do	E. W. Myers	5.7	7.4
Aug. 9	Fogey Creek	At mouth, North Carolina	L. V. Branch	2.94	1.4
Oct. 6	do	do	E. W. Myers	3.02	2.4
Aug. 9	Big Dry Run	One-eighth mile above mouth, North Carolina.	L. V. Branch	1.55	0.85
Aug. 6	Elk Creek	One-half mile below mouth of the Little Elk, Tennessee.	do	7.21	64.0
Aug. 11	South Fork of Elk Creek.	At Banners Elk, North Carolina.	do	11.96	9.38
Oct. 8	do	do	E. W. Myers	11.82	8.48
Aug. 12	North Fork of Elk Creek.	do	L. V. Branch	5.61	7.0
Oct. 8	do	do	E. W. Myers	5.64	4.0
Aug. 4	Cranberry Creek	Cranberry, N. C	L. V. Branch	6.95	5.09
Do	Blevins Creek	do	do	6.03	5.05
Aug. 6	Little Elk Creek	At mouth, North Carolina	do	1.2	6.0
Do	Dark Ridge Creek	One-half mile above mouth, Tennessee.	do	4.65	3.0
July 30	Roan Creek	Above mouth of Mill Creek, Tennessee.	E. W. Myers	5.7	60.3
Aug. 13	do	Key Station, Tenn	L. V. Branch	4.85	5.2
Do	Forge Creek	Near mouth, Tennessee	do	4.53	7.0
July 29	Town Creek	At Shoun crossroads, Tennessee.	do	3.48	29.2
Aug. 13	do	do	do	3.82	6.0
July 30	Mill Creek	At mouth, Tennessee	E. W. Myers	9.48	13.0
Do	Doe Creek	Mouth of Doe (town), Tenn	do	5.23	59.0
Aug. 13	do	do	L. V. Branch	5.49	26.2
Oct. 9	do	do	E. W. Myers	5.46	28.38
Aug. 13	do	Ivyspring post-office, Tennessee.	L. V. Branch	5.94	9.0
Aug. 3	Stony Creek	One-half mile above mouth, Tennessee.	do	6.95	44.0
Oct. 5	do	do	E. W. Myers	7.59	16.0
Dec. 31	do	do	Ernest Graves	4.60	48.0
Aug. 2	Doe River	Above Elizabethton, Tenn	L. V. Branch	5.94	143.4
Aug. 17	do	do	do	6.20	106.0
Oct. 5	do	do	E. W. Myers	6.23	82.0
Dec. 31	do	do	Ernest Graves	5.23	304.0
Aug. 3	do	Near Allentown, Tenn	L. V. Branch	5.56	72.0
Aug. 18	do	do	do	5.81	50.0
Oct. 5	do	do	E. W. Myers	5.85	39.3
Aug. 3	do	Two miles below Roan Mountain, Tennessee.	L. V. Branch	8.46	41.3
Do	Shell Creek	At mouth, Tennessee	do	2.35	14.0
Do	Wilson Creek	One mile above mouth, Tennessee.	do	3.67	5.0
Do	Little Doe River	Allentown, Tenn	do	4.42	35.0
Oct. 5	do	do	E. W. Myers	4.78	17.0
Dec. 29	do	do	do	4.30	28.3
Aug. 3	Laurel Fork of Doe River.	do	L. V. Branch	5.19	30.0
Aug. 17	do	do	do	5.50	15.0
Oct. 5	do	do	E. W. Myers	5.67	9.0
Dec. 29	do	do	do	5.05	27.0
Aug. 2	Gap Creek	At mouth, Tennessee	L. V. Branch	4.00	7.0
Oct. 4	do	do	E. W. Myers	4.12	3.0
Aug. 2	Buffalo Creek	do	L. V. Branch	5.85	20.0
Oct. 4	do	do	E. W. Myers	5.92	10.0
Aug. 2	Sinking Creek	Lower ford of Johnson City—Elizabethton road, Tennessee.	L. V. Branch	3.73	5.0
Oct. 4	do	do	E. W. Myers	3.75	4.0
July 19	Brush Creek	Near Carter, Tenn	L. V. Branch	6.77	10.03
Aug. 16	do	do	do	6.82	9.47
Sept. 24	do	do	E. W. Myers	6.94	5.14

Miscellaneous discharge measurements of tributaries of Tennessee River above Hiwassee River.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Aug. 20	Tellico River	Tellico Plains, Tenn	O. P. Hall	82.0
Do.	Cane Creek	Belltown, Tenn	do	2.0
Do.	Ball Play Creek	Tariffville, Tenn	do	2.2
Do.	Citico Creek	Lillian, Tenn	do	17.2
Sept. 1	do	do	do	15.8
Aug. 20	Mulberry Creek	Ipe, Tenn	do	5.5
Aug. 21	Little Tennessee River.	Chilhowee, Tenn	do	1,751.0
Sept. 1	do	do	do	2,115.0
Aug. 21	Abrams Creek	do	do	40.2
Aug. 31	do	do	do	35.2
Aug. 22	Hesse Creek	Millers, Tenn	do	4.8
Aug. 23	Big Spring Creek	Tuckaleechee Cove, Tenn	do	4.3
Do.	Near Prong of Little River.	do	do	29.5
Do.	Main Prong of Little River.	do	do	92.6
Aug. 30	do	do	do	112.5
Aug. 24	Walden Creek	Henderson Springs, Tenn	do	26.1
Aug. 30	do	do	do	6.2
Aug. 24	Little Cove Creek	do	do	2.5
Do.	West Fork of Little Pigeon River.	do	do	95.2
Aug. 25	do	Sevierville, Tenn	do	88.0
Aug. 29	do	do	do	51.5
Aug. 25	East Fork of Little Pigeon River.	do	do	178.4
Do.	Middle Creek	do	do	1.0
Do.	Bird Creek	Bird Creek, Tenn	do	3.0
Aug. 29	do	do	do	1.5
Aug. 25	Middle Fork of Little Pigeon River.	Richison, Tenn	do	126.8
Aug. 28	do	do	do	68.9
Aug. 27	East Fork of Little Pigeon River.	East Fork, Tenn	do	10.3
Aug. 28	do	do	do	9.1
Aug. 27	Cosby Creek	Cosby, Tenn	do	23.5
Aug. 28	do	Bison, Tenn	do	27.4
Aug. 27	Big Pigeon River	do	do	453.8

Miscellaneous discharge measurements of Hiwassee River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Gage height.	Discharge.
1900.				*Feet.*	*Sec.-ft.*
July 26	Choestoe Creek	Choestoe, Ga	W. E. Hall and H. G. Stokes.		17.3
Do.	Nottely River	do	do		46.8
July 27	Level Land Creek	do	do		29.5
Do.	Stink Creek	Caldwell, Ga.	do		22.8
Do.	Town Creek	do	do		55.6
Do.	Arququah Creek	do	do		18.8
Do.	Wolf Creek	do	do		20.0
July 28	Butternut Creek	Blairsville, Ga.	do		29.3
Do.	Coosa Creek	Coosa Creek, Georgia	do		99.6
Do.	Nottely River	Blairsville, Ga.	do	1.60	505.1
July 30	Young Cone Creek	Near mouth, Georgia	do		81.3
Do.	Ivy Log Creek	Ivy Log, Ga	do		32.7
Do.	Camp Creek	Camp Creek, Georgia	do		13.7
July 31	Nottely River	Thompson's bridge, Georgia	do	1.40	462.0
Do.	Moccasin Creek	Ivy Log, Ga	do		12.8
Do.	Rapier Creek	Ranger, N. C	do		22.0
Do.	Nottely River	do	do	1.40	500.4
Aug. 1	Brasstown Creek	Brasstown, Ga.	do		94.4
Aug. 2	Long Bullet Creek	Twine, N. C	do		11.9
Do.	Hog Creek	Hiwassee, Ga.	do		15.0
Do.	Bell Creek	do	do		20.6
Do.	Hiwassee River	do	do		337.8
Aug. 3	Scataway Creek	Visage, Ga.	do		3.2
Do.	Hightower Creek	Osborn, Ga	do		73.0
Do.	Fodder Creek	Hiwassee, Ga	do		19.0
Do.	Owl Creek	do	do		12.3
Do.	Mill Creek	do	do		22.3
Aug. 4	Centers Creek	Mountain Scene, Ga	do		23.9
Do.	High Shoals Creek	do	do		18.5

Miscellaneous discharge measurements of Hiwassee River, etc.—Continued.

Date.	Stream	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
Aug. 17	Lost Creek	Near Reliance, Tenn	O. P. Hall	7.7
Sept. 4	do	do	do	6.5
Aug. 17	Ellis Creek	do	do	2.0
Do	Spring Creek	At mouth, Tennessee	do	6.8
Sept. 4	do	do	do	4.3
Aug. 18	Childers Creek	Near Reliance, Tenn	do	6.8
Do	Spring Creek	Springtown, Tenn	do	4.0
Do	Conasauga Creek	Mecca, Tenn	do	25.0
Sept. 3	do	Near Jalapa, Tenn	do	20.2

Miscellaneous discharge measurements of Toccoa (Okoee)[a] River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
		GEORGIA.		
1900.				*Sec.-ft.*
July 19	Weavers Creek	Near Blueridge	W. E. Hall and H. G. Stokes.	10.0
Do	Starr Creek	Near Morganton	do	13.6
Do	German Creek	do	do	13.0
Do	Wilscots Creek	Near Wilscots	do	26.0
Do	Persimmon Creek		do	8.0
July 20	Toccoa River	Dial	do	384.2
Do	Noontootly Creek	Near mouth	do	126.0
Do	Big Creek	Three miles from Noontootly Creek	do	52.0
July 23	Skeinah Creek	One mile above mouth	do	15.6
Do	Rock Creek	Near mouth	do	46.0
Do	Coopers Creek	One mile above mouth	do	102.0
July 24	Toccoa River	Gaddistown	do	102.0
Do	Suches Creek	Near Gaddistown	do	27.0
Do	Mill Creek	One mile above mouth	do	22.0
Do	Toccoa River	One-half mile above Mill Creek	do	19.6
		TENNESSEE.		
Aug. 15	Sylco Creek	At mouth	O. P. Hall	3.8
Do	Greasy Creek	do	do	11.3
Aug. 16	Okoee (Toccoa) River.	Parksville	do	734.0
Do	Bakers Creek	do	do	4.0
Sept. 4	Greasy Creek	Above mouth of Rock Creek	do	5.1
Sept. 5	Okoee (Toccoa) River.	Parksville	do	667.0

[a] After entering Tennessee the Toccoa is known as Okoee River.

OLENTANGY RIVER AT COLUMBUS, OHIO.

This station was established November 22, 1898, at the Fifth avenue bridge, Columbus. It is described in Water-Supply Paper No. 36, page 175. The observations of river heights are made under the general direction of Prof. C. N. Brown, of the Ohio State University. Records of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 169. A number of measurements made in the latter part of 1899 were not published in the foregoing reports, and they, together with a measurement made on March 8, 1900, are given in the following list:

October 13, 1899: Gage height, 1 foot; discharge, 7 second-feet.
October 13, 1899: Gage height, 1 foot; discharge, 7 second-feet.
Octoben 14, 1899: Gage height, 1 foot; discharge, 7 second-feet.

October 20, 1899: Gage height, 1 foot; discharge, 7 second-feet.
November 17, 1899: Gage height, 1.20 feet; discharge, 44 second-feet.
December 2, 1899: Gage height, 1.10 feet; discharge, 15 second-feet.
March 8, 1900: Gage height, 5.42 feet; discharge, 5,039 second-feet.

Daily gage height, in feet, of Olentangy River at Columbus, Ohio, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	1.80	2.90	2.25	1.40	1.50	1.10	1.35	1.60	1.00	1.00	1.70
2	1.80	1.80	2.80	2.60	1.40	1.90	1.10	1.20	1.60	1.00	1.00	1.50
3	1.80	1.80	2.80	2.35	1.40	1.90	1.10	1.20	1.45	1.00	1.00	1.30
4	1.80	1.80	2.80	2.15	1.40	1.90	1.10	1.10	1.20	1.00	1.00	1.25
5	1.80	1.80	2.90	1.90	1.40	1.60	1.10	1.10	1.20	1.00	1.00	1.20
6	1.80	1.80	5.55	1.75	1.30	1.40	1.10	1.10	1.10	1.00	1.00	1.20
7	1.80	1.70	6.90	1.60	1.30	1.35	1.10	1.10	1.00	1.00	1.00	1.20
8	1.80	2.15	4.75	1.30	1.30	1.30	1.10	1.10	1.00	1.00	1.00	1.30
9	1.80	3.85	3.65	1.30	1.25	1.20	1.10	1.10	1.00	1.00	1.00	1.30
10	1.80	3.10	3.15	1.35	1.20	1.20	1.10	1.10	1.00	1.00	1.00	1.30
11	1.80	2.15	2.80	1.40	1.20	1.20	1.10	1.10	1.00	1.00	1.00	1.30
12	2.35	1.85	2.65	1.40	1.20	1.20	1.10	1.10	1.00	1.00	1.00	1.30
13	3.10	3.45	2.15	1.50	1.20	1.20	1.10	1.00	1.00	1.00	1.00	1.30
14	2.50	3.90	1.95	1.50	1.20	1.20	1.10	1.00	1.00	1.00	1.00	1.60
15	2.25	3.00	1.75	1.50	1.20	1.20	1.10	1.00	1.00	1.00	1.00	1.50
16	2.50	1.90	1.60	1.50	1.20	1.45	1.10	1.00	1.00	1.00	1.00	1.60
17	2.85	1.80	1.60	1.55	1.20	1.60	1.10	1.00	1.00	1.00	1.00	1.60
18	2.55	1.80	1.60	2.20	1.20	1.35	1.10	1.00	1.00	1.00	1.00	1.55
19	2.20	1.80	1.60	2.90	1.20	1.20	1.30	1.00	1.00	1.00	1.00	1.30
20	3.40	1.80	1.60	2.30	1.20	1.10	1.25	1.35	1.00	1.00	1.00	1.30
21	4.00	1.80	1.60	1.90	1.20	1.10	1.10	1.20	1.00	1.00	1.05	1.30
22	3.20	2.40	1.60	3.65	1.20	1.10	1.00	1.20	1.00	1.00	1.10	1.20
23	2.40	3.20	1.60	3.65	1.20	1.10	1.00	1.20	1.00	1.10	1.10	1.20
24	1.95	2.55	1.60	3.05	1.20	1.20	1.00	2.15	1.00	1.05	1.20	1.20
25	1.80	1.80	1.60	2.60	1.20	1.20	1.05	1.80	1.00	1.00	1.80	1.20
26	1.80	1.80	1.60	2.05	1.20	1.20	1.30	1.70	1.00	1.00	2.35	1.20
27	1.80	1.80	1.60	1.80	1.20	1.26	1.40	2.90	1.00	1.00	2.65	1.20
28	1.80	2.50	1.60	1.50	1.20	1.30	1.90	3.20	1.00	1.00	2.20	1.20
29	1.80	.....	1.60	1.40	1.20	1.30	1.80	3.00	1.10	1.00	1.80	1.20
30	1.80	.....	1.60	1.40	1.30	1.25	1.70	2.20	1.00	1.00	1.70	1.20
31	1.80	.....	1.70	.....	1.35	.....	1.65	1.85	.....	1.00	.....	1.20

SCIOTO RIVER AT COLUMBUS, OHIO.

This station was established November 22, 1898, at the Grandview avenue bridge, Columbus. It is described in Water-Supply Paper No. 36, page 176. The observations are made under the general direction of Prof. C. N. Brown, of the Ohio State University. Measurements for the year 1899 will be found in the Twenty-first Annual Report, Part IV, page 170. A number of measurements made in the latter part of 1899 were not published in the foregoing reports, and they, together with the measurements made in 1900, are given in the following table:

Discharge measurements of Scioto River at Columbus, Ohio.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 13, 1899	9.10	14	Dec. 2, 1899	9.40	43
Oct. 14, 1899	9.10	13	Jan. 18, 1900	11.90	1,328
Oct. 20, 1899	9.20	14	Feb. 15, 1900	12.90	2,391
Nov. 17, 1899	9.30	33	Mar. 7, 1900	17.37	8,581
Nov. 30, 1899	9.30	37			

Daily gage height, in feet, of Scioto River at Columbus, Ohio, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.75	10.45	12.55	12.15	10.20	9.60	9.40	9.90	9.45	9.25	9.15	10.60
2	9.70	10.40	13.00	12.70	10.15	9.60	9.40	9.60	9.30	9.20	9.15	10.35
3	9.65	10.35	12.60	12.90	10.10	9.70	9.30	9.45	9.30	9.20	9.10	10.15
4	9.50	10.30	12.60	12.40	10.05	9.90	9.30	9.30	9.20	9.30	9.20	10.05
5	9.50	10.30	12.65	11.85	10.00	9.95	9.20	9.25	9.20	9.20	9.10	9.95
6	9.45	10.30	16.65	11.35	9.95	10.00	9.20	9.10	9.10	9.15	9.15	9.85
7	9.50	10.35	17.50	11.10	9.90	9.95	9.20	9.20	9.20	9.00	9.20	9.80
8	9.55	11.50	16.05	10.85	9.90	9.90	9.20	9.10	9.15	9.00	9.20	9.80
9	9.60	14.00	15.80	10.65	9.90	9.80	9.20	9.15	9.10	9.20	9.05	9.85
10	9.60	13.25	15.15	10.50	9.80	10.20	9.10	9.25	9.10	9.20	9.10	9.90
11	9.70	12.75	14.40	10.40	9.90	10.45	9.10	9.10	9.00	9.20	9.10	9.75
12	9.75	12.15	13.60	10.40	9.90	10.30	9.10	9.00	9.00	9.40	9.10	9.65
13	11.30	13.55	12.95	10.60	9.90	10.05	9.10	9.00	8.95	9.65	9.15	9.65
14	11.40	13.75	12.30	10.95	9.80	9.75	9.15	8.90	8.90	9.50	9.20	9.45
15	11.35	12.95	11.80	10.90	9.70	9.55	9.10	9.00	8.95	9.35	9.20	9.40
16	11.45	12.50	11.40	10.80	9.70	9.45	9.10	9.25	9.00	9.30	9.20	9.40
17	12.15	11.45	10.90	10.75	9.70	9.45	9.20	9.15	9.00	9.25	9.20	9.40
18	11.95	10.95	10.90	11.80	9.75	9.60	9.10	9.05	9.20	9.20	9.20	9.40
19	11.75	11.25	11.00	12.65	9.65	9.50	9.05	8.90	9.00	9.15	9.20	9.40
20	13.35	10.85	11.15	12.20	9.50	9.45	9.45	9.55	8.90	9.10	9.25	9.35
21	15.25	10.75	11.10	11.65	9.60	9.40	9.30	9.65	8.80	8.10	9.30	9.30
22	14.20	11.90	10.85	12.50	9.60	9.40	9.20	9.50	8.80	9.10	9.30	9.35
23	13.55	12.65	10.70	12.15	9.60	9.30	9.10	9.30	8.70	9.20	9.80	9.40
24	13.15	13.05	10.60	11.90	9.55	9.00	10.15	9.80	8.75	9.20	10.15	9.40
25	12.35	12.30	10.60	11.60	9.50	9.00	9.40	10.05	8.85	9.20	10.65	9.40
26	11.70	12.85	10.80	11.15	9.50	9.05	9.15	10.30	8.90	9.15	11.70	9.35
27	11.10	12.95	10.80	10.80	9.50	9.10	9.05	10.25	8.90	9.00	11.55	9.30
28	10.70	12.65	10.75	10.55	9.50	9.25	9.10	10.05	8.90	9.05	11.50	9.30
29	10.65	.....	10.80	10.45	9.50	9.50	9.10	9.95	9.05	9.05	11.40	9.35
30	10.50	.....	10.90	10.35	9.50	9.35	10.40	9.80	9.30	9.00	11.10	9.35
31	10.85	.....	10.80	.....	9.50	.....	9.90	9.70	.....	9.10	.....	9.35

MAUMEE RIVER NEAR WATERVILLE, OHIO.

This station was established on November 19, 1898, by H. A. Pressey and B. H. Flynn. It is located at the highway bridge near Waterville, the gagings being made on the downstream side. It is described in Water-Supply Paper No. 36, pages 178 and 179, where will also be found the results of the discharge measurements made during 1899. During 1900 the following measurements were made by B. H. Flynn:

July 26: Gage height, 3.30 feet; discharge, 2,143 second-feet.
November 24: Gage height, 4.85 feet; discharge, 6,784 second-feet.

Daily gage height, in feet, of Maumee River near Waterville, Ohio, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.00	3.70	3.60	5.40	3.55	3.80	2.70	3.30	2.45	2.10	2.20	4.35
2	4.25	3.60	3.50	5.40	3.30	4.05	2.60	3.25	2.50	2.20	2.20	4.70
3	4.45	3.60	3.55	5.55	3.30	4.45	2.65	3.10	2.35	2.30	2.30	4.45
4	4.50	3.85	3.80	5.60	2.90	4.45	2.75	2.90	2.25	2.20	2.35	4.25
5	4.50	4.05	4.35	5.75	2.80	4.15	2.80	2.80	2.20	2.25	2.40	4.05
6	4.70	4.25	4.75	5.90	2.80	3.90	2.80	2.70	2.10	2.15	2.55	3.80
7	4.35	4.40	5.35	5.50	2.90	3.40	2.50	2.50	2.20	2.15	2.55	3.75
8	3.90	4.80	5.95	4.90	3.05	3.30	3.20	2.40	2.20	2.10	2.40	3.45
9	3.50	5.55	7.90	4.25	3.10	3.50	3.80	2.40	2.15	2.20	2.35	3.55
10	3.05	6.60	11.40	3.85	3.00	3.70	4.25	2.65	2.20	2.20	2.30	3.10
11	2.90	7.05	11.80	3.55	2.90	3.80	4.30	2.75	2.20	2.20	2.30	3.00
12	3.35	6.65	10.10	3.60	2.70	4.35	4.05	2.45	2.10	2.35	2.25	3.00
13	3.50	6.25	8.60	3.95	2.70	4.60	3.65	2.30	2.15	2.40	2.20	3.00
14	3.50	6.55	7.85	4.00	2.70	4.35	3.60	2.30	2.10	2.50	2.25	3.20
15	3.55	6.40	6.80	4.20	2.80	4.00	3.50	2.20	2.10	2.40	2.30	2.95
16	3.40	6.75	6.10	4.35	2.65	3.90	3.40	2.20	2.10	2.35	2.35	2.85
17	3.30	6.05	6.00	4.60	2.60	3.55	3.35	2.10	2.10	2.30	2.35	2.80
18	3.20	4.80	5.65	5.00	2.50	3.50	3.70	2.10	2.10	2.20	2.45	2.70
19	3.55	3.40	6.80	5.35	2.60	3.30	3.60	2.10	2.10	2.10	2.65	2.65
20	4.05	3.35	6.75	5.05	2.65	3.20	3.50	2.10	2.10	2.15	3.45	2.55
21	4.80	3.50	6.55	5.00	2.65	3.00	3.65	2.10	2.10	2.15	4.15	2.50
22	5.05	3.50	6.70	5.75	2.50	3.00	3.80	2.25	2.10	2.10	4.80	2.50
23	5.30	3.60	6.70	6.10	2.55	3.35	3.75	2.65	2.10	2.20	5.25	2.50
24	5.00	3.85	6.85	6.00	2.50	3.85	3.36	3.00	2.10	2.20	5.35	2.50
25	5.20	4.05	6.65	5.70	2.50	4.50	3.10	3.20	2.10	2.20	5.40	2.35
26	5.10	4.45	6.40	5.25	2.45	4.55	3.30	3.30	2.10	2.20	5.30	2.40
27	4.65	4.10	6.30	4.85	2.40	4.15	3.15	3.15	2.10	2.20	5.25	2.70
28	4.35	3.85	5.90	4.20	2.45	3.65	2.95	2.75	2.10	2.20	4.95	2.75
29	4.60	.....	5.35	3.90	2.60	3.15	2.90	2.70	2.10	2.20	4.55	2.55
30	3.60	.....	5.00	3.80	3.10	2.75	2.75	2.45	2.10	2.20	4.20	2.70
31	3.60	.....	5.25	.....	3.70	.....	3.15	2.40	.....	2.20	.....	2.70

SANDUSKY RIVER NEAR MEXICO, OHIO.

This station was established November 17, 1898, at the highway bridge near Mexico, about 40 miles above Fremont, Ohio. It was abandoned November 17, 1900. Only one measurement was made in 1899, when, at a gage height of 5.40 feet, the discharge was 1,386 second-feet. During 1900 the following measurements were made by B. H. Flynn:

July 25: Gage height, 1.75 feet; discharge, 133 second-feet.
November 22: Gage height, 1.80 feet; discharge, 225 second-feet.

Daily gage height, in feet, of Sandusky River near Mexico, Ohio, for 1900.

Day.	Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.5	2.0	4.4	3.2	1.9	1.9	1.6	2.0	1.7	1.3	0.9
2	1.5	1.9	6.4	4.6	1.8	2.1	1.5	1.9	1.6	1.4	.8
3	1.4	1.7	6.3	5.0	1.8	2.7	1.4	1.7	1.5	1.6	.8
4	1.3	1.8	6.3	4.3	1.8	2.4	1.3	1.6	1.4	1.6	.8
5	1.2	1.9	6.8	4.0	1.7	2.1	1.4	1.4	1.3	1.5	1.0
6	1.1	1.9	9.6	3.4	1.6	1.9	1.5	1.3	1.3	1.5	.9
7	1.1	1.8	15.5	3.0	1.6	2.0	1.3	1.1	1.1	1.5	1.0
8	1.0	4.2	15.3	2.8	1.6	2.2	1.2	1 1	1.2	2.2	1.0
9	1.0	7.7	14.5	2.5	1.7	2.1	1.3	1.0	1.2	2.1	1.0
10	.9	7.6	10.9	2.3	1.6	2.1	1.2	1.0	1.3	1.9	.9
11	2.3	5.3	9.1	2.2	1.7	2.1	1.2	1.0	1.4	1.8	1.0
12	3.5	3.7	7.4	2.7	1.7	1.9	1.1	.7	1.7	1.7	1.0
13	4.2	5.6	5 5	3.4	1.7	1.8	1.0	.9	1.5	1.6	1.1
14	4.0	8.3	4.8	3.3	1.6	1.7	1.0	.8	1.4	1.5	1.0
15	4.3	7.3	4.0	3.3	1.5	1.6	.9	.7	1.3	1.5	.9
16	4.8	4.5	3.6	2.9	1.5	1.6	1.0	1.1	1.1	1.4	.9
17	5.7	3.9	3.1	2.7	1.4	1.5	.9	1.3	1.0	1.3	(a)
18	5.2	3.7	2.8	4.3	1.4	1.5	.8	1.5	1.0	1.3	------
19	4.2	3.2	2.8	5.3	1.4	1.5	.8	1.5	1.0	1.2	------
20	3.7	2.7	2.7	4.9	1.4	1.5	1.0	1.6	1.0	1.1	------
21	7.9	2.4	2.6	3.6	1.3	1.6	.9	3.3	1.1	1.1	------
22	7.8	3.4	2.3	3.3	1.2	1.6	.9	2.9	1.2	1.1	------
23	6.1	3.7	2.4	4.0	1.3	1.6	.8	2.5	1.1	1.1	------
24	4.7	4.6	2.3	4.5	1.2	1.5	.8	5.0	1.1	1.1	------
25	3.9	4.2	2.2	4.0	1.2	1.5	1.3	5.9	1.0	1.2	------
26	3.1	4.1	2.3	3.3	1.1	1.6	2.6	4.6	.8	1.2	------
27	2.8	4.0	2.7	2.6	1.1	1.5	2.5	4.1	.8	1.1	------
28	2.6	3.9	2.7	2.3	1.4	1.6	2.4	5.2	.7	1.0	------
29	2.3	------	2.8	2.0	1.5	1.9	2.0	4.8	.8	1.0	------
30	2.0	------	2.9	1.9	1.6	1.7	1.8	2.5	.9	1.0	------
31	2.1	------	2.8	------	1.7	------	1.9	2.0	------	.9	------

(a) Gage destroyed.

SANDUSKY RIVER AT FREMONT, OHIO.

This station, which was established November 18, 1898, by H. A. Pressey and B. H. Flynn, is at the bridge of the Lake Shore Railroad at Fremont. It is described in Water-Supply Paper No. 36, page 181. One measurement was made in 1899—gage height, 2.32 feet; discharge, 1,784 second-feet. The following measurements were made during 1900:

July 26: Gage height, 2.75 feet; discharge, 2,316 second-feet.
November 23: Gage height, 1.60 feet; discharge, 463 second-feet.

Daily gage height, in feet, of Sandusky River at Fremont, Ohio, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.95	0.65	1.95	1.20	0.60	1.50	0.85	1.40	1.00	1.10	1.00	1.75
2	.95	.65	2.70	1.70	.50	1.60	.85	1.30	.95	1.20	1.05	1.70
3	.95	.60	2.75	1.70	.40	1.65	.85	1.20	.95	1.10	.90	1.60
4	.90	.65	2.85	1.60	.40	1.70	.80	1.10	1.00	1.05	.80	1.35
5	.90	.65	2.90	1.60	.40	1.60	.75	.90	1.50	1.10	.85	1.30
6	.90	.75	4.65	1.50	.30	1.50	.65	.80	1.65	1.20	.80	1.35
7	.90	.75	6.45	1.20	.30	1.60	.70	.80	1.65	1.20	.85	1.20
8	.90	2.35	6.90	1.00	.30	1.60	.85	.80	1.65	1.10	.80	1.40
9	.90	3.30	5.70	.90	.35	1.50	.95	.90	1.75	1.20	.85	1.30
10	.90	2.80	5.30	.80	.40	1.50	.95	.85	1.70	1.15	.90	1.25
11	.95	2.15	3.55	.80	.40	1.60	.90	.65	1.70	1.10	.85	1.20
12	1.05	1.45	2.35	1.35	.30	1.50	.75	.60	1.65	1.05	.85	1.15
13	1.40	3.30	1.65	1.50	.30	1.40	.75	.75	1.65	1.05	.75	1.10
14	1.95	3.35	1.55	1.40	.30	1.50	.65	.75	1.70	.90	.80	1.05
15	2.00	2.70	1.80	1.30	.30	1.45	.50	.80	1.65	.85	.75	1.00
16	2.15	1.85	1.40	1.20	.20	1.20	.60	.75	1.75	.80	.70	1.15
17	2.15	1.15	1.20	1.30	.25	1.20	.50	.75	1.60	.95	.80	1.20
18	2.05	.80	1.20	2.15	.30	1.20	.60	1.10	1.70	1.00	.75	1.15
19	1.75	.95	1.40	2.20	.20	1.20	.55	1.05	1.65	.85	.80	1.10
20	2.00	.85	1.30	1.80	.20	1.10	.40	1.15	1.75	.80	1.10	1.00
21	3.20	.85	1.10	1.60	.20	1.10	.40	2.75	1.80	.90	1.50	1.00
22	2.95	1.35	1.10	1.45	.10	1.20	.40	2.55	1.75	.95	1.70	1.05
23	2.40	1.50	1.00	1.85	.25	1.20	.90	2.20	1.60	1.10	1.80	1.10
24	1.85	1.55	.90	1.95	.25	1.10	1.05	2.75	1.40	1.00	1.85	1.00
25	1.55	1.60	.90	1.75	1.10	1.10	1.70	3.75	1.25	1.05	2.10	1.05
26	1.35	1.70	.90	1.35	1.30	1.00	2.35	3.05	1.10	1.10	2.30	1.15
27	1.25	1.65	.90	1.05	1.30	.90	1.75	2.80	1.00	1.05	2.60	1.15
28	.85	1.80	1.10	.90	1.40	.95	1.70	2.00	1.10	1.00	2.20	1.10
29	.70	.....	1.10	.70	1.40	.90	1.50	1.50	1.00	.90	2.00	1.00
30	.70	.....	1.00	.70	1.40	.80	1.50	1.45	1.00	.85	1.90	1.00
31	.70	.....	1.00	.....	1.40	.....	1.50	1.00	.....	1.00	.....	.90

SENECA RIVER AT BALDWINSVILLE, NEW YORK.

Records of the stations on the New York streams which belong to the coast drainage will be found in Water-Supply Paper No. 47, pages 42 to 80. A number of the streams of that State on which stations have been established belong to the Great Lakes drainage, and following the geographic arrangement which has been determined upon for the publication of the records contained in these reports, the records for these stations are inserted on this and the following pages. The methods employed in the gaging of these streams is discussed on pages 37 to 41 of Water-Supply Paper No. 47, where will also be found a list of the gaging stations in New York State, a table of the current-meter measurements made during 1900, a table of the drainage areas, and other interesting information.

The gaging station on Seneca River at Baldwinsville is described in Water-Supply Paper No. 36, page 183. This river drains the central lake region of New York. The outlets of Otisco, Skaneateles, and Owasco lakes are crossed by Erie Canal, and a portion of their flow is intercepted for water-supply purposes. Water from Lake Erie feeds the main canal as far as Port Byron. Some of this water is discharged into Seneca River, and thence is delivered into Lake Ontario.

The upper reaches of Seneca River are canalized, forming the Cayuga and Seneca canals, while dams on the lower portion admit of slack-water navigation, forming a part of Oswego Canal. During the summer but little water flows over the dam at Baldwinsville. In times of

low water the mills are allowed to run a certain number of hours during the day, or until the supply accumulated in the pond above the dam is drawn down to a certain level. The water is diverted through three power canals, and is conducted to the water wheels by means of short lateral channels. The loss through leakage of wheel gates, flumes, and penstocks is considerable.

The following current-meter measurements were made at Baldwinsville:

	Second-feet.
June 11, 1900:	
Amos race	193.5
Oswego Canal	504.5
Main stream at railroad bridge[1]	1,183.0
Total flow	1,881.0
September 11, 1900 (no water flowing over dam):	
South Side Canal	475.0
Oswego Canal	317.0
Amos race	127.0
Total flow	919.0

The Baldwinsville record shows a relatively low run-off for this stream. The 1900 record is withheld for the present, additional measurements to determine leakage, etc., being needed.

CHITTENANGO CREEK AT BRIDGEPORT, NEW YORK.

This station is described in Water-Supply Paper No. 36, page 184. A current-meter measurement was made at a highway bridge below the inflow of Butternut Creek, near Bridgeport, on June 16, 1900, and the total flow of Chittenango Creek at that point was found to be 95 second-feet. The stage of the stream, as shown by the record kept at Bridgeport, was uniform for several days. The mean flow, as computed from the gage readings, was 95 second-feet for June 15 and 16. There is no opportunity to measure separately the discharge through the turbines or the leakage of the dam at this station, and an allowance of 15 second-feet has been made for the leakage of the dam and the dike leading to the old sawmill. The sawmill, situated on the left side of the stream, runs very irregularly. The water wheels are old, and the penstocks leak considerably. On June 16 a current-meter measurement was made in the headrace leading to the sawmill. The water wheels were running, and the flow was found to be 14.4 second-feet.

The relatively low run-off from the watershed of Chittenango Creek, as shown in the accompanying tables, may be attributed to the diversion of a portion of the flow to supply the summit level of Erie Canal.

State dams are located on the main stream at Chittenango, and on its two tributaries, Limestone Creek and Butternut Creek. Cazenovia Lake, Erieville, De Ruyter, and Jamesville reservoirs impound stor-

[1] Including South Side Canal.

age, by which the flow is regulated to some extent. Water is also diverted from Tioghnioga River, entering the Orville feeder through Limestone Creek.

Additional information in regard to this creek will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily discharge, in second-feet, of Chittenango Creek at Bridgeport, New York, for 1898.

[Drainage area, 307 square miles.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	180	562	427	18	a 53	284	500	a 605
2	.....	a 205	559	360	19	119	297	506	678
3	.....	171	434	348	20	139	320	a 675	669
4	(a)	172	358	a 385	21	117	269	728	793
5	.....	156	379	471	22	111	463	623	1,155
6	.....	309	a 385	414	23	115	a 465	593	1,293
7	.....	235	331	404	24	135	487	569	1,401
8	.....	204	359	320	25	a 85	472	490	a 1,075
9	.....	a 130	386	261	26	142	352	442	857
10	.....	165	474	265	27	149	867	a 465	726
11	(a)	194	1,339	a 465	28	214	972	523	541
12	.....	196	1,571	434	29	154	661	413	480
13	.....	197	a 1,265	454	30	198	a 565	421	630
14	.....	181	921	442	31	.....	519	.....	630
15	.....	354	790	450					
16	82	a 335	694	472	Mean	129	344	612	597
17	116	299	615	619					

a Sunday.

Daily discharge, in second-feet, of Chittenango Creek at Bridgeport, New York, for 1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	a 515	520	632	837	447	426	116	84	81	a 75	60	113
2	571	484	473	a 795	357	346	a 55	79	49	90	145	127
3	636	440	385	752	310	234	97	169	a 45	91	145	a 143
4	737	465	520	861	172	a 105	113	126	133	90	160	159
5	1,067	a 385	a 1,260	866	172	184	132	134	81	80	a 165	149
6	1,310	356	1,331	864	157	229	99	a 70	76	141	228	151
7	1,282	342	1,475	857	a 95	229	123	125	74	89	128	166
8	a 1,135	465	1,069	1,420	172	244	132	125	96	a 45	120	179
9	724	385	860	a 1,675	172	192	a 45	134	96	107	108	155
10	486	385	852	1,369	227	147	89	79	a 15	117	65	a 168
11	473	385	659	1,306	237	a 70	262	62	71	101	46	181
12	623	a 385	a 565	1,274	172	169	271	44	96	101	a 35	211
13	849	538	1,196	1,597	172	192	162	a 15	92	85	72	326
14	738	524	1,061	1,737	a 165	182	169	141	56	72	57	395
15	a 1,260	462	970	1,614	180	109	99	125	88	a 15	65	395
16	1,280	362	665	a 1,405	174	184	a 70	103	79	84	60	374
17	1,101	449	634	1,339	250	192	101	87	a 25	30	88	a 355
18	632	354	526	1,221	310	a 70	221	76	89	38	57	466
19	396	a 385	a 565	859	374	152	210	91	74	38	a 25	706
20	395	541	736	861	374	84	204	a 25	96	45	83	588
21	389	444	766	629	a 385	92	152	120	117	47	70	298
22	a 385	619	962	447	281	100	117	109	39	a 15	78	304
23	399	950	1,061	a 165	265	124	a 70	96	84	60	100	254
24	372	1,074	1,345	627	252	134	102	.....	a 25	68	102	a 200
25	311	1,314	1,061	527	197	a 70	102	.....	67	43	110	139
26	362	a 1,015	a 885	456	195	141	122	.....	49	57	a 25	238
27	308	645	626	331	227	109	110	(a)	112	48	109	261
28	332	755	760	279	a 225	109	88	.....	119	25	133	201
29	a 385	.....	1,075	359	312	84	109	56	96	a 20	114	249
30	448	.....	1,360	a 295	333	91	a 45	96	79	65	105	244
31	637	.....	1,360	.....	229	.....	141	112	.....	65	.....	a 240
Mean	662	551	893	921	245	161	123	96	76	64	95	281

a Sunday.

Daily discharge, in second-feet, of Chittenango Creek at Bridgeport, New York, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	161	467	774	a1,230	266	106	a38	107	91	67	108	a608
2	247	581	671	1,394	268	80	91	108	a53	108	100	355
3	242	581	605	1,447	245	a70	99	68	75	67	82	356
4	263	a595	a595	1,447	245	134	33	80	79	75	a34	288
5	318	580	792	1,342	237	125	82	a38	55	75	67	865
6	379	507	776	1,327	a215	132	153	103	67	91	70	1,330
7	a275	502	892	1,318	295	117	132	40	55	a38	73	1,150
8	374	1,437	591	a1,365	287	88	a130	40	33	100	105	a1,035
9	292	959	583	1,433	295	105	156	49	a33	102	130	690
10	307	1,313	511	1,255	245	a70	77	73	87	114	86	400
11	307	a1,115	a425	1,072	237	116	88	65	60	115	a34	330
12	302	771	463	853	218	108	63	a37	72	136	102	335
13	373	1,187	441	667	a165	67	66	38	37	72	87	480
14	a275	1,700	383	675	247	96	a80	120	57	a42	106	456
15	373	1,445	367	a595	259	95	42	89	65	98	98	a452
16	422	1,188	383	544	283	95	96	92	a15	94	106	425
17	504	985	375	667	268	a70	160	83	70	89	105	497
18	599	a275	a355	620	280	117	136	96	62	63	a45	538
19	971	187	603	1,703	237	73	101	a53	53	77	153	421
20	1,540	189	589	801	a215	107	136	63	111	57	169	423
21	a1,485	242	603	880	222	92	134	83	70	a42	136	431
22	1,445	987	788	a785	166	69	a105	66	117	86	139	a358
23	1,195	992	782	860	171	78	129	124	a53	58	111	378
24	1,074	1,005	1,003	770	136	a43	100	44	79	100	113	844
25	422	a790	a1,115	577	118	116	101	92	62	96	a45	1,231
26	429	706	788	436	98	81	252	a38	84	94	1,255	452
27	764	591	707	355	a40	73	172	75	99	75	1,953	606
28	a790	591	982	268	150	78	117	95	117	a33	1,835	618
29	522	.....	1,090	a275	92	133	a105	86	108	75	1,272	a442
30	372	.....	1,221	370	117	71	124	70	a33	90	1,105	275
31	372	.....	1,351	.....	90.	.....	133	66	.....	85	.....	347
Mean	561	725	697	911	207	93	110	73	68	81	327	562

a Sunday.

ONEIDA CREEK AT KENWOOD, NEW YORK.

A description of this station, which is located at the silk-mill dam in Kenwood, will be found in Water-Supply Paper No. 36, page 186. There is no leakage of the dam, and only a slight leakage of the flume and head gates, which has been taken at 2 second-feet. The flow over a wasteway near the mill is computed by means of Francis's formula. A second spillway in the canal bank near the dam has a broad, irregular crest, over which water sometimes flows. A discharge curve for this spillway has been prepared, using coefficients from the Cornell experiments for dam with a broad, flat crest.[1]

Current-meter measurements were made to check the calculated flow at Kenwood, with the following results:

	Second-feet.	
June 1, 1900:		
Total flow at Oneida Castle		36.6
Flow over dam, crest gage reading 0.15 foot	19	
Flow through turbine, 11.75 feet head, one-third gate	15	
Flow over wasteway near mill	1	
Assumed leakage	2	
Total flow (computed)		37.0
September 17, 1900:		
Total flow measured in headrace		20.0
Flow through turbine, one-third gate	15	
Assumed leakage	2	
Total flow (computed)		17.0

[1] See Proc. Am. Soc. C. E., March, 1900, p. 282.

At Oneida is a State dam diverting water for the supply of the summit level of Erie Canal. No measurements of diversion to the feeder have been made. Practically the entire flow of Oneida Creek, less leakage of the dam, is taken for this purpose during the low-water season.

Additional information in regard to this creek will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily discharge, in second-feet, of Oneida Creek at Kenwood, New York, for 1898.

[Drainage area, 59 square miles.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	90	70	18	75	102	*a* 69
2	(*a*)	72	63	19	75	115	40
3	.....	70	80	20	75	*a* 121	60
4	.....	65	*a* 76	21	70	123	205
5	112	60	82	22	110	109	170
6	58	*a* 58	65	23	*a* 100	123	240
7	60	60	60	24	100	100	173
8	58	58	55	25	75	86	*a* 136
9	*a* 45	51	45	26	120	93	100
10	23	265	50	27	180	*a* 77	80
11	23	274	*a* 50	28	129	61	50
12	30	172	50	29	133	76	70
13	27	*a* 140	45	30	*a* 100	64	101
14	51	119	50	31	100	.....	101
15	110	123	55				
16	*a* 100	106	101	Mean	83	105	90
17	102	106	108				

a Sunday.

Daily discharge, in second-feet, of Oneida Creek at Kenwood, New York, for 1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	*a* 76	50	115	122	71	46	18	*a* 15	144	23
2	96	65	96	*a* 115	60	36	*a* 20	21	69	29
3	108	80	115	116	60	36	20	21	56	*a* 25
4	210	72	112	96	59	*a* 35	20	21	66	27
5	300	*a* 59	*a* 157	122	54	31	30	21	*a* 55	29
6	160	50	22	131	55	31	34	21	44	29
7	143	50	202	166	*a* 48	31	21	24	40	25
8	*a* 114	50	168	334	53	24	41	*a* 18	26	33
9	95	35	128	*a* 260	53	24	*a* 40	24	26	41
10	80	37	75	214	53	24	51	24	24	*a* 25
11	138	100	90	196	54	*a* 25	26	21	26	97
12	180	*a* 74	*a* 149	496	59	26	24	24	*a* 27	70
13	205	56	235	416	59	26	24	24	28	70
14	273	37	157	406	*a* 48	26	24	24	26	91
15	*a* 225	47	123	341	53	51	21	*a* 19	22	82
16	183	42	140	*a* 260	60	41	*a* 20	25	26	73
17	135	39	144	196	61	36	31	25	26	*a* 30
18	101	41	133	166	68	*a* 30	28	25	22	30
19	75	*a* 40	*a* 157	166	66	26	26	24	*a* 25	97
20	65	52	198	144	91	31	26	24	28	79
21	67	160	135	136	*a* 80	26	24	25	24	92
22	*a* 57	365	157	110	82	26	25	*a* 25	26	80
23	55	232	254	*a* 102	63	31	*a* 25	25	24	68
24	75	147	183	96	54	31	26	25	26	*a* 55
25	85	99	190	91	66	*a* 31	21	24	24	70
26	60	*a* 161	*a* 170	110	43	31	21	25	*a* 25	36
27	55	232	157	110	43	31	20	24	26	39
28	42	122	123	91	*a* 71	24	21	25	26	27
29	*a* 43	.....	230	86	108	24	18	*a* 26	26	34
30	51	.....	183	*a* 93	76	21	*a* 20	29	26	27
31	75	.....	165	.....	59	.....	21	31	.....	*a* 34
Mean	117	93	157	183	62	30	25	23	33	60

a Sunday.

NOTE.—No record for August and September.

Daily discharge, in second-feet, of Oneida Creek at Kenwood, New York, for 1900.

Day.	Jan.	Mar.	Apr.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	------	98	(a)	19	(a)	27	15	17	26	71
2	29	194	290	18	29	22	(a)	17	26	a 63
3	26	99	208	(a)	25	16	15	14	16	55
4	34	(a)	154	23	------	16	15	14	a 16	126
5	29	135	149	20	22	(a)	15	17	16	193
6	40	191	313	17	25	16	16	17	18	160
7	(a)	223	382	23	32	13	19	(a)	16	160
8	86	140	(a)	43	(a)	15	14	14	40	138
9	54	150	220	52	42	14	(a)	35	32	a 149
10	51	199	200	(a)	31	------	15	18	37	160
11	47	(a)	196	30	24	25	15	17	a 35	138
12	60	98	212	23	22	(a)	15	17	33	108
13	47	124	201	17	22	14	15	19	26	108
14	(a)	100	204	17	25	15	14	a 13	22	88
15	45	67	(a)	17	(a)	16	14	25	22	88
16	104	52	172	27	31	18	(a)	23	19	a 123
17	81	62	218	(a)	54	20	17	25	22	158
18	76	a 48	302	17	46	32	15	19	a 30	160
19	364	148	268	19	38	(a)	15	19	37	138
20	304	394	224	17	34	17	13	19	50	138
21	(a)	262	177	17	40	14	19	a 17	50	108
22	196	259	(a)	14	(a)	14	19	17	50	88
23	89	259	234	14	34	13	(a)	17	46	a 162
24	209	102	160	(a)	28	13	17	23	43	237
25	161	(a)	134	19	27	32	17	25	a 337	176
26	101	82	102	16	80	(a)	15	19	632	132
27	------	154	85	19	55	28	17	17	353	126
28	a 30	128	88	14	36	31	17	(a)	282	108
29	46	128	(a)	19	(a)	28	15	19	225	96
30	45	128	61	26	31	20	a 11	19	168	a 97
31	47	118	------	------	28	19	17	23	------	98
Mean	92	148	198	21	38	19	16	19	91	127

a Sunday.

NOTE.—No record for February and May.

WEST BRANCH OF FISH CREEK AT McCONNELLSVILLE, NEW YORK.

This station is described in Water-Supply Paper No. 36, page 186. During the summer the flashboards are on the dam, and Francis's formula is used in computing the flow. At other times a discharge curve derived from Cornell experiments is used. Three water wheels are in use. Two are 54-inch wheels built by the Camden Water Wheel Works, and are usually run ten hours a day, at a nearly constant gate opening.

Current-meter measurements of the discharge of one of these wheels under light and heavy load gave the following results:

June 2, 1900, discharge, 43.2 second-feet.
September 6, 1900, discharge, 51.8 second-feet.

Ten dams located on this stream furnish power to 17 mills.

Additional information in regard to this creek will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily discharge, in second-feet, of West Branch of Fish Creek at McConnellsville, New York, for 1898.

[Drainage area, 187 square miles.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	137	365	237	18	a50	346	365	a120
2	.....	a50	319	245	19	98	227	365	187
3	.....	111	292	217	20	81	190	a370	157
4	.....	121	172	a195	21	57	172	371	190
5	.....	130	155	182	22	55	467	220	287
6	.....	137	a120	182	23	·57	a700	216	317
7	.....	131	146	196	24	332	750	300	468
8	.....	122	138	182	25	a360	624	329	a390
9	.....	a65	135	199	26	197	434	319	285
10	.....	102	557	180	27	231	1,097	a255	285
11	.....	81	1,562	a140	28	181	871	299	225
12	.....	87	997	199	29	181	686	251	170
13	100	124	a700	186	30	147	a440	172	120
14	90	134	734	212	31	.....	464	.....	120
15	96	397	434	162					
16	47	a360	514	157	Mean	134	333	384	210
17	47	562	365	147					

a Sunday.

Daily discharge, in second-feet, of West Branch of Fish Creek at McConnellsville, New York, for 1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	a120	228	402	586	273	18	615	153	567	1,644	189
2	126	183	402	a520	313	19	615	a120	a485	1,434	374
3	194	183	438	601	243	20	530	183	505	1,174	374
4	261	172	595	601	184	21	495	198	433	1,085	a255
5	321	a120	a700	601	184	22	a360	258	442	1,045	303
6	396	212	956	591	184	23	314	338	443	a940	244
7	396	156	856	689	a120	24	425	438	442	664	194
8	a285	156	700	1,557	183	25	350	438	442	564	189
9	325	147	856	a2,110	154	26	325	a360	a360	470	174
10	422	136	583	1,690	154	27	338	403	552	366	134
11	502	117	546	1,724	183	28	308	403	599	366	a50
12	587	a80	a700	2,055	243	29	a225	.....	599	364	700
13	873	99	1,178	2,440	194	30	278	.....	599	a220	455
14	873	132	1,178	2,920	a120	31	278	.....	599	.....	483
15	a795	94	1,178	3,040	189						
16	787	131	972	a2,410	189	Mean	435	206	648	1,206	239
17	735	148	782	1,720	189						

a Sunday.

Daily discharge, in second-feet, of West Branch of Fish Creek at McConnellsville, New York, for 1900.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	278	96	a52	60	48	69	157	160
2	255	78	78	60	a10	54	144	117
3	232	a28	78	60	20	49	133	144
4	243	70	52	58	50	65	93	122
5	243	58	52	a10	50	65	132	257
6	a205	70	96	50	60	64	104	201
7	225	70	80	50	60	a34	143	169
8	165	88	a52	50	28	39	217	150
9	185	90	78	50	a10	39	180	117
10	185	a52	78	58	50	59	163	118
11	185	78	78	50	50	55	110	133
12	172	70	70	a30	60	54	107	127
13	a105	60	70	56	60	64	107	127
14	148	68	60	168	60	a36	132	137
15	140	78	a10	98	58	71	112	97
16	135	86	60	61	a10	76	101	82
17	125	a52	60	64	60	76	86	121
18	120	72	70	48	60	46	78	112
19	106	58	60	a19	55	86	144	95
20	a75	78	60	30	55	71	207	58
21	104	70	60	50	196	a60	224	50
22	104	70	a10	50	239	106	239	28
23	96	68	60	60	a128	116	246	31
24	96	a28	50	55	87	218	231	31
25	86	70	64	30	87	148	196	31
26	86	70	60	a19	66	134	330	31
27	a38	70	76	60	66	140	355	51
28	82	70	26	134	66	a128	223	51
29	71	70	a36	76	50	150	187	31
30	52	68	60	50	a58	150	179	31
31	88	.....	60	50	.....	206	.....	58
Mean	143	68	60	57	65	88	168	99

a Sunday.

OSWEGO RIVER ABOVE MINETTO, NEW YORK.

Oswego River is formed by the junction of Oneida and Seneca rivers at Three River Point. It has extensive natural storage in Oneida Lake, which covers an area of 80 square miles, and in the Finger Lakes of central New York, which it drains. Certain tributary lakes serve also as reservoirs for the water supply of the middle division of Erie Canal, and a portion of the flow is diverted for this purpose.

Oswego River has been canalized by the construction of dams, affording slack-water navigation on a part of the stream. In all there are 7 dams on the river. Surplus water at the State dams supplies power to numerous mills situated on the adjacent banks. Lateral canals and locks carry boats around the dams and connect with backwater from the next succeeding dam in each instance.

In establishing a gaging station it was impossible to measure the entire stream in a single channel, since, in order to avoid slack water from dams, it was necessary to select a site where the river is paralleled by the canal. A cable station was established September 14, 1900, 3 miles above Minetto, and below the State dam at Battle Island. A gage board was placed one-fourth mile upstream from the cable. A

weight gage is used, being suspended from a framework projecting over the water beyond the low-water margin. The position of the weight when the gage reads zero has been determined with reference to a fixed bench mark. The gage is so arranged that the readings are reversed, thus, 8.00 would be extreme low water, and when the water rises the readings are less. Morning and evening readings are taken, usually twelve hours apart, and the average of the two readings is given in the table.

A current-meter measurement was made at the cable station on September 15. The mean gage height during the measurement was 5.4 feet, and the discharge 1,677 second-feet. This does not include the diversion through Oswego Canal. The lowest water on this stream usually occurs Sundays, due to the stopping of water wheels and the consequent refilling of ponds.

In this connection reference may be made to the gaging record which was maintained by the United States Board of Engineers on Deep Waterways on Oswego River at the Oswego Falls dam from November, 1898, to May, 1899, inclusive. A description of this station will be found in Water-Supply Paper No. 36, page 188.

The drainage areas tributary to Oswego River at the different gaging stations are as follows:

Drainage areas of Oswego River.

	Square miles.
At mouth	5,002
At high dam near Oswego	5,000
At cable station	4,990
At Fulton	4,916

Additional information in regard to this river will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily gage height, in feet, of Oswego River above Minetto, New York, for 1900.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	5.65	4.90	0.70	17	6.20	5.08	4.55	c0.35
2	.....	5.65	4.90	.85	18	5.65	5.15	5.70	c .70
3	.....	5.58	5.75	.50	19	5.82	5.18	4.75	c .50
4	.....	5.55	5.75	.50	20	5.60	4.70	4.25	c .45
5	.....	5.55	5.00	c .65	21	5.52	6.15	4.25	c .40
6	.....	5.55	4.75	c1.50	22	5.55	5.40	(a)	c .45
7	.....	6.15	4.66	c1.50	23	5.28	4.85	(a)	c .35
8	.....	5.05	4.70	c1.50	24	5.60	5.55	(a)	c .40
9	.....	5.30	4.80	c1.35	25	6.10	5.55	(a)	c .15
10	.....	5.55	4.90	c1.15	26	5.80	5.50	b3.05	c .25
11	.....	5.35	5.50	c1.05	27	5.65	5.50	2.25	.10
12	.....	5.20	4.50	c .85	28	5.72	6.45	1.60	.40
13	.....	5.15	4.60	c .85	29	5.70	5.05	1.15	.55
14	5.72	5.60	4.55	c .50	30	5.75	4.95	.60	.65
15	5.70	5.52	4.55	c .30	31	.....	4.80	.....	.80
16	6.50	5.30	4.60	c .30					

a No record. b New weight gage. c Used board gage.

OSWEGO RIVER AT HIGH DAM NEAR OSWEGO, NEW YORK.

A description of this station, with tables of daily gage heights, will be found in Water-Supply Paper No. 36, page 189. The dam is of masonry, with a crest 365.5 feet long. Flashboards are maintained on the dam during the greater part of the year. When flashboards are on, the flow over the dam has been computed by means of Francis's formula, with a constant coefficient of 3.33. In estimating the flow over the dam when flashboards are removed a discharge curve has been prepared, using coefficients in the weir formula derived from Cornell University experiment No. 3,[1] and taking into consideration irregularities in the profile of the crest.

A headrace at the left end of the dam diverts water to supply power to an electric-light plant and to the waterworks pumping station. There are 8 water wheels in use. A regular record of the run of the water wheels has not been kept, and the diversion for this purpose has been estimated from current-meter measurements in the headrace.

Power diversions at high dam near Oswego.

Date.	Working head on wheels.	Measured discharge.
1900.	*Feet.*	*Sec.-feet.*
June 12	13	323
September 15	14	352

Three pairs of water wheels, which were in operation when the foregoing measurements were made, are run twenty-four hours a day. Taking the average of the foregoing measurements and adding 105 second-feet for the additional pair of wheels, the diversion for water power has been estimated at 450 second-feet, as a round figure.

The flow from an auxiliary spillway in the end of the headrace has been calculated from the weir formula, using coefficients derived by Bazin for a dam having a similar crest section.

Some uncertainty attaches to the record at this station during the spring months, owing to the carrying away of the flashboards by high water at dates not definitely ascertained.

In the accompanying tables of monthly and daily mean flow no allowance has been made for diversion to Oswego Canal.

Additional information will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

[1] See Proc. Am. Soc. C. E., March, 1900, p. 274.

Daily discharge, in second-feet, of Oswego River at high dam near Oswego, New York, for 1897.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	12,150	.....	4,500	1,470	a3,300	1,760	1,200	1,020	3,000
2	11,550	a7,750	4,620	2,650	3,300	.....	1,150	1,260	3,000
3	10,950	7,550	4,620	2,480	.....	1,760	(a)	1,430	3,220
4	(a)	7,250	4,620	(a)	3,300	1,670	850	1,430	2,950
5	10,950	7,220	.....	2,480	3,050	(a)	1,050	1,320	a3,850
6	10,950	6,900	a4,520	2,400	.....	1,550	1,100	1,430	.....
7	10,950	6,800	4,520	2,150	2,870	1,760	1,100	(a)	3,620
8	10,750	.....	4,400	1,750	(a)	1,670	970	1,370	3,620
9	11,650	a6,600	4,400	1,820	2,150	1,840	920	1,430	4,400
10	.....	6,400	4,400	1,750	2,330	1,670	(a)	1,570	4,550
11	a11,550	6,400	4,400	(a)	2,330	720	1,050	1,430	4,800
12	11,550	.....	.....	2,300	2,500	(a)	1,050	1,430	(a)
13	11,550	6,275	a4,400	1,670	2,330	1,100	960	1,320	4,650
14	10,950	6,150	4,170	1,480	2,450	1,270	1,220	a1,320	4,550
15	10,950	.....	4,170	1,670	(a)	1,150	1,100	.....	5,500
16	10,750	a6,275	4,150	1,830	2,150	1,200	1,150	1,630	5,400
17	.....	6,275	3,900	1,830	2,500	1,020	(a)	1,750	5,500
18	a10,200	6,275	3,770	(a)	2,500	970	750	1,850	5,500
19	9,800	5,900	.....	1,980	2,330	(a)	1,100	2,020	(a)
20	9,550	5,650	a3,610	1,900	2,330	850	1,300	2,020	5,500
21	9,350	5,650	3,070	1,980	2,250	880	.....	(a)	5,100
22	9,250	.....	3,070	1,830	(a)	920	1,220	2,120	4,780
23	9,100	a5,520	2,870	1,900	2,000	920	1,220	1,850	4,780
24	8,900	5,250	2,870	1,670	1,900	920	(a)	2,120	3,630
25	a8,100	5,520	2,670	(a)	1,900	1,100	1,150	2,120	3,200
26	8,100	5,250	.....	2,480	1,850	(a)	1,100	2,120	(a)
27	8,100	5,150	a2,870	2,660	1,850	1,020	1,050	2,870	3,850
28	8,100	5,150	2,550	2,660	1,850	1,350	1,100	(a)	3,420
29	8,060	.....	2,970	3,500	(a)	970	1,020	3,650	2,900
30	7,500	a5,500	2,720	3,170	1,760	1,050	1,020	3,650	3,620
31	.....	5,500	.....	3,240	2,160	.....	(a)	.....	3,430
Mean	10,048	6,166	3,801	2,174	2,370	1,244	1,076	1,821	4,168

a Sunday.

Daily discharge, in second-feet, of Oswego River at high dam near Oswego, New York, for 1898.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,600	5,520	10,350	9,400	(a)	6,430	2,780	780	1,480	.....	3,250	3,900
2	(a)	5,520	10,200	9,250	8,250	.....	2,780	780	1,480	a1,470	3,250	3,900
3	3,000	5,520	9,900	(a)	8,080	6,540	(a)	780	1,400	.....	3,250	.....
4	2,600	5,000	9,600	8,750	8,850	5,630	.....	1,200	a950	1,470	3,250	a4,700
5	3,320	5,000	9,250	8,620	8,900	a5,630	.....	950	1,330	1,400	.....	3,900
6	2,900	(a)	(a)	8,300	8,960	5,630	.....	850	1,260	.....	a3,050	3,450
7	3,430	5,520	8,820	8,080	9,120	5,630	1,480	a850	1,260	1,330	3,220	3,900
8	3,220	5,000	8,960	7,800	(a)	4,880	.....	1,070	1,770	.....	3,050	3,350
9	(a)	5,100	8,960	7,500	9,120	4,880	.....	850	1,700	a1,400	3,250	3,150
10	2,820	5,100	8,960	(a)	8,960	4,650	a1,200	850	1,770	1,260	4,800	.....
11	2,820	5,100	9,100	7,370	8,670	4,650	1,200	770	a1,480	1,200	4,900	a3,260
12	3,220	6,550	9,400	6,950	.....	a4,650	1,330	680	1,630	1,200	.....	3,260
13	4,770	(a)	(a)	6,650	8,370	4,400	1,950	630	1,770	860	a5,800	2,300
14	5,100	5,400	10,200	6,650	8,370	4,170	1,950	a900	1,480	.....	5,800	2,100
15	5,500	5,100	10,350	6,420	a8,280	4,100	.....	680	1,330	.....	5,530	2,470
16	(a)	4,600	10,350	6,420	.....	.....	.....	850	1,330	a1,770	5,300	2,650
17	3,280	6,750	10,550	(a)	.....	3,770	(a)	850	1,760	1,630	5,200	.....
18	5,400	7,080	10,350	6,080	7,370	3,770	.....	850	a1,200	1,770	5,050	a2,850
19	5,400	7,080	10,350	5,900	7,370	a3,500	.....	850	1,200	1,770	.....	2,650
20	5,400	(a)	(a)	6,700	.....	3,500	.....	850	1,200	1,950	a5,050	2,850
21	6,150	7,350	10,350	6,000	.....	3,500	.....	a760	1,200	1,950	5,050	3,900
22	6,400	7,350	10,550	5,900	(a)	3,300	.....	900	1,200	.....	5,300	4,580
23	(a)	7,750	10,550	5,900	6,850	3,300	.....	850	1,200	a2,460	4,900	5,650
24	7,880	8,150	10,350	(a)	.....	3,170	(a)	760	1,330	2,850	4,770	.....
25	7,880	8,150	10,350	8,080	.....	.....	.....	830	a1,400	2,850	4,770	a5,800
26	5,950	8,150	10,200	8,500	6,670	(a)	.....	1,480	930	2,920	.....	5,800
27	7,600	(a)	(a)	8,960	.....	.....	.....	1,320	1,330	3,050	a4,580	5,650
28	6,550	7,880	9,880	9,100	.....	2,970	.....	a1,320	1,200	3,360	4,580	4,770
29	6,550	.....	9,880	8,900	(a)	2,850	.....	1,320	1,330	3,250	4,350	5,300
30	(a)	.....	9,750	8,850	.....	2,780	.....	1,130	1,400	(a)	4,350	5,300
31	4,550	.....	9,750	.....	6,550	.....	(a)	1,130	.....	3,250	.....	.....
Mean	4,896	6,238	9,898	7,578	8,161	8,331	1,834	925	1,377	2,018	4,452	3,899

a Sunday.

Daily discharge, in second-feet, of Oswego River at high dam near Oswego, New York, for 1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	a4,450	2,750	3,670	6,300	9,600	5,370	.....	580	670	a540	1,100	650
2	4,020	2,570	3,900	(a)	9,600	5,370	a1,000	650	.....	650	1,100	.....
3	4,450	2,750	4,120	6,550	9,600	.....	.....	650	a450	650	1,350	a980
4	5,170	.....	4,120	6,550	.....	a4,400	1,000	650	580	580	.....	980
5	.....	a2,370	a5,050	6,550	8,650	4,400	1,000	.....	540	580	a1,350	780
6	5,580	2,370	850	6,550	.....	3,950	780	a650	510	580	1,500	980
7	4,700	2,300	5,300	6,300	a6,950	1,230	650	650	650	.....	1,350	900
8	a4,100	1,070	4,800	.....	8,080	1,000	.....	545	540	(a)	980	980
9	3,250	530	4,580	a8,530	7,520	780	a1,000	650	.....	540	1,350	.....
10	3,050	630	4,580	8,250	6,960	.....	900	580	a2,670	540	980	a1,360
11	3,250	.....	.....	8,530	6,960	a900	1,000	650	510	540	.....	1,100
12	3,250	a630	a5,050	8,800	.....	900	780	.....	450	540	a1,350	1,980
13	3,900	1,630	5,050	8,800	.....	720	780	a580	520	480	980	1,100
14	.....	1,950	4,800	8,550	a6,150	1,800	650	540	650	510	1,100	1,500
15	a5,530	2,370	4,900	.....	6,150	1,800	.....	580	480	(a)	980	1,500
16	5,650	2,660	5,050	a8,530	6,420	1,800	a900	650	450	510	980	.....
17	5,650	2,470	4,900	8,530	6,420	.....	720	650	(a)	480	980	a2,500
18	5,280	.....	.....	8,530	6,420	a1,800	650	450	.....	580	.....	2,500
19	5,170	a2,470	a4,580	8,250	6,150	1,650	650	.....	480	460	a1,100	2,700
20	5,280	2,750	4,580	8,530	.....	1,650	650	a450	540	540	980	2,500
21	.....	2,850	4,700	7,670	a6,150	1,500	580	540	450	.....	1,100	2,700
22	a4,780	3,260	.....	.....	6,150	1,500	.....	650	480	a650	980	2,500
23	4,780	3,260	5,050	a7,550	6,150	1,230	a650	580	.....	650	980	.....
24	4,580	3,260	4,900	7,200	6,150	.....	650	540	a450	650	.....	a2,500
25	5,0s0	.....	.....	6,820	5,630	a1,500	580	580	540	580	.....	2,500
26	5,180	a3,910	a5,650	6,820	5,400	1,800	.....	580	540	540	(a)	1,500
27	2,300	3,800	5,650	6,680	.....	1,500	650	a540	540	650	980	1,500
28	3,050	3,800	5,550	6,820	a5,400	.....	580	540	540	.....	980	1,120
29	a2,300	.....	6,550	.....	5,400	780	.....	990	540	a900	980	780
30	2,650	.....	6,830	a9,900	5,400	720	a580	800	.....	650	780	1,820
31	2,650	.....	6,830	.....	5,400	.....	580	650	.....	650	.....	(a)
Mean	4,252	2,475	4,874	7,684	6,754	2,002	748	612	615	585	1,095	1,612

a Sunday.

Daily discharge, in second-feet, of Oswego River at high dam near Oswego, New York, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,820	2,880	4,140	a11,600	11,480	4.880	a2,000	650	.....	720	1,220	.....
2	1,360	2,880	1,970	12,250	11,150	4,880	1,840	720	a650	780	1,220	a7,450
3	1,360	.....	3,930	12,250	10,550	a4,650	1,060	980	650	780	980	6.950
4	1,820	a4,600	a3,930	12,250	9,900	4,180	1,410	.....	650	780	(a)	8,530
5	1,500	3,700	4,600	12,600	9,600	3,980	2,150	a780	650	780	1,220	8,530
6	.....	3,250	4,600	12,600	a8,980	3,980	3,500	650	720	.....	1,220	8,800
7	a1,820	3,700	4,800	.....	8,980	3,980	.....	650	720	a900	1,220	9,130
8	1,820	5,050	4,600	a17,550	9,900	4,180	a650	720	.....	900	1,500	9,130
9	2,150	5,300	4,600	16,800	8,980	3,500	580	650	a720	900	1,220	a8,250
10	1,820	.....	.....	16,450	8,670	a3,300	460	650	650	900	1,650	8,530
11	1,820	a5,550	a4,140	16,040	8,670	3,300	580	650	650	900	(a)	7,700
12	.....	7,960	4,350	16,040	8,080	3,080	550	a650	580	980	a1,500	7,700
13	.....	6,320	4,140	16,040	(a)	3,080	510	650	580	.....	.....	7,200
14	a1,970	7,130	4,350	.....	8,080	3,0s0	.....	.....	580	a720	1,500	6,400
15	1,970	6,320	4,350	a15,330	7,800	2,880	a780	980	.....	720	1,500	.....
16	1,650	6,850	4,140	14,940	7,250	.....	720	580	a650	780	1,500	a5,880
17	.....	6,050	.....	14,940	7,250	a3,500	780	650	580	780	.....	4,850
18	2,720	a6,050	a3,930	14,600	6,950	2,880	780	.....	580	980	a1,500	6,120
19	3,250	.....	4,140	14,250	.....	2,700	780	a650	580	.....	1,500	5,880
20	.....	5,050	4,140	14,600	a6,420	2,700	780	720	780	780	1,650	5,880
21	a6,320	5,050	4,600	.....	6,420	2,500	.....	650	780	a780	1,820	5,880
22	6,600	5,350	5,300	a14,250	5,900	2,320	a780	650	.....	780	1,650	.....
23	6,320	4,600	5,550	13,850	6,420	.....	720	580	a780	980	1,650	a6,660
24	5,800	.....	6,600	13,850	5,900	a2,320	720	580	550	900	.....	6,120
25	5,550	a1,970	a6,320	12,780	5,530	1,840	900	.....	720	780	a2,880	6,400
26	2,880	1,360	6,600	12,450	5,150	2,000	780	a720	780	900	5,050	6,400
27	.....	2,880	6,600	12,450	a5,150	2,000	720	580	780	.....	5,800	6,400
28	a4,140	1,820	6,8s0	.....	5,150	2,000	720	580	.....	a900	5,800	6,120
29	3,700	.....	7,670	a12,100	4,880	2,000	a580	550	.....	980	6,850	.....
30	3,700	.....	8,820	11,780	4,880	2,000	580	550	a720	980	6,850	a5,880
31	.....	.....	.....	.....	.....	.....	650	650	.....	980	.....	5,880
Mean	3,077	4,653	4,991	14,025	7,645	3,132	966	669	670	853	2,418	6,990

a Sunday.

SALMON RIVER ABOVE PULASKI, NEW YORK.

A current-meter station was established on this stream September 5, 1900. It is located at a highway bridge 2 miles from the village of Pulaski. The stream bed is of gravel, the banks are bold, and the channel bottom is nearly flat. The gage board is attached to the center pier of the bridge, and readings are taken twice daily, at 6 a. m. and at 7 p. m. The mean of the two observations for each day is given in the table. A current-meter measurement made on September 4 showed a discharge of 103 second-feet. The mean gage reading during the measurement was 1.03 feet. There are 3 dams at Pulaski, furnishing power to 14 establishments. The total effective head obtained varies, with the stage of the stream, from 24 feet to 36 feet.

There is an undeveloped power, with a precipitous fall of 110 feet, at Salmon Falls. In November, 1898, a gaging station was established by the United States Board of Engineers on Deep Waterways 1 mile above these falls, but it was abandoned in June, 1899. A description of the station will be found in Water-Supply Paper No. 36, page 190. The drainage above the abandoned gaging station is 191 square miles, while that above the bridge station near Pulaski is 264 square miles.

Additional information regarding this river will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily gage height, in feet, of Salmon River above Pulaski, New York, for 1900.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.60	1.20	2.50	17	1.00	1.40	1.50	1.30
2	.....	1.50	1.20	2.30	18	1.00	1.40	1.70	1.30
3	.....	1.35	1.85	2.20	19	1.00	1.35	2.55	1.60
4	.....	1.25	1.80	2.50	20	1.00	1.35	4.20	1.95
5	1.00	1.20	1.75	2.75	21	2.15	1.30	4.30	1.40
6	1.00	1.05	1.90	2.45	22	2.25	1.25	3.65	1.45
7	1.00	1.10	1.90	2.30	23	1.75	1.25	3.10	1.60
8	1.00	1.35	2.75	2.15	24	1.65	1.45	2.45	2.25
9	1.00	1.85	2.55	1.65	25	1.55	2.00	2.50	2.50
10	1.00	1.80	2.25	1.50	26	1.35	1.95	3.50	2.40
11	.90	1.60	1.90	1.50	27	1.25	1.85	4.70	2.20
12	.90	1.50	1.90	1.40	28	1.25	1.85	3.75	2.20
13	.90	1.40	1.80	1.40	29	1.25	1.70	3.35	2.10
14	.90	1.40	1.80	1.40	30	1.45	1.75	2.55	2.20
15	.95	1.30	1.70	1.35	31	.....	1.75	.....	2.30
16	1.00	1.40	1.50	1.30					

MOOSE RIVER AT MOOSE RIVER, NEW YORK.

On June 5, 1900, a gaging station was established on this stream at Moose River, 4 miles below the McKeever railroad station. The section of the channel chosen to be spanned by a cableway has a width of 225 feet, with a nearly flat gravel bottom. A vertical gage board was attached to a pile driven out in the stream beyond the low-water margin and protected from ice and logs by a floating boom anchored upstream.

Moose River is characterized throughout its entire course by rifts

and rapids. Topographically the watershed is rocky, precipitous, and mostly timbered. The drainage area above the gaging station is 346 square miles. An area of 41 square miles in the headwaters is subject to regulation by storage, controlled by a State dam at Old Forge, at the foot of the Fulton Lakes. There are numerous undeveloped water powers on the stream, including two falls near Lyonsdale, where a head of 30 or more feet might be obtained, and another (Millers Falls) of nearly equal height below the town of Moose River. Water power is developed at 8 dams, a total fall of 225 feet being utilized, the aggregate capacity of the turbines installed being more than 7,000 horsepower.

No current-meter measurements have thus far been made. Gage readings are taken twice daily, morning and evening, and the mean of the two readings for each day is given in the accompanying table.

Additional information in regard to this river will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily gage height, in feet, of Moose River at Moose River, New York, for 1900.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.50	0.85	0.90	0.70	1.15	17	0.92	0.80	1.20	0.70	0.75	2.05
2	.....	.60	.70	.80	.75	1.20	18	.65	.75	1.00	.65	.60	2.30
3	.....	.25	.70	.65	.80	1.05	19	.60	.85	.85	.60	.65	1.70
4	.....	.35	.60	.55	.70	.95	20	.80	.90	.60	.55	.75	3 95
5	2.00	.30	.50	.60	.60	.85	21	.95	.80	.60	.80	.75	4.45
6	1.55	.35	.55	.55	.60	1.10	22	.90	.65	.60	1.20	.70	4.10
7	1.25	.70	.60	.55	.60	1.10	23	.80	.55	.50	1.55	.70	3.70
8	1.20	.85	.55	.60	.65	2.25	24	.70	.60	.45	1.30	1.30	3.35
9	1.95	.75	.55	.65	.60	3.10	25	.80	.85	.55	1.05	2.00	3.20
10	1.55	.70	.60	.70	.60	2.50	26	.60	3.05	.65	.90	1.65	3.05
11	1.40	.65	.70	.55	.65	1.75	27	.40	1.85	1.75	.90	1.30	3.65
12	1.20	.90	.65	.55	.55	1.15	28	.30	1.20	2.00	.85	1.30	3.75
13	1.08	.90	.80	.55	.45	.95	29	.50	.90	1.35	.70	1.25	3.55
14	1.05	.80	1.80	.50	.45	.90	30	.55	.75	1.40	.80	1.25	3.20
15	.82	.75	1.75	.40	.70	1.25	31	.....	.70	.95	.....	1.30	.....
16	1.05	.70	1.25	.70	.85	1.75							

BEAVER RIVER, NEW YORK.

Beaver River rises in the western part of Hamilton County, crosses Herkimer County, and emerges from the Adirondacks at the town of Number Four, on the Lewis County line. The flow from the tributary watershed above Beaver, comprising an area of 153 square miles, or 47.5 per cent of the entire drainage area, is regulated by storage in the Beaver Flow or Stillwater, an artificial lake formed by a timber dam 16 feet high. In addition to the reservoir formed by the State dam at Beaver, there are within this region more than 50 natural lakes, including Red Horse Chain, so that a comparatively uniform flow is maintained throughout the summer season.

An examination of Beaver River with reference to facilities for gaging was made early in July, 1900. The almost continuous rapids in the upper reaches of the stream limit the desirable sites for gaging stations to the stream channel below Beaver Falls, 4 miles from its confluence with Black River at Castorland. Arrangements were

made for the establishment of a cable station, but owing to the presence of log rafts in the stream during the greater portion of the summer the record has not yet been started.

From the State dam at Beaver to the town of Number Four, a distance of 10 miles, the stream consists of numerous bowlder rapids, alternating with short stretches of smooth water. Above Beaver Lake there is a high fall, forming a descent of 60 feet within a distance of 400 or 500 feet. From the foot of Beaver Lake to Belfort, a distance of 12 miles, the stream channel continues rocky and precipitous, although the adjacent watershed is sandy and for the most part covered with timber. Eagle Falls, 2 miles below Beaver Lake, consists of a series of cascades, aggregating a descent of 75 feet. There are a number of other undeveloped water powers in this vicinity.

Water power is developed at Beaver Falls, at Croghan, and at Belfort, aggregating 4,400 horsepower, at five dams, and utilizing a fall of 133 feet. There is also an abandoned power at Tisses Falls, below Belfort, where a total head of 60 feet could be obtained. Power is developed at Belfort, under a head of 50 feet, for the generation of electricity which is transmitted to adjacent towns, a distance of 16 miles.

Rainfall and other meteorological records have been kept since January, 1889, at Number Four, in the heart of the timber-covered portion of the watershed.

Additional information regarding this river will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

BLACK RIVER AT HUNTINGTONVILLE DAM, NEAR WATERTOWN, NEW YORK.

A description of this station, including tables of daily gage heights, will be found in Water-Supply Paper No. 36, page 191. The entire flow of Black River at this point, aside from leakage and a slight diversion for the municipal water supply of Watertown, passes over the Huntingtonville dam. Two or more readings of the crest gage are taken daily, and the mean of the readings from midnight to midnight has been used in estimating the mean daily flow. In computing the flow over the dam, an allowance of 200 second-feet has been made for leakage through seams and crevices in the limestone rock underlying the dam. This amount has been arrived at from an estimate of the size of the orifices and the head on the same, when the water was drawn down in the summer of 1897.

There is no way to check direct the flow during high water immediately below the dam, but a current-meter measurement was made at Glenpark Bridge on June 6, 1900, which gave a total flow of 2,175 second-feet.

The mean daily flow for the years 1897, 1898, 1899, and 1900 is given

in the accompanying tables. It does not represent the total water-yielding capacity of the tributary drainage area, inasmuch as a portion of the flow from the headwaters is diverted to the Forestport feeder to supply Black River Canal. Storage reservoirs, to compensate water-power users, are maintained by the State of New York on Beaver and Moose rivers, the principal tributaries of Black River. Owing to flood-water storage, diversion, and the effect of mills starting and stopping irregularly, the regimen of this stream is far from natural. Measurements of the amount of diversion of Black River below Forestport reservoir have been made by Mr. E. C. Murphy, for the New York State canal survey.

The highest water observed while the record has been kept was on the morning of April 21, 1900, the reading of the crest gage being 108.41 feet, and the corresponding flow 30,150 second-feet, equivalent to a flow of 16 second-feet per square mile of tributary drainage.

This stream is of great importance as a source of water power, having 22 dams in its lower stretch of 18 miles, furnishing, in round numbers, 60,000 horsepower to 80 mills along its banks, which employ an aggregate of 3,900 persons.

Additional information will be found in Water-Supply Paper No. 47, pages 37 to 41, in a paper entitled "Methods employed in the gaging of New York streams during the year 1900."

Daily discharge, in second-feet, of Black River at Huntingtonville dam, New York, for 1897.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.	Dec.
1	.....	1,220	5,050	8,550	3,362	978	a1,710	.....	598	6,812
2	.....	.....	5,170	a7,692	2,865	956	1,606	.....	872	5,850
3	.....	.....	5,850	6,514	2,300	1,066	1,580	.....	1,738	2,835
4	.....	.....	a6,176	5,890	2,835	a890	1,292	.....	2,610	2,455
5	.....	2,060	8,020	6,602	3,328	782	990	.....	2,362	a3,420
6	.....	2,865	8,650	6,218	a3,095	646	782	.....	1,850	4,665
7	.....	a3,230	9,590	5,970	2,579	1,066	630	.....	a1,850	5,290
8	.....	3,396	10,916	4,739	2,300	710	a362	.....	2,120	5,490
9	.....	3,600	11,540	a3,705	2,000	678	536	.....	2,150	5,770
10	.....	4,230	11,540	2,900	4,484	746	630	.....	2,800	5,850
11	.....	5,650	a10,500	2,900	6,176	a536	2,930	.....	4,374	7,428
12	.....	5,970	8,750	2,455	6,428	582	6,812	.....	4,411	a7,692
13	.....	6,602	7,340	2,515	a5,970	836	7,252	.....	4,850	7,120
14	.....	a6,260	6,856	3,029	4,411	614	5,850	1,044	a4,020	6,680
15	.....	5,650	7,120	4,592	3,362	1,110	a3,420	1,220	3,670	7,252
16	.....	5,130	7,924	a5,170	2,770	1,198	2,362	2,455	3,029	8,068
17	.....	4,300	8,850	4,665	2,424	1,110	1,710	a854	4,125	8,500
18	.....	3,950	a9,240	4,125	2,030	a1,000	2,000	1,176	5,170	8,308
19	.....	3,880	9,690	3,328	1,658	934	2,424	1,110	5,210	a6,092
20	.....	2,240	9,390	3,062	a1,460	978	1,804	956	3,950	3,420
21	.....	a8,600	9,690	2,485	2,090	1,000	1,292	854	a2,930	3,195
22	1,460	8,550	9,290	2,642	2,706	890	a1,022	800	3,362	3,195
23	1,460	10,916	8,280	a3,095	2,270	728	978	782	2,835	3,130
24	2,610	16,500	7,648	2,424	1,804	630	694	a480	2,150	2,770
25	1,850	4,250	a9,144	2,515	1,388	a480	522	956	1,850	2,393
26	3,420	12,080	11,176	3,950	1,198	1,000	566	746	3,396	a2,515
27	.....	10,760	12,640	4,776	a978	934	582	782	6,218	2,270
28	.....	a7,924	14,142	4,374	1,198	890	322	854	a9,144	2,180
29	.....	6,176	13,806	4,020	978	1,220	a1,254	710	9,890	2,060
30	.....	5,450	10,552	a3,775	934	1,940	.....	710	8,116	2,000
31	.....	5,450	.....	3,600	.....	2,000	.....	a678	.....	1,804
Mean	2,160	6,317	9,484	4,267	2,713	879	2,280	954	4,155	4,725

a Sunday.

NOTE.—No record from September 1 to October 13, inclusive.

Daily discharge, in second-feet, of Black River at Huntingtonville dam, New York, for 1898.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,738	2,770	2,300	7,340	a4,411	2,770	1,436	1,110	1,244	1,556	3,095	2,548
2	a2,270	2,930	2,610	6,646	3,362	2,362	1,316	1,580	1,220	a1,022	2,706	2,455
3	1,940	2,835	2,300	a5,050	3,530	2,030	a872	1,132	1,110	1,088	2,610	2,455
4	2,000	2,610	2,300	3,950	3,705	1,804	800	1,292	a330	1,110	2,393	a2,240
5	2,120	2,770	2,150	3,600	3,915	a1,738	1,110	1,460	1,340	1,412	2,300	2,300
6	2,000	a2,455	a2,150	3,600	4,776	1,556	1,088	1,880	1,766	2,770	a2,210	2,240
7	1,850	2,610	2,150	3,420	4,411	1,532	1,176	a1,710	1,684	3,420	3,095	1,940
8	1,580	2,610	2,210	3,362	a3,420	1,340	1,022	1,580	2,060	2,865	2,930	1,804
9	a1,850	2,455	2,674	3,095	2,770	1,176	956	1,244	1,940	a1,910	2,930	1,658
10	1,804	2,300	3,420	a3,029	2,930	1,244	a728	1,110	1,804	1,940	2,930	1,684
11	1,804	3,195	6,386	3,029	2,455	1,484	836	1,110	a1,460	1,684	8,404	a1,532
12	1,766	3,900	12,360	2,800	1,940	a1,292	1,000	1,176	1,484	1,364	9,240	1,804
13	3,029	a8,164	a18,200	2,642	3,600	1,340	1,000	1,340	1,292	1,292	a9,144	1,804
14	4,300	7,340	23,300	2,706	3,800	1,804	978	a1,268	956	1,606	8,750	1,850
15	4,665	6,470	27,900	2,930	a3,328	2,150	1,000	630	1,000	2,706	7,472	1,850
16	a4,448	5,450	23,700	2,900	2,642	2,030	1,000	1,244	890	a3,500	6,176	1,880
17	4,265	4,484	17,950	a2,548	2,610	1,804	a956	1,000	872	4,411	4,592	2,000
18	3,880	3,950	14,800	2,240	2,362	1,532	1,000	890	a508	3,775	3,880	a1,850
19	3,530	3,600	13,750	2,548	2,150	a1,154	1,436	956	800	2,996	3,360	1,940
20	3,420	a3,362	a12,304	2,865	2,548	1,850	1,154	934	818	2,706	a2,963	2,090
21	4,300	3,775	12,804	3,775	2,865	2,150	1,220	a956	1,132	2,674	3,294	2,090
22	5,650	3,985	13,582	4,265	a2,706	2,000	1,220	818	1,044	2,963	3,294	2,548
23	a5,650	3,915	13,032	5,250	2,424	1,804	1,220	1,110	890	a4,374	3,029	4,230
24	6,176	3,600	11,280	a6,386	2,548	1,658	a934	2,150	1,460	5,480	3,294	5,610
25	5,970	3,230	9,390	7,252	2,770	1,340	1,292	2,610	a2,738	4,592	2,800	a5,450
26	5,530	2,930	8,260	8,950	2,865	a1,220	2,000	3,095	2,865	4,055	2,548	5,130
27	4,739	a2,770	a6,900	10,140	3,775	1,066	1,710	3,130	2,770	5,570	a1,658	4,300
28	3,950	3,095	6,176	9,690	4,055	1,340	1,340	a2,706	2,393	6,680	2,030	3,420
29	3,396	-------	6,302	7,780	a3,362	1,316	1,364	2,000	2,770	6,558	2,331	3,095
30	a2,900	-------	7,340	5,850	3,230	1,292	1,292	1,460	1,850	5,250	2,610	3,705
31	2,930	-------	7,924	-------	3,130	-------	a1,508	1,658	-------	3,950	-------	4,813
Mean	3,402	3,806	9,609	4,654	3,174	1,639	1,128	1,495	1,483	3,138	3,932	2,720

a Sunday.

Daily discharge, in second-feet, of Black River at Huntingtonville dam, New York, for 1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4,230	1,940	3,565	4,125	18,000	3,095	1,460	956	978	a 956	2,240	1,176
2	3,985	2,090	3,260	a 3,915	16,150	2,393	a1,022	1,000	1,244	956	3,420	1,198
3	3,396	2,030	3,230	3,800	14,800	2,240	1,000	1,110	a 630	1,460	4,055	a1,412
4	3,600	2,000	3,328	3,565	13,694	a1,804	956	1,000	1,110	1,340	3,230	2,090
5	10,396	a2,000	a3,880	3,600	12,080	1,658	1,388	854	480	1,176	a2,900	2,060
6	9,740	2,000	5,170	3,985	9,490	1,710	1,436	a 678	1,000	1,022	2,706	1,658
7	8,750	2,000	5,970	4,520	a7,516	1,658	1,580	800	890	1,022	2,393	1,460
8	a8,750	2,000	5,530	6,900	5,090	1,532	1,460	890	1,022	a 678	1,850	1,220
9	7,972	2,000	5,090	a 8,116	4,125	1,340	a1,176	1,000	1,066	1,044	1,832	1,198
10	6,812	1,984	4,592	8,308	3,705	1,532	1,880	854	a1,022	854	1,460	a1,110
11	5,450	1,850	4,125	8,950	3,362	a1,220	1,340	728	1,220	956	1,412	1,658
12	4,484	a1,984	a5,210	10,656	3,705	1,532	2,150	678	678	800	a1,066	4,850
13	4,055	2,240	8,164	11,072	3,880	1,340	1,738	a 710	1,340	818	1,436	8,404
14	3,950	2,240	8,020	12,136	a3,260	1,340	1,532	728	630	818	1,132	8,404
15	a4,702	2,240	7,736	13,694	2,930	1,132	1,412	1,044	694	a 818	1,220	7,928
16	5,810	2,150	6,900	a13,806	3,029	1,460	a1,022	1,110	1,176	694	1,364	5,650
17	5,890	2,210	6,680	14,086	3,095	1,460	934	1,066	a 764	1,000	1,460	a2,706
18	5,450	1,984	5,850	14,086	3,705	a1,460	1,000	1,606	1,220	978	1,460	3,294
19	5,250	a1,850	a5,250	14,700	3,029	1,658	1,292	1,000	1,176	1,044	a1,066	4,702
20	3,095	2,000	4,629	17,400	3,775	1,340	956	a 710	710	1,088	1,110	5,450
21	3,740	2,090	4,665	20,900	a4,484	1,220	956	522	800	854	1,244	6,470
22	a3,362	2,362	4,629	24,400	4,337	1,220	1,000	1,000	1,066	a 522	1,176	6,680
23	3,195	2,963	4,665	a24,950	3,775	1,220	a 978	890	710	1,000	1,066	5,050
24	2,930	3,465	5,050	25,000	3,500	1,340	1,220	854	a 630	956	1,198	a4,337
25	2,770	3,420	4,930	24,850	2,900	a1,268	1,340	1,244	1,198	1,066	1,110	4,300
26	2,900	a3,095	a4,776	24,950	2,424	1,292	1,132	1,110	1,110	1,110	a 782	2,930
27	2,610	3,420	4,592	24,300	2,485	1,532	1,044	a 854	1,198	1,110	1,088	2,548
28	2,393	3,530	4,230	23,450	a2,393	1,340	1,088	872	1,198	1,110	1,132	2,300
29	a2,000	-------	4,090	22,250	2,362	1,176	836	890	1,198	a1,066	1,066	2,240
30	2,300	-------	4,592	a20,350	3,362	1,340	a 550	1,000	1,532	1,292	912	2,240
31	2,120	-------	4,195	-------	3,420	-------	458	956	-------	1,940	-------	a1,804
Mean	4,712	2,326	5,051	13,894	5,609	1,528	1,205	897	990	1,018	1,652	3,501

a Sunday.

Daily discharge, in second-feet, of Black River at Huntingtonville dam, New York, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,766	2,300	2,865	a3,800	11,280	2,000	a978	1,340	1,240	780	1,610	9,900
2	1,710	2,300	2,610	4,265	11,020	1,710	978	1,110	a1,200	1,440	1,535	8,000
3	1,710	2,240	2,579	5,370	10,812	2,000	1,000	1,220	1,010	1,200	1,440	6,400
4	1,710	a2,060	a2,770	6,050	9,740	a2,060	854	1,000	(b)	960	1,120	5,650
5	1,710	2,060	2,770	7,384	9,000	2,200	1,000	a854	.....	1,120	1,370	5,700
6	1,710	2,150	2,930	7,560	a7,780	2,000	1,110	694	.....	1,200	1,120	5,650
7	a1,710	2,200	2,865	9,740	6,900	2,150	1,110	1,000	.....	a780	1,245	5,700
8	2,300	2,150	2,674	a12,192	6,050	2,424	a764	1,154	.....	1,010	.....	4,900
9	2,362	4,850	2,930	10,760	5,650	2,579	1,268	690	(a)	960	.....	4,180
10	2,362	5,850	2,930	10,760	6,602	2,485	1,244	820	.....	1,240	.....	3,300
11	2,240	a5,770	a2,674	10,240	7,560	a2,610	1,340	780	760	980	2,990	3,460
12	2,150	5,250	2,930	10,344	6,050	2,000	1,268	a1,610	740	870	2,895	3,145
13	2,270	6,344	2,674	9,490	a5,770	2,030	1,532	1,010	780	780	2,475	2,990
14	a1,710	11,458	2,610	7,340	5,650	1,766	1,580	1,490	780	a580	2,120	2,780
15	1,940	12,304	2,610	a6,386	5,250	1,580	a1,198	1,730	740	820	2,250	3,080
16	1,850	14,030	2,610	7,208	5,250	1,580	1,460	1,680	a390	780	1,485	2,200
17	1,580	13,470	2,610	9,096	5,650	1,268	1,220	1,535	740	1,010	1,780	2,780
18	1,710	a11,280	a2,548	10,604	5,530	a1,154	1,268	1,240	1,120	1,050	1,680	2,255
19	1,940	9,590	2,610	20,100	5,250	1,460	1,340	a2,120	1,100	1,050	3,900	2,595
20	2,930	7,924	2,610	27,050	a5,170	1,364	1,766	1,010	1,120	1,050	8,600	2,830
21	a5,930	5,770	2,610	30,000	4,930	1,044	1,580	1,240	980	a740	9,175	2,780
22	6,280	5,130	3,420	a29,500	4,374	1,044	a1,460	1,200	980	960	8,900	2,535
23	5,850	5,130	4,020	27,700	4,265	1,110	1,556	810	a1,055	1,240	8,600	2,535
24	5,770	4,850	3,915	25,200	3,705	1,110	1,766	480	1,240	1,440	7,820	3,640
25	4,850	a4,230	a3,600	23,300	3,161	a1,176	1,340	810	1,780	1,980	6,280	5,450
26	4,125	3,775	3,600	21,750	3,420	1,340	1,220	a500	1,490	2,340	6,680	5,280
27	3,670	3,095	3,260	20,000	a2,706	978	2,150	780	1,295	2,120	9,900	4,900
28	a3,420	2,996	3,260	17,050	2,485	836	1,850	780	1,200	a1,605	12,250	4,220
29	3,195	.....	3,260	a14,800	2,150	764	a1,316	1,780	915	1,860	13,900	3,810
30	2,865	.....	3,260	12,752	2,000	1,044	1,268	1,440	a800	1,885	12,250	.....
31	2,548	.....	3,465	.....	1,904	.....	1,176	1,240	.....	1,935	.....	.....
Mean	2,834	5,734	2,970	13,926	5,711	1,630	1,321	1,134	1,020	1,218	5,014	4,230

a Sunday. *b* Sluice gates open.

GRAND RIVER, MICHIGAN.[1]

This is the largest stream in the State. Its drainage basin, which includes a total area of 5,572 square miles, is situated in the central portion of the lower peninsula, and drains into Lake Michigan. It lies in the southern border of the pine belt and is for the most part cleared. Occasional tracts of forest remain, however, as, for example, Slocum's Grove, in Muskegon County, which forms a part of the drainage basin of Crockery Creek, and contains between 4,000 and 5,000 acres of hard-wood and hemlock timber, now being lumbered. The basin is overlain with glacial drift deposits, including sand, clay, overwash, gravel, and till, with outcroppings of rock at rare intervals. A stratum of limestone, said to be 52 feet thick, appears in the east side of the bed of Grand River at Grand Rapids, 100 feet above the Pearl street bridge. It dips in a northeasterly direction, at a slope of 50 feet to the mile, and does not appear in the west side canal. The watershed receives an annual rainfall varying from 25 inches in the region of the headwaters to 30 or 35 inches near the mouth of the river. From the foot of the rapids formed by the limestone ledge at Grand Rapids to the mouth of the river at Lake Michigan the flow is

[1] Report of Robert E. Horton.

very sluggish; the fall in this portion is given below, from levels run by Mr. Fred Morley, United States assistant engineer.

Fall of Grand River between Grand Rapids and its mouth.

Section.	Distance.	Fall.
	Miles.	*Feet.*
Grand Rapids to Grandville	6.0	2.85
Grandville to Lamont	11.5	2.92
Lamont to Grand Haven	21.64	0.43
Total	39.14	6.20

In the upper half of this stretch of the river the immediate banks of the stream are high, sometimes forming natural levees at elevations greater than that of the adjacent flood plain. Mr. Morley states that below Lamont bayous and low swamps are common between the river banks and the foothills bordering the valley. The valley as a whole is narrow; gravel bluffs from 50 to 60 feet high occasionally stand close to the stream. The river below Grand Rapids has been adjudged navigable, and a project has been formed for its canalization, the plan being for a waterway, with a navigable depth of 10 feet, connecting the city of Grand Rapids with Lake Michigan.

The drainage areas of the main stream and its tributaries at various points are given in the following table:

Drainage areas of Grand River and its tributaries.

Stream.	Location.	Area.
		Sq. mi.
Grand River	Above Lansing	756
Red Cedar River	Above mouth	472
Grand River	Below mouth of Red Cedar River	1,229
Do	Above Portland	1,404
Lookingglass River	Above mouth	306
Grand River	Below mouth of Lookingglass River	1,710
Do	Above Lyons	1,748
Maple River	Above Maple Rapids	459
Do	Above mouth	919
Grand River	Below mouth of Maple River	2,667
Do	At Ionia	2,818
Do	Above Lowell	2,971
Flat River	At mouth	602
Grand River	Below mouth of Flat River	3,573
Thornapple River	Above mouth	824
Grand River	Above Grand Rapids water-power dam	4,883
Do	Above mouth	5,572

The watershed is comparatively flat. The total fall of the river from the extreme headwaters to the mouth, a distance of more than 200 miles, is about 350 feet.

Fall and slope of Grand River.

Location.	Elevation above mean tide.	Approximate fall.		Approximate distance.	
		To mouth of stream.	Between points.	From mouth.	Between points.
	Feet.	*Feet.*	*Feet.*	*Miles.*	*Miles.*
Grand Haven	581.3	0.0	0.0	0	0
Grand Rapids[a]	587.5	6.2	6.2	39	39
Lowell	635.0	53.7	47.5	67	28
Ionia	640.0	58.7	5.0	83	16
Portland	710.0	128.7	70.0	106	23
Lansing	825.0	243.7	115.0	138	32
Jackson	915.0	333.7	90.0	192	54

[a] Foot of rapids.

The northwestern and southeastern portions of the watershed are thickly interspersed with small lakes. A considerable number of these have no surface outlets, and their drainage basins do not contribute to the run-off of the river except through ground water.

The water of Grand River is hard. Samples collected on June 20, 1899, showed the following analyses:[1]

Analyses of water from Grand River and tributary streams, in parts per million.

Stream.	Location.	Total residue.	Chlorine.	Free ammonia.	Albuminoid ammonia.	Temporary hardness.
Grand River	Grand Rapids pumping station.	281.6	4.0	0.112	0.320	240
Thornapple River	At Cascade	280.0	4.3	.094	.208	250
Muskegon River	Above Big Rapids	184.0	1.9	.052	.344	170
Bailey Creek (spring fed)		245.6	1.7	.006	.096	225

Grand River serves as a source of water supply to the city of Grand Rapids. The average daily consumption of that city for the year 1899–1900 was 13,693,499 gallons a day, equivalent to a flow of 21.3 second-feet. The population in 1900 was 87,565.[2]

In connection with proposed improvements for navigation, gaging stations have been established at various points on Grand River below Grand Rapids. All gages are set with their zeros at the Lake Michigan datum, 581.28 feet above mean tide of the New York harbor deep-sea levels. Since 1890 observations have been taken at different stages of the stream, notably during high water, with a view to determining its slope. Cross sections have also been made, and these data will, when completed, form a basis for computing the flow of the river by means of Kutter's formula.

[1] Report of Consulting Engineers to Pure Water Commissioners of the City of Grand Rapids Michigan, 1899.
[2] Report of Board of Public Works, Grand Rapids, 1900.

The results of the gage readings for the year 1891, referred to the Lake Michigan datum, are given in the following table:

Gage heights, in feet, of Grand River at various points.

Month.	Mean gage heights.				Highest observed.				Lowest observed.			
	Grand Rapids.	Grandville.	Lamont.	Grand Haven.	Grand Rapids.	Grandville.	Lamont.	Grand Haven.	Grand Rapids.	Grandville.	Lamont.	Grand Haven.
1891.												
January	8.16	4.93	1.81	−0.70	9.74	6.38	2.37	+0.42	7.19	4.08	1.27	−1.28
February	8.95	5.90	2.72	− .93	13.64	10.68	6.67	− .13	7.04	4.28	1.37	−1.68
March	11.91	9.48	5.35	− .79	16.64	14.08	8.87	− .29	8.99	6.18	2.77	−1.53
April	11.45	8.52	4.65	− .47	14.49	11.48	6.87	+ .17	8.29	5.18	2.17	−1.08
May	6.93	3.62	.92	− .35	8.19	5.08	2.17	+ .17	6.24	2.78	.37	− .90
June	6.45	2.99	.66	− .25	6.99	3.78	1.07	+ .72	5.74	2.38	.37	− .69
July	5.77	2.51	.37	− .63	6.49	3.18	.77	+ .27	5.16	2.08	.07	− .91
August	5.33	2.12	.09	− .41	6.34	3.08	.87	+ .02	4.92	1.78	− .13	− .72
September	5.60	2.51	.26	− .32	5.14	3.08	.77	+ .02	5.12	1.73	− .23	−1.29

Float measurements of the flow of Grand River were made by Mr. Morley during the low-water period of 1891, as follows:[1] July 21, 5.52 miles below Grand Rapids; August 18, 16.68 miles below Grand Rapids. Rod floats were run across the stream at intervals of 10 feet, and were timed while passing downstream a distance of 100 feet. From these measurements the minimum flow of 1891 was estimated at 981.5 second-feet, the corresponding stage on the Grand Rapids gage being 5.67 feet.

In addition to the foregoing, Mr. Morley calculated the flow at various stages, from measured slopes and sections, by means of Kutter's formula, with the following results:

Calculated flow of Grand River near Grand Rapids.

Gage height on Grand Rapids gage.	Corresponding gage height at discharge section.	Area of cross section. (A)	Wetted perimeter. (P)	Hydraulic radius— $\frac{A}{P}=R$.	Slope.	Coefficient of roughness.	Mean velocity.	Discharge.
Feet.	*Feet.*	*Square feet.*	*Lineal feet.*		*Feet per foot.*		*Feet per second.*	*Second-feet.*
5.67	2.57	1,205.5	330.0	3.653	0.000035	0.026	0.8142	981.5
7.32	4.24	1,765.4	345.5	5.109	.0000466	.026	1.2187	2,151.0
10.32	7.62	2,961.9	367.5	8.059	.0000559	.026	1.8614	5,514.0
14.32	11.54	4,365.4	392.0	11.136	.000087	.026	2.8363	12,382.0

A nearly continuous record of the stage of Grand River at the Chicago and West Michigan Railroad bridge, 1 mile below the dam in Grand Rapids, has been kept since May 26, 1897. A copy of this record has been furnished by George W. Bunker, United States assistant

[1] Report on Survey of Grand River below Grand Rapids, War Department, 1892.

engineer. The daily gage heights, referred to the Lake Michigan datum, are given in the following tables:

Daily gage height, in feet, of Grand River at Grand Rapids, Michigan, for 1897.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		7.5	6.5		6.2		6.3	6.4
2		6.8	6.5	6.9	6.4	5.9	5.9	6.4
3		7.2	6.5	6.9	6.6	6.0	5.8	6.4
4		7.1		6.7	6.4	6.0	5.9	6.4
5		7.0		6.7		6.0	5.9	
6			6.3	6.6		5.9	6.0	6.8
7		7.0	6.3	6.7	6.1	5.8		6.8
8		6.8	6.3		6.3	5.9	6.1	7.0
9		7.0	5.4	6.8	6.4	5.8		7.0
10		7.0	5.4	6.8	6.4		6.2	7.0
11		6.9		6.7	6.2	5.9	6.3	7.6
12		6.8	6.3			6.0	6.6	
13			6.5	6.6	6.1	6.1	6.7	8.1
14		6.6	6.8	6.4	6.2	6.3		8.2
15		6.6	7.3			6.4	6.6	8.2
16		6.8	7.2	6.4	6.2	6.3	6.8	8.1
17		7.3	7.0	6.4	5.9		7.0	8.0
18		7.0		6.4	6.1	6.1	6.9	7.0
19		6.9	6.7	6.4		6.1	6.6	
20			6.6	6.3	6.2	5.9	6.6	7.2
21		6.9	6.5	6.3	6.2	6.1		7.2
22		6.9	6.5		6.1	6.2	6.6	7.5
23		6.4	6.5	6.2	6.1	6.2	6.6	8.1
24		6.3	6.6	6.2	6.1		6.6	8.4
25		6.3		6.3	6.0	6.0		
26	8.2	6.7	6.5	6.3		6.0	6.7	
27	8.2		6.5	6.3	6.0	5.9	6.7	8.4
28	8.0	6.6	6.5	6.4	6.0	5.7		8.4
29	7.9	6.5	6.9		6.0	5.8	6.7	8.4
30		6.5	7.3	6.6	6.0	6.1	6.5	8.0
31			7.2	6.1		6.1		8.0

Daily gage height, in feet, of Grand River at Grand Rapids, Michigan, for 1898.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		9.8	12.2	14.1		6.8	6.9	6.4	6.6	6.8	7.4	7.8
2		9.7	11.9	13.9	8.1	6.4	7.0	6.4	6.7		7.4	7.7
3	7.9	9.4	11.4		8.1	6.9		6.4	6.6	6.9	7.3	7.7
4	7.9	9.2	10.6	12.4	8.1	6.1		6.5		6.7	7.1	
5	7.4	9.3	10.2	11.6	8.0		6.6	6.6		6.4	7.2	7.5
6	7.4	9.1		11.2	7.9	6.2	6.6	6.5	6.6	6.3		7.5
7	7.4	9.9	9.4	10.7	7.8	6.4	6.7		6.6	6.3	7.4	7.4
8	7.4	9.4	9.2	10.3		6.5	6.5	6.8	6.6	6.5	6.9	7.2
9		9.1	9.6	10.0	7.6	6.6	6.5	6.8	6.6		7.3	7.4
10	6.8	8.9	11.9		7.6	6.6		6.9	6.5	6.7	7.3	7.4
11	6.9	9.8	13.5	9.5	7.4	6.8	6.4	6.8		6.6	7.4	
12	6.7	11.7	15.7		7.3		6.5	6.7	6.2	6.4	7.5	7.9
13	6.9			9.0	7.2	6.7	6.3	6.8	6.2	5.5		8.3
14	7.4	12.5	18.7	8.8	7.1	7.0	6.4		6.4	6.2	7.7	8.2
15	7.6	12.8	19.5	8.4		6.6	6.3	6.7	6.2	6.4	7.9	8.2
16	8.0	13.0	19.7	8.4	6.9	7.2	6.3	6.8	6.8		8.0	8.1
17	8.0	13.1	19.2		6.9	7.4		7.2	6.8	6.7	8.2	7.8
18	7.8	12.9	18.6	8.2	6.8	7.0	6.4	8.1		6.9	8.2	
19	7.8	12.9	18.1	8.2	7.2		6.4	7.5	6.9	6.9	8.4	
20	7.7			8.4	8.0	6.9	6.5	7.5	6.8	6.8		8.1
21	7.9	12.9	17.0	8.4	7.9	6.9	6.4		6.5	7.3	8.7	7.4
22	8.9		16.7	8.5		6.5	6.4	9.1	6.5	7.6	8.8	7.7
23	8.4	13.1	16.6	8.7		6.4	6.4	7.0	6.8		8.8	8.0
24	9.0	13.1	16.4		7.8	6.8		7.0	7.2	7.6		8.3
25	9.2	13.1	15.8	8.8	7.7	7.0	6.4	6.8		7.3	8.2	
26	10.2	13.1	15.2	8.7	7.5		6.4	6.8	7.6	7.5	8.2	
27	9.4			8.8	7.3	7.4	6.2	6.8	7.6	7.6		9.2
28	9.6	12.4	14.2	8.6	7.3	7.3			7.2	7.6	7.8	9.9
29	9.6		13.9	8.5		7.0	6.2	6.8	6.8	7.7	7.9	9.6
30	9.4		14.0	8.3		7.0	6.2	6.6	6.8		7.9	9.2
31			14.2		7.0			6.6		7.6		10.0

Daily gage height, in feet, of Grand River at Grand Rapids, Michigan, for 1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	9.9	14.1	10.0	9.3	8.6	6.0	6.9	6.4	.....	6.6	6.7
2	.....	9.8	14.3	.....	9.4	8.4	.....	6.8	6.4	7.2	7.0	6.7
3	10.0	9.4	14.7	9.9	9.5	8.3	6.2	6.5	.....	6.7	7.0	.....
4	9.3	9.4	15.3	10.4	9.4	.....	.....	.....	.....	6.7	7.0	6.5
5	10.2	.....	.....	11.4	9.7	7.9	7.0	6.8	6.4	6.7	6.8	.....
6	10.3	9.0	14.9	13.1	9.6	7.6	6.7	.....	6.5	6.7	7.1	6.3
7	13.0	8.9	14.6	14.0	.....	7.6	6.8	6.9	6.6	6.8	7.0	6.3
8	.....	.....	14.2	14.6	8.7	7.4	.....	6.6	6.7	.....	6.9	.....
9	12.6	.....	13.0	.....	8.5	.....	.....	6.6	6.7	6.6	6.8	.....
10	12.0	.....	11.9	16.0	8.3	.....	.....	6.5	.....	6.4	6.8	.....
11	12.8	.....	11.4	16.3	8.2	.....	.....	6.6	6.7	6.7	7.0	6.8
12	11.2	.....	.....	16.5	8.2	7.4	.....	6.4	6.6	6.6	.....	7.6
13	11.2	8.1	12.5	16.5	7.6	.....	.....	.....	6.7	6.5	6.9	7.5
14	11.4	8.1	12.8	16.4	.....	.....	6.6	6.5	6.5	6.6	7.0	7.5
15	.....	8.1	13.1	16.2	7.9	7.4	6.9	6.4	6.6	.....	7.0	7.6
16	12.3	8.4	13.3	15.7	7.6	.....	.....	6.5	6.5	6.9	7.2	.....
17	12.4	8.4	13.9	14.9	7.7	6.8	6.9	6.5	.....	6.8	6.8	.....
18	12.4	8.1	13.3	14.2	7.7	.....	6.9	6.4	6.7	6.9	7.2	7.4
19	12.3	.....	.....	13.4	7.7	.....	.....	6.4	6.9	7.0	.....	7.2
20	12.0	9.1	12.2	12.3	7.7	6.5	6.9	.....	6.9	6.8	7.0	7.3
21	11.8	9.4	12.3	11.8	.....	.....	6.6	6.4	6.7	6.8	7.0	7.2
22	.....	.....	12.3	11.1	7.6	.....	6.6	.....	6.9	.....	6.9	7.0
23	10.6	9.4	12.1	.....	7.4	.....	.....	.....	.....	6.9	6.6	.....
24	10.3	9.4	11.3	10.4	7.2	.....	6.8	6.6	.....	6.6	6.6	.....
25	9.9	9.3	11.0	10.0	7.2	6.1	6.7	6.6	7.4	6.5	6.8	.....
26	.....	.....	.....	9.9	7.1	6.2	7.0	6.6	7.6	.....	.....	7.5
27	10.6	13.7	10.5	9.7	7.0	.....	7.1	.....	7.3	.....	6.6	7.4
28	10.0	14.0	10.8	.....	.....	.....	7.0	6.4	7.3	6.8	.....	7.6
29	.....	.....	10.8	9.4	8.1	6.2	6.9	6.3	7.1	.....	6.4	7.6
30	9.8	.....	10.2	.....	.....	.....	.....	6.3	.....	7.2	.....	7.6
31	9.9	.....	.....	.....	8.6	.....	7.1	6.4	.....	7.0	.....	.....

Daily gage height, in feet, of Grand River at Grand Rapids, Michigan, for 1900

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	.....	.....	8.3	16.8	17	.....	12.3	8.9	9.8
2	.....	.....	8.3	16.7	18	.....	11.5	8.7	.....
3	.....	.....	8.1	16.5	19	.....	11.0	8.7	.....
4	.....	.....	7.9	16.3	20	.....	10.6	8.7	.....
5	.....	.....	7.9	16.1	21	.....	10.2	8.7	.....
6	.....	.....	7.9	15.7	22	7.9	.....	8.8	.....
7	.....	.....	7.9	15.1	23	7.9	9.7	9.8	.....
8	.....	11.6	7.9	.....	24	7.7	9.3	11.4	.....
9	.....	14.1	8.1	13.5	25	7.4	9.0	12.2	.....
10	.....	14.6	8.1	12.7	26	7.0	8.7	12.8	.....
11	.....	13.9	7.9	11.8	27	6.7	8.5	13.5	.....
12	.....	13.4	8.0	11.2	28	7.0	8.3	15.4	.....
13	.....	12.8	8.1	10.6	29	8.7	.....	16.7	.....
14	.....	12.7	8.2	10.3	30	8.7	.....	17.0	.....
15	.....	12 8	8.2	.....	31	8.5	.....	17.0	.....
16	.....	12.8	8.2	10.0					

In 1899 the following measurements of the volume of flow of the stream were made under Mr. Bunker's direction. The measurements were made by means of rod floats spaced at intervals of 20 feet across the channel, and timed through a distance of 100 feet.

Discharge measurements of Grand River.

Date.	Location of section.	Elevation of water surface, Lake Michigan datum.	Corresponding stage at Grand Rapids gage.	Mean area of section.	Mean velocity per second.	Discharge.
1899.		*Feet.*	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-feet.*
Apr. 13	Brick House	14.514	16.49	6,131.6	3.061	18,770
Apr. 23	do	8.968	11.09	3,337.6	2.237	7,465
June 19	do	4.048	*a* 6.39	1,437.6	1.377	1,980
June 29	do	3.480	6.17	1,177.0	1.187	1,397
Aug. 31	do	3.301	6.44	751.2	1.210	909
June 16	Lamont	1.077	*a* 7.09	1,699.1	1.206	2,048
June 29	do	.487	6.17	1,402.2	.957	1,342
Sept. 8	do	.....	6.69	1,214.2	.749	910
Apr. 19	Grand Rapids	13.334	13.39	4,091.4	2.584	10,571
June 28	do	6.142	6.14	784.3	1.903	1,492
June 30	do	6.168	6.17	619.5	1.756	1,098

a Approximate; interpolated.

The relation between the various sections is shown in the following table:

Table showing relation between sections on Grand River where discharge measurements were made.

Location.	Distance below Grand Rapids.	Drainage area.	Proportional drainage area at Grand Rapids.
	Miles.	*Sq. miles.*	*Per cent.*
Brick House	4.0	4,961	98.7
Lamont	16.5	5,179	94.6
C. & W. M. R. R. bridge, Grand Rapids	0.0	4,900	100.0

A gaging was made at Grand Rapids on July 13, 1898, by W. M. Mills, C. E., from which the flow was estimated at 1,000 second-feet. The results of all gagings thus far made are summarized in the following table, the results of measurements made below Grand Rapids having been reduced to equivalent flow at the Chicago and West Michigan Railroad bridge:

Table showing discharge of Grand River at Chicago and West Michigan Railroad bridge at Grand Rapids.

Date.	Hydrographer.	Stage at Grand Rapids gage.	Discharge.
		Feet.	*Sec.-feet.*
September 8, 1899	Geo. W. Bunker	6.69	862
August 31, 1899	do	6.44	897
1891	Fred Morley	5.67	981
July 13, 1898	W. M. Mills	6.29	1,000
June 30, 1899	Geo. W. Bunker	6.17	1,098
June 29, 1899	do	6.17	1,270
Do	do	6.17	1,379
June 28, 1899	do	6.19	1,492
June 16, 1899	do	7.09	1,937
June 19, 1899	do	6.39	1,954
1891	Fred Morley	7.32	2,151
1891	do	10.32	5,514
April 22, 1899	Geo. W. Bunker	11.09	7,368
April 19, 1899	do	13.39	10,570
1891	Fred Morley	14.32	12,382
April 13, 1899	do	16.49	18,527

Two gagings of the low-water flow of Thornapple River were made by L. W. Anderson on September 14, 1899, near the mouth of the stream and just above the village of Ada. The velocities were determined by means of both surface and rod floats, which were timed while passing through 100-foot sections. The flow was found to be 155 second-feet, or 0.19 second-foot per square mile from a drainage area of 824 square miles.

Float measurements of Flat River about 7½ miles above its mouth have been made by R. J. M. Danley. Soundings were taken every 10 feet across the channel, and rod floats were put in at the same intervals. The velocity was determined by timing the floats while passing a distance of 200 feet. The drainage area above the point of measurement is 556 square miles, 46 square miles less than at the mouth of the stream.

Discharge measurements of Flat River about 7.5 miles above its mouth.

Date.	Discharge.	
1898.	*Second-feet.*	*Sec.-ft. per sq. mile.*
July 16	215	0.39
July 29	215	0.39
September 5	220	0.40

Mr. Danley states that these measurements represent extreme low water preceded by a period of six weeks with little or no rain.

Arrangements have been made with L. W. Anderson, C. E., for the continuation of gagings of Grand River at Grand Rapids. A gage has been placed at the Fulton street bridge where observations of the stage of the water are taken twice daily. Current-meter measurements of the flow will be made, from which, with the measurements already available, a rating curve for the Grand Rapids cross section can be prepared.

A station has also been established on Grand River at the Schuyler street bridge in North Lansing. The river freezes over through nearly its entire length above Lansing, and in the spring large quantities of ice are brought down. At the point selected for gaging, however, the river does not freeze over, owing to the presence of a dam an eighth of a mile above.

Two miles above the North Lansing gaging station Grand River receives the drainage from Red Cedar River, on which a gaging station was established in January, 1901. The gage is located at the Grand Trunk Railroad bridge on the grounds of the Michigan Agricultural College. The stream is narrow, with gravel bed and without flood plains; the current is moderate.

The station on Red Cedar River, as well as that at North Lansing on Grand River, is under the immediate direction of Prof. H. K. Vedder, of the Michigan Agricultural College.

The drainage areas above the stations are as follows:

Drainage areas above gaging stations.

River.	Location.	Area.
		Sq. miles.
Grand River	Fulton street bridge, Grand Rapids	4,900
Do	North Lansing	1,238
Red Cedar River	Michigan Agricultural College	358

The fall and the power in use at the principal dams on the main river and its branches are given in the following table. There is no storage developed on the stream. The dams are of timber, usually provided with logways, though the logging industry on the river is now practically at an end. During the winter months anchor ice is a frequent source of annoyance to water-power users. The present development involves two power canals which run parallel with the river.

Developed water powers on Grand River and its tributaries.

Stream.	Location.	Number of dam.	Number of mills at dam.	Effective head or fall.			Rated power of water wheels reported.
				Greatest.	Least.	Average.	
				Feet.	*Feet.*	*Feet.*	*Horsepower.*
Grand River	Grand Rapids	1	24	15	6.5	12.5	2,000
Do	Lyons	2	3	9	4.0	7.5	150
Do	Three miles above Lyons.	3	1				
Do	Portland	4	1				241
Do	do	5	2				
Do	Grand Ledge	6	2	9	6.0	7.5	130
Do	do	7	None.				
Do	North Lansing	8	6	9	3.0	7.0	200
Do	Eaton Rapids	9	2	9	5.0	7.5	140
Do	Winfield	10	2				
Do	Jackson	11					
Buck Creek	Grandville	1	1			13.0	400
Rogue River	Childsdale	1	1	18	8.0		418
Do	Rockford	2	1				
Porter Creek	Edgerton	1	1	14	12.0	13.0	52
Thornapple River	Ada	1	2	8	4.0	10.0	32
Do	Alaska	2	2			6.0	90
Do	Labarge	3	1				
Do	Middleville	4	3				
Flat River	Lowell	1	1			8.0	297
Do	Three miles above Lowell.	2	1	12		11.0	466
Do	Alton	3	2				
Do	Belding	4	1				186
Do	Greenville	5	1				
Lookinglass River	Portland	1	2	8	4.0	7.0	203
Red Cedar River	Okemos	1	2				
Do	Williamstown	2	2				

Water power was originally developed at Grand Rapids in 1836 by the construction of a rubble diverting or wing dam on the limestone ledge at the east side of the stream. In 1851–52 a dam was built across the stream and the width of the east side canal was increased to 60 feet, with the intention of providing slack-water navigation past the Long Rapids at this point. In 1866 W. T. Powers purchased the

water privilege on the west side of the stream, and joined with the power users on the east side to build the present timber dam, the crest line of which is 678 feet long. The east side canal is 2,560 feet long and the west side canal 3,750 feet long.

Where the space between the canals and river does not permit of the erection of mills or factories, wheel pits are placed at the river's edge and the power is carried to the mills by telodynamic transmission.

Each canal is entitled to half the flow of the stream. Water privileges on the east side were sold by priority, beginning at the lower end of the canal. The flow in the west side canal, constituting half of the power of the stream, was divided into 66 equal parts or "runs." The net power of one run of stone, at the ordinary stage of the stream and under a head of 12½ feet, has been fixed at 15 horsepower. On this basis the ordinary effective power available at Grand Rapids is estimated at 2,000 horsepower. The power is utilized in the manufacture of furniture, in flour mills, machine, iron, and brass works, and for the generation of electricity. In addition power is transmitted electrically to Grand Rapids from the plant of the Peninsular Electric Company on Flat River, above Lowell. The transmission line is 16 miles long, the tension 10,000 volts.

The foregoing list of water powers does not include a number of rural grist and feed mills on the smaller tributaries, some of them very small, only permitting the mills to run intermittently by holding back the flow as pond storage. Abandoned sites where dams have been washed out are not infrequently found. These were used to supply power for sawmills which have long since ceased to be operative through lack of timber supply.

The fall at Grand Rapids aggregates 18 feet, and the available power could be greatly increased by constructing a new dam, increasing the head, and concentrating the entire flow in one wheel pit, for the generation of electricity. It is estimated that an average of 2,200 horsepower net can be obtained 8 months of the year, from May to December, while during the four spring months a minimum of 3,200 horsepower will be available, with the exception of a few days, when the head will be reduced by backwater to 6 feet or less. The plan contemplates the erection of a 12-foot concrete dam, the construction of a power canal along the stream bed, and the excavation of the tailrace channel 2½ feet below the present bed of the river. It would admit of the filling in of the present power canals and the reclamation of valuable land along the river front.[1]

The available power of the main stream is for the most part utilized. It is stated that a site exists between Lyons and Portland where a head of 12 feet could be obtained by the erection of a dam 10 feet

[1] Report on Development of Water Power, Grand Rapids, Michigan. Rae and Monroe, Chicago, 1899.

high. A dam is also contemplated at Delta, 7 miles downstream from Lansing, where a fall of 7 feet is available.

Four miles above Lowell, Flat River forms a bend 5 miles in circumference. The natural difference in elevation of the stream at the two ends of the loop is 11 feet. By building a dam 20 feet high on the upstream side, and carrying the water across the neck of the bow, a head of 30 feet could be obtained, which would yield a minimum of 1,000 horsepower.

On Rogue River, 1 mile below Childsdale, a dam could be erected which would afford a head of 20 feet. Other unimproved privileges are at Fallassburg on Flat River, where a 12-foot head is available at Ada and Cascade on Thornapple River, and at Maple Rapids and other points on Maple River. There are also two abandoned powers on Buck Creek in the vicinity of Grandville, at each of which a head of 12 to 14 feet could be obtained.

Much of the available power on tributaries of Grand River is, however, of little value, owing to irregular flow, limited supply, and remoteness from population centers.

MUSKEGON RIVER, MICHIGAN.

The drainage basin of this stream lies immediately north of that of Grand River. Originally it was covered with pine timber, but now it is almost entirely cleared. Much of the soil is sand and gravel, unfit for profitable cultivation. Large stump-covered areas form a conspicuous feature of the topography. The drainage areas tributary to the stream are given in the following table:

Drainage areas of Muskegon River and tributary.

Stream.	Location.	Area.
		Sq. miles.
Muskegon River	Above Clam River	787
Clam River	Above mouth	307
Muskegon River	Below Clam River	1,094
Do	Above Big Rapids	1,764
Do	Above Newaygo	2,352
Do	Above mouth	2,663

In March, 1901, a station was established at the dam of the Newaygo Portland Cement Company. This dam crosses Muskegon River in a deep valley above the village of Newaygo. It is of timber, having framed cribs filled with stone. Its height is 21 feet; it rests on a hardpan foundation, and is considered to be practically water tight. It is provided with a main spillway, with logways, and with four floodways. The floodways are provided with Taintor segmental flood gates, which are operated by a traveling crab. A record is kept of the time and amount of opening of the flood gates and logways, as well as of the depth of water on the crests of the spillways. Ordinarily the flood gates and logways are closed, and the entire flow

passes over the main spillway or through the turbines. Water is carried from the pond to the power house by a short headrace separated from the stream channel by a crib breakwater.

The power house contains two pairs of 35-inch Leffel standard turbines on horizontal shafts. The water wheels are connected to electrical generators by endless rope drives. The power will be used for driving machinery in the adjoining cement mills, and the load and consequent discharge of the turbines will be fairly constant. The record kept for the water wheels includes working head, hours run per day, and average width of gate opening for each pair of wheels, as indicated by the Lombard governors.

A gaging of Muskegon River at Big Rapids was made August 27, 1881, by Frederick P. Stearns, civil engineer, and the discharge was found to be 877 second-feet. This amount is taken as the ordinary flow, and is used in partitioning the water power among the several privileges at Big Rapids.

The Newaygo dam is the first one above the mouth of the stream. An effective head of 14 feet is obtained there. Power is also developed at Big Rapids, where there are two dams. The lower dam is a rough timber structure, built with a view to its use in log driving. One hundred and seventy-two horsepower is now in use for the generation of electricity, the head obtained being 8 feet. At the upper dam in Big Rapids power is distributed through two lateral hydraulic canals. The total flow is estimated as equivalent to the discharge through an orifice of 6,758 square inches area under a head of 8 feet, with a coefficient of contraction of 0.7. Each user is entitled to install wheels having a certain number of square inches vent. The head varies from $6\frac{1}{2}$ to 11 feet, the average or ordinary head being 8 or 9 feet. The rated power of the turbines installed is 668 horsepower. It is stated that but 350 horsepower is actually in use. The power utilized at Newaygo and Big Rapids aggregates 1,000 horsepower. Aside from the foregoing, there is no power developed within the drainage basin, except in a small way on certain tributaries.

From the vicinity of Evart to Newaygo, Muskegon River flows between high banks, and has a rapid fall. Levels, which have been run for this purpose, show that within a distance of 10 miles, 5 miles each way from Big Rapids, there is a total fall of 104 feet. Of this 16 feet is now utilized, leaving an available fall of 88 feet. There are favorable sites for the location of dams, so that practically the entire fall could be economically developed. At Rogers's bridge, 6 miles below Big Rapids, surveys have been made for the erection of a dam to give a head of 35 feet.

In connection with power development, good opportunities exist for the conservation of flow by artificial storage. The water-surface areas of the principal lakes of the watershed and of the tributary drainage which they control is given below.

Drainage and surface areas of lakes in Muskegon River watershed.

Lake.	Drainage area.	Water surface.
	Sq. miles.	*Sq. miles.*
Muskrat Lake and group	57	8.0
Clam Lakes	67	6.7
Higgins Lake	67	15.0
Houghton Lake (not including Higgins Lake)	185	31.0
Higgins and Houghton lakes	252	46.0

In the upper portion of the watershed there is a total lake area of about 110 square miles. Formerly a lumbermen's dam was maintained for the purpose of flooding logs between Houghton and Higgins lakes, but this has been washed out. A properly constructed dam at this site would flow an area of 15 square miles and would yield a storage of 400,000,000 cubic feet per foot of depth. A lumbermen's dam, built of logs and earth, which still remains about a mile below the foot of Houghton Lake, raises the water level in that lake 4 feet, providing a storage of, in round numbers, 3,350,000,000 cubic feet. Thomas H. Coughlin, superintendent of the Muskegon Booming Company, states that a dam could be constructed at this site which would admit of a total storage 8 feet in depth and would greatly increase the flooded area over that of the present lake.

HURON RIVER, MICHIGAN.

This river receives drainage from a broad, flat basin interspersed with lakes, situated in southeastern Michigan. The inland basin is connected with Lake Erie by a long, narrow valley, in which occurs a large portion of the fall and available power of the stream.[1] A gaging station has been established at Ann Arbor, under the immediate charge of Prof. J. B. Davis, of the University of Michigan. Current-meter measurements are made from a temporary bridge or by fording. The stream at this point is winding. It flows in a shallow channel, and ordinarily does not overflow its banks. The bed is generally of gravel. The river usually freezes over during the winter, except immediately below the dams. Natural storage in the numerous lakes and marshes regulates the flow to some extent. The character of the watershed has changed somewhat in recent years. Areas of tamarack swamp lands, the soil of which was formerly a quaking bog, have been cleared and drained and are now under cultivation. The drainage area above the mouth of the river is 1,043 square miles; above Ann Arbor it is 841 square miles. A gaging of the bank-full flow of the stream at the Geddes dam, 3 miles below Ann Arbor, was made by Professor Davis, and the estimated discharge was 1,200 second-feet. The Geddes dam has a flat crest and is practically water tight. The

[1] A report on the water power of Huron River, by James T. Greenleaf, C. E., was published in the Tenth Census of the United States, Vol. XVI, Water Power, Pt. I, pp. 443-495.

length of the crest is 200 feet and the depth of water on the crest at the time the measurement was made was 1.7 feet.

THUNDER BAY RIVER, MICHIGAN.

Thunder Bay River is joined by two large branches 8 and 10 miles above its mouth, respectively. These branches, as well as the main stream, are further subdivided at short distances upstream, so that the river is of relatively small magnitude, except for a few miles near its mouth, where occurs the outcrop of the Traverse shales. It is in passing over this rock ledge that the most rapid fall of the stream occurs. The drainage area was formerly heavily timbered with Michigan pine. Most of the pine has, however, been cut, but a large amount of small conifers, hard woods, white birch, and cedar remains, so that the watershed may be considered as representing a forested rather than a cleared area. A record of precipitation is kept at Alpena, near the mouth of the stream. The outcrop of the Traverse and St. Clair shales crosses the watershed in a northeast-southwest direction, crossing the river channel a few miles west of Alpena. The surface above the line of this outcrop is almost continuous limestone, composed of calcium carbonate of 96 to 98 per cent purity, small areas being covered with sand or with thin drift deposits.

No water powers of importance have been developed on either of the branches. On the main stream there are two power dams. The lower one, which is at Alpena, was constructed in 1862. It is 1 mile from the head of Thunder Bay, an arm of Lake Huron. The river is navigable to the dam, forming a harbor. The dam and privileges of the river are owned jointly by the Alpena Waterworks Company and the Alpena Booming Company. The water wheels installed have a rated capacity of 864 horsepower under a head of 9 feet. The power is used for pumping the municipal water supply and for the generation of electricity. The second dam is at the mill of the Fletcher Paper Company, 4 miles above Alpena, and 2,000 horsepower is developed from a fall of 17 feet. The only dams above the Fletcher mills are those used for floating logs. Spruce dam, at Long Rapids, gives a head of 7 or 8 feet. At Lower Rapids a head of 20 feet could be obtained by the construction of a dam.

The drainage basin of Thunder Bay River contains thirty lakes, with an average area of about 1 square mile. In addition to these is Hubbard Lake, which has a water surface of 13.4 square miles. A timber dam at the foot of the latter lake produces a storage depth of 5 feet, with an aggregate storage capacity of 1,867,500,000 cubic feet, equivalent to a flow of 68 second-feet for thirty days. A similar dam at the foot of Beaver Lake gives a storage depth of 6 feet. The water from Beaver Lake is used chiefly for driving logs.

The limestone area contains numerous sink holes, often deep and precipitous. Surface water entering these pits disappears with greater

or less rapidity by finding outlets to a lower level through limestone fissures. Such a pocket, known as Sunken Lake, is located near the north branch of Thunder Bay River, and it absorbed the entire flow of that tributary, involving a considerable loss to power users, until, in 1900, a clay puddle dam was constructed across the channel leading from the stream to the sink hole in such a manner as to turn the water down its original channel. Owing to the pervious nature of the rock strata the effective and apparent boundaries of the watershed may differ materially.

The drainage areas tributary to the stream are as follows:

Drainage areas of Thunder Bay River and tributaries.

Stream.	Location.	Area.
		Sq. miles.
South Branch	Above mouth	454
North Branch	do	199
Thunder Bay River	Above mouth of North Branch	580
Do	Above mouth of South Branch	789
Do	At Alpena	1,267
Hubbard Lake	(Water surface)	134
Do	(Drainage area)	148

A gaging station has been established in connection with the dam and mill of the Fletcher Paper Company. The record kept includes the depth flowing over the main dam and logway and the discharge through the turbines. There are four pairs of Trump Model wheels set on horizontal shafts. The water wheels are not run otherwise than at full gate. The dam, which is of timber crib work filled with stone, is on a limestone rock foundation and is 20 feet high and 454 feet long between abutments. A log slide divides the spillway into two sections. The slide has a channel 6 feet in width and is closed by plank flashboards to an elevation of 1 foot above the crest line. The spillway has a vertical face and a crest 4 feet in width, sloping upstream, with a batter of 1 vertical to 5 horizontal. The upstream face of the dam has a batter of about 3 horizontal to 1 vertical. The left section of the spillway is 255½ feet long. The flat crest is covered with sheet iron, slightly rounded at the lip. The right spillway section is 181.7 feet in length, and the crest is faced with planking.

ST. JOSEPH RIVER, MICHIGAN.

St. Joseph River rises at Bunday Hills, in northern Hillsdale County, Michigan, flows southwesterly into Indiana, turns northward at South Bend, recrosses the State line near Bertrand, and debouches into Lake Michigan at St. Joseph. The total area drained is, approximately, 4,586 square miles, of which 2,916 square miles are in Michigan and 1,670 square miles in Indiana. The drainage basin contains more than 400 small lakes, varying in surface area from an eighth of a square mile to 6 square miles. Of these, approximately 100 are in

Indiana and 300 in Michigan. No storage is developed on the stream. The drainage areas of the river and its more important tributaries are given in the following table:

Drainage areas of St. Joseph River and its tributaries.

Stream.	Location.	Area.
		Sq. miles.
St. Joseph River	Above Three Rivers	863
Prairie River	Above mouth	164
Portage River	do	178
Rack River	do	213
St. Joseph River	Below Three Rivers	1,417
Do	Above Niles	3,616
Dowagiac River	Above mouth	281
St. Joseph River	Below mouth of Dowagiac River	3,898
Do	Above mouth of Pawpaw River	4,157
Pawpaw River	Above mouth	429
St. Joseph River	Below mouth of Pawpaw River	4,586

The drainage basin lies in a completely glaciated region, and is overlain with diversified drift deposits. The current of the river from South Bend to its mouth was formerly reversed, and this valley formed an outlet for the waters of Lake Michigan, which turned to the southwest, through Kankakee River, at South Bend, and thus reached the Mississippi through Illinois River. Leverett states[1] that there is still a well-defined river channel connecting St. Joseph River with the Kankakee, the surface of which, where it leaves the St. Joseph, is but 45 or 50 feet above the present low-water surface of that stream. The watershed of St. Joseph River in Michigan contains relatively little marsh land not artificially drained and relatively little uncleared land. About a third of the lakes are, however, without outlets. The proportion of undrained lakes in Indiana is smaller, and the swamp lands are much more extensive.

Elkhart River, one of the principal Indiana tributaries of the St. Joseph, drains an area of about 500 square miles which contains large lakes and extended swamp areas, with the principal fall occurring in the passage of the stream from marsh to marsh.

St. Joseph River was formerly navigable for boats as far as Elkhart, or perhaps above, and the older dams were provided with locks, long since abandoned and closed. Prof. James Du Shane is of the opinion that at the present time the low-water depth of the river over the rapids is from 1½ to 2 feet. A rise of 5 feet represents ordinary high water, and a rise of 8 feet represents extreme high water. Within the last twenty-two years two freshets have occurred which raised the water in some portions of the river higher than here given. The average width from bank to bank is 400 feet, and the average slope from Elkhart to Berrien Springs is 2.1 feet to the mile.

The first water-power mill in southwestern Michigan was constructed by Eli Ford, in 1827, on Dowagiac Creek, near its confluence with St.

[1] Water resources of Indiana and Ohio, by Frank Leverett: Eighteenth Ann. Rept. U. S. Geol. Survey, Pt. IV, p. 439.

Joseph River, at Niles. This mill, known as the Volante mill, has been in operation since 1828. Power development on St. Joseph River began at a somewhat later date. The dam at Niles was built about 1856. At South Bend the power was developed by the South Bend Manufacturing Company, and was sold in the form of rights to the flow through wheels of a certain number of square inches vent under the available head. The dam is 10 feet high, with lateral power canals on each side. Under an order of the court the water is to be maintained at a stage not lower than 6 inches below the crest of the dam. Nineteen privileges have been granted, calling for a flow of 3,195.5 cubic feet per second under a head of 9.5 feet. Fourteen of these privileges are now in use. The minimum flow of the stream is usually considered to be 1,000 second-feet, but it is stated to have gone considerably lower during the months of July and August, 1895. At Elkhart there is a similar power development, the flow of the stream being divided among eleven mills. The power at Elkhart was originally divided by priority, the amount being specified as so many runs of stone, or "sufficient for the purpose of the mill."

The following table gives the principal facts regarding water power in the St. Joseph River Basin, so far as reported:

Developed water powers in St. Joseph River Basin.

Stream.	Location.	Dam number.	Number of mills at dam.	Effective head or fall.			Rated power of water wheels reported.
				Greatest.	Least.	Average.	
				Feet.	*Feet.*	*Feet.*	*Horse-power.*
St. Joseph River	Buchanan	1				11.0	
Do	Niles	2	2			12.0	4,018
Do	South Bend	3	14	12.0	4.0	9.5	2,588
Do	Mishawaka	4	3	11.0	7.0	10.0	1,760
Do	Elkhart	5	3	13.0	6.0	10.0	1,920
Do	Constantine	6					
Do	Three Rivers	7	3	10.0	6.0	8.5	600
Do	Below Mendon	8					
Do	Burlington	9					
Do	Tekonsha	10	1	8.0	6.0	7.0	89
Pawpaw River	Watervliet	1	1	14.0	6.0	10.0	600
Do	Hartford	2					
Do	Lawrence	3					
South Branch of Pawpaw River.	Pawpaw	1	1	14.0	12.5	13.5	132
Do	do	2	1	17.0		17.0	108
Spring Brook	Almena	1					
Dowagiac Creek	Niles	1	2			12.0	356
Do	Above Niles	2	1			14.5	715
Pokagon Creek	Summerville	1					
South Branch of Dowagiac Creek.	Dowagiac	1	1	10.0	8.0	9.0	95
Do	Lagrange	2					
Christiana Creek	Elkhart	1					
Elkhart River	do	1		8.5	4.0	7.0	60
Do	Goshen	2	2	17.0	10.0	14.5	700
Do	Benton	3					
Portage River	Three Rivers	1	1	10.5	8.5	9.5	297
Rocky River	do	1	1	15.0	11.0	14.0	459
Swan Creek	Colon	1	1	10.0	5.0	8.0	107
Coldwater River	Union City	1	1	9.0		9.0	52
Do	Above Union City.	2	1				
Do	Hodunk	3	1				
Nottawa Creek	Athens	3	1	9.0	6.5	8.0	35

There are a number of undeveloped powers between the present dams, and projects are now formed to utilize them. The power is to be used largely for the generation of electricity for transmission to neighboring towns. A part of it will supplement the power at existing dams. At Berrien Springs, Michigan, a concrete dam 30 feet in height is proposed. This will make available a fall of 20 feet. Eighteen water wheels of a rated capacity of 7,500 horsepower are to be installed. This power is in sec. 18, T. 17 W., R. 6 S., Michigan meridian. At Bertrand, Michigan, a fall of 12 feet could be obtained by the construction of a suitable dam.

Two available sites for dams exist between Mishawaka and Elkhart, Indiana. The former is in sec. 11, T. 38 N., R. 2 E., second principal meridian, where a 12-foot fall is available. The width of the river is about 350 feet. The latter site, called the Twin Branch site, is in sec. 12, T. 37 N., R. 3 E., second principal meridian. A dam 422 feet long is proposed at this point, which would make available a fall of 21 feet.

At Bristol, Indiana, a dam formerly existed, but it was washed out. A site exists in sec. 31, T. 38 N., R. 5 E., second principal meridian, where a fall of 16 feet could be obtained by the construction of a dam 600 feet in length.

At Mottville, Michigan, in sec. 6, T 8 S., R. 5 W., Michigan meridian, a fall of 9½ feet could be obtained by the construction of a dam 540 feet in length.

An undeveloped water power also exists near Three Rivers, Michigan, in sec. 1, T. 6 S., R. 11 W., where about 9 feet fall could be obtained.

The available power of tributaries of St. Joseph River is of little value, as is indicated by the existence of numerous abandoned sites where dams have been carried away by freshets. At Ligonier, Indiana, a dam formerly existed on Elkhart River, but it was washed out. There are three undeveloped powers on Pawpaw River, in Antwerp Township, Van Buren County, Michigan, with falls of 9 feet, 14 feet, and 9 feet, respectively.

Arrangements have been made with the Berrien Springs Power Company for the maintenance of a record of flow of St. Joseph River at their plant when completed. The record will include discharge over the 500-foot concrete dam, and the run of water wheels, which will be 18 in number, arranged in sets of three pairs each. In the meantime a temporary gaging station has been established at the dam of the Berrien Springs Power Company at Buchanan, Michigan, 10 miles above Berrien Springs. The dam is of timber, of the Beardsley gravity type, with a straight crest approximately 400 feet long. It is 9.83 feet high, and is built on an earth foundation.

In January, 1891, the following gaging of St. Joseph River was made by John F. Meighan at Leepers Bridge, 1 mile below the dam at South Bend:

Discharge measurement of St. Joseph River at Leepers Bridge in January, 1891.

Elevation of water surface above city datum	(feet)	7.57
Area of cross section	(square feet)	1,232
Wetted perimeter	(lineal feet)	262.91
Hydraulic mean radius		4.686
Slope	(feet per foot)	0.000378
Coefficient of roughness in Kutter's formula		0.030
Coefficient *c* in Kutter's formula		65
Mean velocity	(feet per second)	2.735
Discharge	(second-feet)	3,369

The stated depth of extreme high water on the crest of the Niles dam is 5 feet, indicating a freshet discharge of about 15,000 second-feet, or 4.5 second-feet per square mile. The extreme high-water flow over the Dowagiac River dam at Niles is stated to be 2 feet depth on the crest of the 120-foot spillway, corresponding to a flow of about 1,200 second-feet, or 4.3 second-feet per square mile, from a drainage area of 281 square miles.

KALAMAZOO RIVER, MICHIGAN.

The details of the hydrography of this stream have been given in an earlier report.[1] The drainage areas of the river and its tributaries are as follows:

Drainage areas of Kalamazoo River and its tributaries.

Stream.	Location.	Area.
		Sq. miles.
North Branch of Kalamazoo River	Albion	138
South Branch of Kalamazoo River	do	136
Kalamazoo River	Below junction of North and South branches	274
Do	Marshall	443
Do	Above Battle Creek	603
Battle Creek	At mouth	244
Kalamazoo River	Below Battle Creek	847
Do	At Plainwell	1,307
Do	At Allegan	1,508
Do	At mouth	2,064

The accompanying table gives a summary of the developed water powers of the drainage basin. Most of the powers on the main stream are utilized. In 1898–99 a dam giving 23 feet head was built between Allegan and Otsego, to develop 2,000 horsepower for electrical transmission. This plant has the merit of being the first large long-distance transmission plant in the State.[2] A portion of the fall between this dam and Allegan is still undeveloped, and it is claimed that a head of 20 feet could be obtained by the construction of a dam 2 miles above that city. Above Otsego, on the main river, there are one or two rapids having falls of several feet which are not yet developed.

[1] Report on the run-off and water power of Kalamazoo River, by Robert E. Horton: Water-Supply and Irrigation Paper U. S. Geol. Survey No. 30, pp. 22–38.

[2] Proc. Mich. Eng. Soc. 1900, pp. 84–91; also Engineering Record, Jan. 13, 1900.

Developed water powers in Kalamazoo River Basin.

Stream.	Location.	Number of dam.	Number of mills at dam.	Effective head or fall.			Rated power of water wheels reported.
				Greatest.	Least.	Average.	
				Feet.	*Feet.*	*Feet.*	*Horse-power.*
Kalamazoo River	Allegan	1	12				1,150
Do	Above Allegan	2	1			23.0	2,000
Do	Otsego	3	5			12.0	1,725
Do	Plainwell	4	5			9.0	786
Do	Battle Creek	5	7	12	10	12.0	469
Do	do	6	1				
Do	Ceresco	7	1			8.0	289
Do	Marshall	8	1			6.0	(a)
Do	do	9	1	14	12	13.0	200
Do	Marengo	10	1				118
North Branch	Albion	11	1				
Do	Newburg Mills	12	1				
Do	Bath Mills	13	1				33
Do	Concord	14	1			9.0	118
Do	Horton	15	1			10.0	55
South Branch	Albion	1	2				
Do	North Homer	2	1				69
Do	Homer	3	1				214
Do	Mosherville	4	1				80
Rice Creek	Marshall	1	1			12.0	136
Battle Creek	Battle Creek	1	1			6.0	86
Do	Bellevue	2	1				
Do	Olivet	3	1				
Augusta Creek	Augusta	1	1	18	17	18.0	260
Gull Lake outlet	Galesburg	1	1	13	12	13.0	81
Do	Howlandsburg	2	1	12	10	11.0	70
Do	Yorkville	3	1			20.0	80
Comstock Creek	Comstock	1	1	12		11.5	22
Portage Creek	Kalamazoo						
Wilder Creek	Eckford						
Wabasacon Creek	Bedford						
Comstock Creek	Above Comstock	2	1			23.0	35

(a) Undershot water wheel.

It is stated that a dam could be built 1 mile above the mouth of Swan Creek, which enters Kalamazoo River 8 miles below Allegan, and a head of 40 feet be obtained.

During a portion of 1900 a daily record of the river stage was kept at Kalamazoo, the results of which are given on the following page. Earlier records will be found in Water-Supply Paper No. 30, page 36. Arrangements have been made for the maintenance of a gaging record at the electric-power dam at Trowbridge, 6 miles above Allegan. The plant includes four pairs of 45-inch Leffel-Sampson turbines on horizontal shafts. The gate opening and discharge of two pairs are controlled by Lombard governors. The excess of flow not taken by the turbines is discharged over a spillway having three Taintor flood gates, each 20 feet long. The spillways have flat crests 20 feet in width, with slopes of 1 to 1 on the upstream and downstream faces. The discharge on the downstream side is received on a floating apron 20 feet in width, which is anchored to the flood-gate cribs by chains.

Daily gage height, in feet, of Kalamazoo River at foot of Sheldon street, Kalamazoo, Michigan, for 1900.

Day.	Sept.	Day.	Sept.	Day.	Sept.	Day.	Sept.	Day.	Sept.
6	68.45	11	68.20	16		21		26	
7	68.32	12	68.15	17		22		27	
8	68.25	13	68.00	18	68.05	23		28	
9		14	67.90	19	67.90	24		29	67.90
10	68.15	15	68.02	20	67.90	25		30	

NOTE.—On August 9 the gage height was 68.50 feet.

Daily gage height, in feet, of Kalamazoo River at Gull street, Kalamazoo, Michigan, for 1901.

Day.	Mar.	Day.	Mar.	Day.	Mar.	Day.	Mar.	Day.	Mar.
16	69.86	20	71.10	23	71.87	26	71.40	29	71.27
17		21	71.72	24	71.66	27		30	
18	70.10	22	72.12	25	71.52	28	71.48	31	
19	70.75		71.97						

NOTE.—Gage height on April 1 was 70.04 feet, and on April 12, 68.02 feet.

Daily gage height, in feet, of Kalamazoo River at extension of Paterson street, Kalamazoo, Michigan, for 1900.

Day.	Sept.	Day.	Sept.	Day.	Sept.	Day.	Sept.	Day.	Sept.
1	68.71	6	68.10	11	67.90	16		21	68.20
2	68.54	7	68.23	12		17		22	67.98
3	68.47	8	68.10	13		18		23	67.94
4	68.41	9	68.10	14		19		24	68.09
5		10	67.99	15		20			

STREAMS OF NORTHERN PENINSULA OF MICHIGAN.

The streams of the northern peninsula of Michigan are contrasted with those of the southern portion of the State by their steep slopes, rocky channels, and occasional waterfalls. They possess numerous water powers, which are almost wholly undeveloped, and many of which are in close proximity to the mining centers of the iron and copper region. Arrangements are being made for the establishment of a gaging station on one of the larger streams.

On Ontonagon River at Glenns Falls a head of 100 feet could be obtained, which would yield an estimated minimum of 4,500 horsepower. This is in sec. 31, T. 50 N., R. 31 W., about three-fourths of a mile south of the Victoria mine. Ontonagon River is the largest Lake Superior tributary in Michigan. It extends entirely across the northern peninsula, and finds its headwaters in a region of numerous small lakes near the Wisconsin-Michigan line. Its fall is mostly concentrated in the short stretch between the summit of the Michigan Range at Rockland and its entrance to Lake Superior at Ontonagon.

Owing to the lack of a map on suitable scale, the drainage area can not at present be estimated.

Dead River, tributary to Lake Superior at Marquette, possesses a fall of 850 feet in a distance of 10 miles.

Much of the southern slope of the upper peninsula drains into Menominee River, a tributary of Green Bay. A report on that river was published in the Tenth Census of the United States.[1] Other streams possessing good falls and opportunities for lake storage in the region of their headwaters are the Escanaba, Manistique, Michigamme, and Tahquemenon rivers.

MISSISSIPPI RIVER AT ST. PAUL, MINNESOTA.

Records of gage heights are maintained by the United States Weather Bureau at St. Paul, and are furnished to the Geological Survey. The station is described in Water-Supply Paper No. 36, page 194.

Daily gage height, in feet, of Mississippi River at St. Paul, Minnesota, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	3.4	3.7	3.2	0.8	1.1	5.4	5.8	4.5	2.0
2	.....	.....	.....	3.0	3.7	3.0	.7	1.2	5.3	5.8	4.5	2.0
3	.....	.....	.....	3.2	3.8	2.9	1.0	1.2	5.0	5.9	4.5	2.0
4	a4.4	.....	.....	3.7	3.8	2.7	2.0	1.2	4.8	5.9	4.5	2.2
5	.....	.....	.....	3.8	3.8	2.6	2.6	1.0	4.7	6.3	4.6	2.3
6	.....	a6.3	a3.2	4.6	3.7	2.5	2.9	1.0	4.5	6.5	4.6	2.3
7	.....	.....	.....	5.6	3.5	2.5	2.9	1.0	4.2	6.6	4.6	2.2
8	.....	.....	.....	5.6	3.4	2.4	3.0	1.1	4.0	6.3	4.5	1.9
9	.....	.....	.....	5.2	3.3	2.4	2.9	1.2	3.9	6.2	4.4	1.9
10	.....	.....	.....	5.0	3.5	2.4	2.9	1.5	4.2	6.0	4.3	1.8
11	.....	.....	.....	4.8	3.2	1.8	2.8	2.2	4.4	5.9	4.2	2.4
12	.....	.....	.....	4.5	3.0	1.8	2.8	2.8	5.3	5.8	4.1	3.6
13	a3.9	a5.1	.....	4.3	2.9	1.9	3.0	2.9	5.8	5.7	4.0	3.5
14	.....	.....	a3.7	4.2	2.8	1.9	3.0	3.5	5.7	5.7	3.8	2.8
15	.....	.....	.....	4.1	2.8	1.5	2.8	3.7	5.5	5.4	3.5	1.8
16	.....	.....	.....	4.0	2.8	1.5	2.8	4.0	5.3	5.3	2.7	2.6
17	.....	.....	.....	4.4	2.8	1.4	2.6	4.2	5.2	5.3	2.1	2.4
18	.....	.....	.....	4.6	2.9	1.3	2.5	4.3	5.1	5.3	2.0	2.7
19	.....	.....	.....	4.8	2.9	1.3	2.3	4.2	5.0	5.2	2.0	3.3
20	.....	3.5	.....	4.6	2.6	1.2	2.2	4.0	5.2	5.1	2.1	3.0
21	a3.8	.....	.....	4.4	2.5	1.2	2.2	3.8	5.5	5.0	2.1	2.7
22	.....	.....	a3.7	4.2	2.7	1.2	2.2	3.7	5.7	4.8	2.1	2.4
23	.....	.....	.....	4.0	2.8	1.2	2.2	3.7	5.9	4.8	2.0	2.3
24	.....	.....	.....	4.0	2.8	1.2	2.1	3.9	5.9	4.6	1.9	2.4
25	.....	.....	.....	4.0	2.8	1.0	1.8	4.1	6.0	4.5	1.6	(b)
26	.....	.....	.....	3.9	2.7	1.0	1.5	4.5	6.0	4.5	1.3	(b)
27	.....	.....	.....	3.8	2.8	1.0	1.1	4.7	6.0	4.3	1.8	(b)
28	.....	a3.2	.....	3.8	2.8	.9	1.1	5.0	6.0	4.5	2.1	(b)
29	.....	.....	.....	3.8	3.2	.9	1.3	5.4	5.9	4.6	2.0	(b)
30	a3.6	.....	.....	3.7	3.3	.8	1.0	5.5	5.8	4.5	2.0	(b)
31	.....	.....	a3.7	.....	3.3	.....	1.0	5.4	.....	4.3	.....	a2.1

a Approximate; river frozen. b River frozen.

WEST GALLATIN RIVER NEAR SALESVILLE, MONTANA.

This station, which was established in July, 1895, is located at the highway bridge crossing the stream about 5 miles south of Salesville. It is described in Water-Supply Paper No. 36, page 195. Results of measurements for 1899 will be found in the Twenty-first Annual

[1] Vol. XVII, Water Power, Pt. II, pp. 71-81.

Report, Part IV, page 184. During 1900 the following discharge measurements were made under the direction of Samuel Fortier:

Discharge measurements of West Gallatin River near Salesville, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
May 23	4.86	1,944	July 12	3.61	871
June 7	5.90	3,727	Do	3.60	842
Do	5.90	3,796	August 15	3.10	512
June 18	4.72	2,028	August 25	3.15	526
June 24	4.51	2,039			

Daily gage height, in feet, of West Gallatin River near Salesville, Montana, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.40	.....	.....	3.30	4.00	6.15	4.10	3.20	3.00	3.20	3.10	2.80
2	.....	.....	.....	3.40	4.10	5.80	4.10	3.20	3.00	3.20	3.10	2.80
3	.....	.....	.....	3.40	4.25	6.40	3.90	3.20	3.00	3.10	3.10	2.85
4	.....	.....	.....	3.40	4.50	6.60	3.70	3.23	3.20	3.20	3.10	2.90
5	.....	3.30	.....	3.50	4.70	6.65	3.70	3.23	3.20	3.20	3.10	3.00
6	.....	.....	.....	3.60	5.15	6.90	3.70	3.10	3.20	3.20	3.10	3.00
7	.....	.....	3.10	3.80	4.95	6.55	3.70	3.10	3.20	3.20	3.10	3.00
8	3.30	.....	.....	3.60	5.05	6.25	3.70	3.10	3.15	3.10	3.10	2.90
9	.....	.....	.....	3.50	5.15	6.30	3.70	3.10	3.00	3.10	3.10	2.90
10	.....	.....	.....	3.50	5.55	6.15	3.60	3.10	3.00	3.10	3.10	2.90
11	.....	.....	.....	3.50	6.05	6.45	3.60	3.10	3.00	3.10	3.00	2.90
12	.....	3.00	3.10	3.50	6.05	5.50	3.60	3.10	2.90	3.10	2.90	2.90
13	.....	.....	.....	3.50	5.55	5.55	3.50	3.10	3.00	3.10	3.00	2.90
14	.....	.....	.....	3.50	5.30	5.55	3.50	3.10	3.00	3.10	3.00	2.90
15	3.20	.....	.....	3.50	5.25	5.75	3.50	3.10	3.10	3.10	3.00	2.90
16	.....	.....	.....	3.60	5.15	5.50	3.40	3.10	3.00	3.10	3.00	2.85
17	.....	.....	.....	3.50	5.15	5.30	3.40	3.13	3.00	3.10	3.00	2.80
18	.....	.....	.....	3.60	5.20	5.15	3.40	.....	3.10	3.10	2.90	2.80
19	.....	.....	.....	3.70	5.00	5.20	3.40	3.10	3.10	3.10	2.80	2.80
20	.....	.....	3.10	3.85	5.10	5.25	3.40	3.10	3.10	3.10	2.70	2.80
21	.....	3.20	.....	4.00	5.15	5.30	3.30	3.10	3.10	2.90	2.70	2.80
22	3.20	.....	.....	4.15	5.40	5.20	3.40	3.10	3.00	3.00	2.80	2.80
23	.....	.....	.....	4.35	5.45	5.29	3.30	3.10	3.20	3.10	2.80	2.80
24	.....	.....	.....	4.05	5.65	5.20	3.30	3.13	3.10	3.10	2.80	2.85
25	.....	.....	.....	3.90	5.75	4.70	3.30	3.13	3.10	3.10	2.80	2.85
26	.....	.....	.....	4.00	6.25	4.70	3.30	3.20	3.10	3.10	2.80	2.80
27	.....	.....	.....	4.00	6.75	4.40	3.35	3.15	3.10	3.00	2.80	2.80
28	.....	3.10	.....	4.10	6.90	4.20	3.30	3.15	3.20	2.90	2.80	2.80
29	3.20	.....	3.30	4.10	6.45	4.20	3.20	3.15	3.10	2.90	2.80	2.80
30	.....	.....	.....	4.00	6.45	4.10	3.28	3.10	3.13	3.00	2.80	2.80
31	.....	.....	.....	.....	6.05	.....	3.30	3.00	.....	3.00	.....	2.78

MIDDLE CREEK NEAR BOZEMAN, MONTANA.

This station, which was established August 3, 1895, is located in Middle Creek Canyon, 9 miles from Bozeman. It is described in Water-Supply Paper No. 36, page 196. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 183. During 1900 the following measurements of discharge were made under the direction of Samuel Fortier:

May 22: Gage height, 0.57 foot; discharge, 211 second-feet.
June 5: Gage height, 0.90 foot; discharge, 366 second-feet.
June 18: Gage height, 0.60 foot; discharge, 248 second-feet.
June 24: Gage height, 0.60 foot; discharge, 241 second-feet.
July 7: Gage height, 0.26 foot; discharge, 104 second-feet.
August 15: Gage height, 0.02 foot; discharge, 51 second-feet.

Daily gage height, in feet, of Middle Creek near Bozeman, Montana, for 1900.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.30	0.10	0.00	0.00	17	.....	0.20	0.02	0.00	.....
2	.....	.30	.10	.00	.00	18	0.60	.20	.02	.00	.....
3	.....	.20	.10	.00	.00	19	.50	.20	.02	.01	.....
4	.....	.20	.10	.00	.00	20	.60	.20	.02	.01	.....
5	.....	.30	.20	.00	.00	21	.80	.10	.02	.01	.....
6	.....	.20	.10	.00	.00	22	.60	.10	.01	.00	.....
7	.....	.20	.10	.00	.00	23	.90	.10	.01	.00	.....
8	.....	.30	.10	.00	.00	24	.60	.10	.01	.00	.....
9	.....	.30	.10	.00	.00	25	.60	.20	.01	.00	.....
10	.....	.30	.05	.00	.00	26	.50	.10	.01	.00	.....
11	.....	.30	.05	.00	.00	27	.50	.10	.01	.00	.....
12	.....	.20	.04	.00	.00	28	.50	.20	.01	.00	.....
13	.....	.20	.03	.00	.00	29	.40	.10	.01	.00	.....
14	.....	.20	.03	.00	.....	30	.30	.10	.00	.00	.....
15	.....	.30	.02	.00	.....	31	.....	.10	.00	.....	.....
16	.....	.20	.02	.00	.....						

NOTE.—This station was discontinued in 1899, but was reopened on June 18, 1900. It was closed for the winter on October 13.

GALLATIN RIVER AT LOGAN, MONTANA.

This station, which was established August 24, 1893, by F. H. Newell, is located on the bridge of the Northern Pacific Railroad crossing the river at Logan. It is described in Water-Supply Paper No. 36, pages 197 and 198, where will also be found the results of measurements for 1899. During 1900 the following measurements of discharge were made under the direction of Samuel Fortier:

Discharge measurements of Gallatin River at Logan, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-feet.*	1900.	*Feet.*	*Sec.-feet.*
May 29	3.91	4,630	August 13	0.62	349
June 15	2.32	1,966	September 4	.77	445
June 23	1.51	1,066	October 15	1.00	600
June 28	1.22	744	October 16	1.00	596
July 16	.40	239			

Daily gage height, in feet, of Gallatin River at Logan, Montana, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	1.40	2.00	3.50	1.00	0.50	0.70	0.90	1.00	1.10
2	.....	.....	.....	1.40	2.00	3.50	.90	.50	.70	.90	1.00	1.10
3	1.20	.....	.....	1.40	2.05	3.70	.90	.50	.80	.90	1.00	1.10
4	.....	.....	.....	1.40	2.30	3.70	.80	.50	.80	1.00	1.00	1.10
5	.....	.....	.....	1.40	2.30	3.75	.80	.50	.80	1.05	1.00	1.10
6	.....	.....	.....	1.40	2.50	3.90	.80	.50	.80	1.10	1.00	1.10
7	.....	1.50	1.80	1.40	2.80	3.85	.80	.50	.80	1.10	1.00	1.10
8	.....	.....	.....	1.40	2.70	3.60	.80	.60	.80	1.10	1.00	1.10
9	.....	.....	.....	1.40	2.80	3.40	.70	.60	.80	1.00	1.00	1.10
10	1.30	.....	.....	1.40	3.05	3.25	.60	.60	.80	1.00	1.00	1.00
11	.....	.....	.....	1.40	3.35	2.75	.60	.60	.80	1.00	1.00	1.00
12	.....	.....	.....	1.40	3.60	2.50	.50	.60	.80	1.00	1.00	1.00
13	.....	.....	.....	1.40	3.70	2.50	.40	.60	.80	1.00	1.00	1.00
14	.....	(a)	1.40	1.40	3.25	2.35	.40	.60	.80	1.00	1.00	1.00
15	.....	.....	.....	1.50	3.15	2.15	.40	.60	.80	1.00	1.00	1.00
16	.....	.....	.....	1.50	3.00	2.00	.40	.60	.80	1.00	1.00	1.00
17	1.30	.....	.....	1.50	3.00	2.00	.40	.60	.80	1.00	1.00	1.00
18	.....	.....	.....	1.60	3.00	1.90	.40	.60	.80	1.00	1.15	1.00
19	.....	.....	.....	1.60	3.00	1.70	.40	.60	.90	1.00	1.35	1.00
20	.....	.....	.....	1.60	3.00	1.70	.40	.60	.90	1.00	1.50	1.00
21	.....	(a)	1.50	1.60	3.00	1.55	.40	.60	.90	1.00	1.55	1.00
22	.....	.....	.....	1.60	3.00	1.50	.40	.60	.90	1.00	1.50	1.00
23	.....	.....	.....	1.80	3.00	1.50	.40	.60	.90	1.00	1.40	1.00
24	1.50	.....	.....	1.90	3.05	1.50	.40	.60	.90	1.00	1.30	1.00
25	.....	.....	.....	2.00	3.30	1.40	.40	.60	.90	1.00	1.20	1.10
26	.....	.....	.....	2.05	3.40	1.40	.40	.70	.90	1.00	1.10	1.10
27	.....	.....	.....	2.00	3.75	1.30	.50	.70	.90	1.00	1.10	1.00
28	.....	1.50	1.50	2.00	4.00	1.20	.50	.70	.90	1.00	1.10	1.00
29	.....	.....	.....	2.00	4.00	1.10	.50	.70	.90	1.00	1.10	1.00
30	.....	.....	.....	2.00	3.60	1.00	.50	.70	.90	1.00	1.10	(a)
31	1.50	.....	.....	.....	3.70	.....	.50	.70	.....	1.00	.....	(a)

a Frozen.

MADISON RIVER NEAR REDBLUFF, MONTANA.

This station, which was established May 2, 1897, is located 4 miles below the Redbluff iron county bridge over the river and 1½ miles below the mouth of Cherry Creek. It is described in Water-Supply Paper No. 37, page 205. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 186. During 1900 the following measurements of discharge were made under the direction of Samuel Fortier. Cherry Creek flows into Madison River between the gage and the point where the river is measured, and its discharge should, therefore, be added to that of the river in order to obtain the total discharge at the gage.

Discharge measurements of Madison River near Redbluff, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-feet.*	1900.	*Feet.*	*Sec.-feet.*
June 8	2.57	4,412	June 25	.....	a49
Do	.....	a146	June 26	1.79	2,486
June 9	2.53	4,237	July 13	1.40	1,597
June 19	1.92	2,715	Do	.....	a7
Do	1.92	2,848	August 16	1.30	1,434
Do	.....	a66	Do	.....	a9
June 25	1.85	2,610			

a Cherry Creek.

Daily gage height, in feet, of Madison River near Redbluff, Montana, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	(a)	1.00	2.00	2.70	1.60	1.40	1.40	1.50	1.50	1.40
2	.....	(a)	.....	1.00	2.25	2.50	1.60	1.40	1.40	1.50	1.50	1.40
3	.....	.....	.....	1.00	2.40	2.80	1.55	1.40	1.40	1.50	1.50	1.40
4	(a)	.....	.....	1.30	2.40	2.80	1.50	1.40	1.40	1.50	1.40	1.40
5	.....	.....	.....	1.30	2.45	2.88	1.50	1.40	1.40	1.50	1.40	1.40
6	.....	.....	.....	1.30	2.30	2.90	1.50	1.40	1.40	1.50	1.40	1.40
7	.....	.....	.....	1.40	2.35	2.90	1.50	1.40	1.40	1.50	1.40	1.40
8	.....	(a)	1.00	1.30	2.40	2.80	1.50	1.40	1.40	1.50	1.40	1.40
9	.....	.....	.....	1.30	2.45	2.80	1.50	1.45	1.40	1.50	1.40	1.40
10	.....	.....	.....	1.30	2.50	2.80	1.50	1.50	1.40	1.50	1.40	1.40
11	(a)	.....	.....	1.30	2.62	2.70	1.50	1.50	1.50	1.50	1.40	1.40
12	.....	.....	.....	1.30	2.70	2.65	1.50	1.50	1.50	1.50	1.40	1.40
13	.....	.....	.....	1.30	2.80	2.40	1.50	1.45	1.40	1.50	1.40	1.40
14	.....	.....	.....	1.30	2.70	2.30	1.50	1.40	1.40	1.50	1.40	1.40
15	.....	(a)	1.00	1.35	2.55	2.20	1.50	1.40	1.40	1.50	1.40	1.40
16	.....	.....	.....	1.40	2.45	2.10	1.50	1.40	1.40	1.50	1.40	1.40
17	.....	.....	.....	1.45	2.30	2.50	1.50	1.40	1.40	1.50	1.40	1.40
18	(a)	.....	.....	1.50	2.25	1.85	1.50	1.40	1.40	1.50	1.40	1.40
19	.....	.....	.....	1.50	2.10	1.80	1.50	1.40	1.40	1.50	1.40	1.40
20	.....	.....	.....	1.50	2.20	1.70	1.50	1.40	1.40	1.50	1.40	1.40
21	.....	.....	.....	1.50	2.23	1.70	1.50	1.40	1.40	1.50	1.40	1.40
22	.....	(a)	1.00	1.60	2.20	1.70	1.50	1.40	1.40	1.50	1.40	1.40
23	.....	.....	.....	1.70	2.25	1.65	1.50	1.40	1.40	1.50	1.40	1.40
24	.....	.....	.....	1.80	2.37	1.60	1.50	1.40	1.40	1.50	1.40	1.40
25	(a)	.....	.....	1.80	2.45	1.60	1.50	1.40	1.40	1.50	1.40	1.40
26	.....	.....	.....	1.80	2.60	1.60	1.50	1.40	1.50	1.50	1.40	1.40
27	.....	.....	.....	1.80	2.80	1.60	1.50	1.40	1.50	1.50	1.40	1.40
28	.....	.....	.....	1.80	2.90	1.60	1.50	1.40	1.50	1.50	1.40	1.40
29	.....	.....	1.00	1.80	3.00	1.60	1.50	1.40	1.50	1.50	1.40	1.40
30	.....	.....	.....	1.82	3.00	1.60	1.40	1.40	1.50	1.50	1.40	.....
31	.....	.....	.....	.....	2.95	.....	1.40	1.40	.....	1.50	.....	.....

a Frozen.

JEFFERSON RIVER AT SAPPINGTON, MONTANA.

This station, which was established by Arthur P. Davis in 1894, is located on the bridge of the Northern Pacific Railroad crossing the river at Sappington. It is described in Water-Supply Paper No. 37, pages 206 and 207, where will also be found the results of measurements for 1899. During 1900 the following measurements of discharge were made under the direction of Samuel Fortier:

Discharge measurements of Jefferson River at Sappington, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
May 31	5.01	5,918	July 16	1.92	844
June 16	3.83	3,593	August 1	1.57	589
June 23	3.46	3,240	October 6	2.45	1,586
June 28	3.00	2,279			

Daily gage height, in feet, of Jefferson River at Sappington, Montana, for 1900.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	2.80	3.90	5.00	2.70	1.60	1.50	2.10	2.50	2.50
2	(a)	2.90	3.90	4.90	2.60	1.60	1.50	2.20	2.50	2.50
3	(a)	3.15	4.00	4.80	2.50	1.60	1.50	2.25	2.50	2.50
4	(a)	3.30	4.05	4.90	2.50	1.50	1.50	2.33	2.50	2.50
5	(a)	3.40	4.20	5.00	2.40	1.50	1.60	2.40	2.50	2.60
6	(a)	3.50	4.35	4.00	2.40	1.50	1.60	2.43	2.40	2.60
7	(a)	3.60	4.55	4.90	2.40	1.50	1.60	2.40	2.40	2.60
8	(a)	3.60	4.65	4.90	2.40	1.50	1.60	2.40	2.40	2.60
9	(a)	3.60	4.85	4.70	2.30	1.50	1.60	2.40	2.40	2.60
10	3.00	3.45	5.05	4.60	2.30	1.50	1.70	2.40	2.40	2.60
11	2.80	3.30	5.25	4.50	2.20	1.50	1.70	2.40	2.40	2.60
12	2.80	3.20	5.50	4.20	2.20	1.50	1.70	2.40	2.40	2.50
13	2.80	3.20	6.10	4.00	2.20	1.50	1.70	2.30	2.40	2.50
14	2.70	3.20	6.40	4.00	2.10	1.50	1.70	2.30	2.40	2.50
15	2.70	3.20	6.55	3.90	2.00	1.50	1.70	2.30	2.40	2.50
16	2.70	3.30	6.60	3.80	1.90	1.50	1.70	2.30	2.40	2.50
17	2.60	3.30	6.45	3.90	1.80	1.50	1.70	2.30	2.40	2.40
18	2.70	3.30	6.25	4.00	1.80	1.50	1.80	2.30	2.40	2.40
19	2.80	3.30	6.10	4.10	1.70	1.50	1.85	2.20	2.40	2.40
20	2.80	3.40	5.95	4.20	1.70	1.50	1.90	2.20	2.40	2.40
21	2.90	3.40	5.80	3.90	1.70	1.50	1.90	2.20	2.40	2.40
22	2.90	3.50	5.75	3.65	1.70	1.50	1.90	2.20	2.40	2.40
23	3.00	3.60	5.55	3.30	1.70	1.50	1.90	2.30	2.40	2.40
24	3.10	3.65	5.50	3.20	1.70	1.50	1.90	2.30	2.40	2.40
25	3.10	3.75	5.40	3.10	1.70	1.50	1.90	2.30	2.40	2.40
26	3.10	3.80	5.35	3.00	1.60	1.50	2.00	2.40	2.40	2.40
27	3.05	3.90	5.30	2.90	1.60	1.45	2.00	2.40	2.40	2.40
28	2.95	3.90	5.30	2.85	1.60	1.45	2.00	2.40	2.40	2.30
29	2.80	3.90	5.40	2.80	1.60	1.45	2.00	2.40	2.50	2.30
30	2.70	3.90	5.30	2.80	1.60	1.50	2.00	2.40	2.50	2.30
31	2.70	.....	5.15	.....	1.60	1.50	.....	2.50	.....	2.30

a The river was frozen from January 1 to March 9, inclusive.

MISSOURI RIVER AT TOWNSEND, MONTANA.

Observations of gage heights are maintained at this place by the Missouri River Commission, and the results are furnished to the Geological Survey by the Corps of Engineers, United States Army. The heights given are the means of two daily readings expressed in feet above the St. Louis directrix, which is 412.73 feet above the mean Gulf level. The figures 3,300 have been omitted from the record, so that it is necessary to add that amount to the daily observations to obtain the elevation of the water surface above the St. Louis datum. A description of this station will be found in Water-Supply Paper No. 37, page 208. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 187. During 1900 the following discharge measurements were made under the direction of Samuel Fortier:

Discharge measurements of Missouri River at Townsend, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
May 28	92.10	15,982	July 17	88.53	2,296
June 15	90.65	8,871	August 14	88.30	1,955
June 22	90.16	7,797	October 12	88.92	3,419
June 29	89.50	4,524			

Daily gage height, in feet, of Missouri River at Townsend, Montana, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	90.8	88.8	92.0	89.2	90.4	91.8	89.2	88.2	a88.2	88.7	88.9	90.5
2	93.0	88.8	90.0	89.4	90.5	91.7	89.1	88.2	88.3	88.7	88.9	90.5
3	93.0	88.8	90.0	89.6	90.5	91.7	89.0	88.2	88.3	88.8	88.9	90.3
4	92.9	88.8	93.7	89.6	90.6	91.8	88.9	88.2	88.3	88.8	88.9	90.0
5	92.5	88.8	93.7	89.7	90.6	91.8	88.9	88.2	88.3	88.8	88.9	90.7
6	92.5	88.8	93.7	89.8	90.7	91.8	88.8	88.2	88.4	88.9	88.9	90.0
7	91.5	88.8	93.7	89.8	90.9	91.7	88.8	88.2	88.4	88.9	88.9	89.5
8	91.4	88.8	93.4	89.8	91.2	91.7	88.8	88.2	88.4	88.9	88.9	89.2
9	89.5	88.8	90.4	89.8	91.4	91.7	88.8	88.2	88.4	88.9	88.9	89.0
10	89.5	88.8	90.5	89.8	91.6	91.5	88.7	88.3	88.4	88.9	88.9	88.9
11	89.4	88.8	90.7	89.7	91.8	91.2	88.7	88.3	88.4	88.9	88.9	88.8
12	89.3	88.8	90.5	89.2	92.2	90.9	88.6	88.2	88.4	88.9	88.9	88.7
13	89.1	89.0	90.3	89.5	92.3	90.7	88.4	88.2	88.4	88.9	88.9	88.6
14	89.1	92.3	89.9	89.5	92.4	90.6	88.3	88.2	88.4	88.9	88.9	88.6
15	89.1	92.2	89.5	89.6	92.4	90.5	88.3	88.2	88.4	88.9	88.9	88.6
16	89.1	92.1	89.3	89.7	92.2	90.5	88.3	88.2	88.4	88.9	88.9	88.7
17	89.1	92.1	89.3	89.8	92.2	90.5	88.3	88.2	88.4	88.9	89.0	88.7
18	89.1	92.2	89.3	89.8	92.1	90.5	88.3	88.2	88.4	88.8	89.1	88.6
19	89.1	92.2	89.2	89.8	92.1	90.4	88.3	88.2	88.4	88.8	89.1	88.7
20	89.1	92.3	89.2	89.8	91.9	90.3	88.3	88.2	88.4	88.8	89.1	88.8
21	89.1	92.2	89.3	89.8	91.9	90.2	88.3	88.2	88.4	88.8	89.2	88.9
22	89.1	92.1	89.3	89.9	91.8	90.0	88.3	88.2	88.4	88.8	89.3	88.8
23	89.1	92.1	89.4	90.1	91.7	89.9	88.3	88.2	88.4	88.8	89.6	88.7
24	89.1	92.1	89.4	90.2	91.7	89.8	88.3	88.2	88.4	88.8	89.9	88.7
25	89.1	92.1	89.5	90.3	91.7	89.7	88.3	88.2	88.5	88.8	90.1	88.7
26	89.1	92.1	89.5	90.3	91.7	89.6	88.3	a88.2	88.5	88.8	90.2	88.6
27	89.1	92.1	89.5	90.3	91.8	89.4	88.3	a88.2	88.6	88.8	90.7	88.5
28	89.0	92.1	89.6	90.3	92.1	89.4	88.3	a88.2	88.6	88.9	90.7	88.4
29	89.0	.....	89.5	90.3	92.3	89.3	88.3	a88.2	88.6	88.9	90.7	88.2
30	88.8	.....	89.3	90.3	92.2	89.3	88.3	a88.2	88.6	88.9	90.5	87.9
31	88.8	.....	89.2	.....	92.1	.....	88.3	a88.2	.....	88.9	.....	87.9

a Approximate; no readings received.

CROW CREEK, MONTANA.

Crow Creek, a tributary of Missouri River, is in Jefferson County, Montana. Its headwaters are at an elevation of between 7,000 and 8,000 feet above sea level. It flows in a southeasterly direction for about 25 miles, and empties into Missouri River 33 miles below Toston, at an elevation of about 4,000 feet.

At the foot of the mountains the valley is approximately 12 miles square. About half of it is owned by the residents, and approximately a third of the land owned is being irrigated, though perhaps scantily at times. This leaves without water about 70,000 acres, the greater part of it the choice land of the valley and, according to the farmers who have made efforts in that direction, well adapted to the raising of hay, grain, and fruit crops. The only apparent source of water supply for this vast tract of uncultivated land is small storage reservoirs on Crow Creek, at points along the canyon where the valley widens sufficiently to permit their construction. From the best information obtainable from those familiar with the canyon, the largest of these valleys is from a fourth to a half mile wide and about 2 miles long. On October 13, 1900, the flow of Crow Creek at the mouth of the canyon, 5 miles above Radersburg, Montana, was, by actual measurement, 16 second-feet. On the same date the discharge at the bridge 1 mile below the canyon was also 16 second-feet. The high-water flow lasts from four to six weeks, with an occasional summer flood, and is confined in a channel having an average width of from 25 to 30

feet, with vertical banks of from 4 to 5 feet on either side, and a fall of 58.7 feet to the mile.

MILK RIVER AT HAVRE, MONTANA.

This station, which was established by C. C. Babb on May 15, 1898, is described in Water-Supply Paper No. 37, page 209. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 189. During 1900 the following measurements of discharge were made by C. W. Ling:

Discharge measurements of Milk River at Havre, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
April 21	2.90	242	August 4	1.40	12
April 26	3.30	327	August 11	1.40	13
April 27	3.00	302	August 13	2.60	182
Do	3.07	314	August 14	2.40	145
May 3	3.20	390	August 20	1.60	27
May 7	2.70	309	August 31	1.60	27
May 11	2.40	207	September 4	1.50	23
May 15	2.60	260	September 5	1.70	48
May 16	4.00	863	September 8	2.00	80
May 17	5.20	1,651	September 10	2.50	142
May 18	4.50	1,112	September 17	1.90	50
May 24	3.40	444	September 22	2.20	97
May 31	3.00	312	October 2	2.00	84
June 9	2.60	185	October 6	3.10	314
June 12	2.40	142	October 8	2.90	236
June 21	2.20	117	October 12	2.60	157
June 27	2.10	108	October 16	2.90	265
July 3	1.90	76	October 22	2.40	129
July 10	2.00	92	October 27	2.30	114
July 18	1.70	30	November 2	2.30	96
July 25	1.50	14	November 10	2.00	63
August 3	1.40	17			

Daily gage height, in feet, of Milk River at Havre, Montana, for 1900.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.10	3.10	2.00	1.50	1.60	2.00	2.30	(a)
2	.....	3.30	3.00	2.00	1.40	1.50	2.00	2.30	(a)
3	.....	3.20	2.90	1.90	1.40	1.50	2.10	2.30	(a)
4	.....	3.00	2.70	1.90	1.40	1.50	2.20	2.20	(a)
5	.....	2.90	2.70	1.90	1.40	1.70	2.40	2.20	(a)
6	.....	2.80	2.70	1.90	1.40	1.70	3.10	2.20	(a)
7	.....	2.70	2.70	1.80	1.40	1.80	3.10	2.20	(a)
8	.....	2.60	2.60	1.80	1.30	2.00	2.90	2.20	(a)
9	.....	2.60	2.60	1.90	1.30	2.10	2.80	2.20	(a)
10	3.40	2.50	2.40	2.00	1.30	2.50	2.70	2.00	(a)
11	3.40	2.40	2.40	2.10	1.40	2.40	2.60	1.90	(a)
12	3.70	2.30	2.40	1.80	2.75	2.40	2.60	2.20	(a)
13	3.60	2.40	2.30	1.80	2.65	2.40	2.50	2.40	(a)
14	3.60	2.40	2.30	1.70	2.40	2.00	2.50	2.20	(a)
15	3.40	2.60	2.30	1.70	2.20	2.00	2.80	2.50	(a)
16	3.30	4.00	2.30	1.70	2.00	1.90	2.90	(a)	(a)
17	3.00	5.10	2.30	1.70	1.90	1.90	3.00	(a)	1.40
18	3.20	4.60	2.40	1.70	1.70	1.90	2.90	(a)	1.40
19	2.90	4.10	2.20	1.60	1.60	1.90	2.80	(a)	1.40
20	2.90	3.70	2.20	1.60	1.60	1.90	2.70	(a)	1.40
21	2.90	3.60	2.20	1.60	1.50	2.00	2.70	(a)	1.40
22	2.90	3.90	2.20	1.60	1.50	2 20	2.40	(a)	1.60
23	2.90	3.60	2.20	1.50	1.40	2.20	2.40	(a)	(a)
24	3.10	3.40	2.10	1.50	1.40	2.10	2.30	(a)	(a)
25	3.30	3.30	2.10	1.50	1.40	2.00	2.30	(a)	(a)
26	3.30	3.20	2.20	1.50	1.40	2.00	2.30	(a)	(a)
27	2.90	3.10	2.10	1.50	1.40	2.00	2.30	(a)	(a)
28	3.10	2.90	2.10	1.60	1.40	1.90	2.30	(a)	(a)
29	2.90	3.00	2.10	1.50	1.40	1.90	2.30	(a)	(a)
30	3.00	2.90	2.00	1.50	1.40	2.00	2.20	(a)	(a)
31	.....	3.00	.....	1.50	1.60	.....	2.20	.....	(a)

a Frozen.

YELLOWSTONE RIVER NEAR LIVINGSTON, MONTANA.

This station, which was established May 2, 1897, is located at the highway bridge over the Yellowstone 5 miles south of Livingston. It is described in Water-Supply Paper No. 37, pages 210 and 211, where will also be found the results of measurements for 1899. During 1900 the following measurements were made under the direction of Samuel Fortier:

Discharge measurements of Yellowstone River near Livingston, Montana.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
May 25	3.08	7,917	July 14	1.76	4,623
Do	3.15	8,482	August 7	.75	3,160
June 14	4.30	13,552	September 29	−.45	1,710
June 21	4.08	11,835	October 17	−.60	1,599
June 27	3.40	9,094			

Daily gage height, in feet, of Yellowstone River near Livingston, Montana, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	(a)	.....	−1.00	0.30	3.80	2.80	0.95	−0.05	−0.45	−0.70	−0.95
2	.....	(a)	.....	− .90	.60	4.00	2.68	.90	− .05	− .43	− .70	− .88
3	.....	(a)	.....	− .80	.75	4.20	2.55	.88	− .10	− .40	− .70	− .90
4	.....	(a)	.....	− .70	1.40	4.30	2.50	.80	− .10	− .43	− .70	− .90
5	.....	(a)	.....	− .70	1.75	4.35	2.40	.75	− .10	− .45	− .70	− .90
6	−0.85	(a)	(a)	− .70	2.30	4.70	2.30	.75	− .10	− .45	− .70	− .90
7	.....	(a)	(a)	− .50	2.20	4.75	2.23	.70	− .15	− .45	− .73	− .90
8	.....	(a)	(a)	− .20	2.15	4.38	2.13	.70	− .15	− .48	− .75	− .90
9	.....	(a)	(a)	− .30	2.67	4.60	2.10	.65	− .20	− .50	− .75	− .90
10	.....	(a)	(a)	− .60	3.35	3.95	2.03	.60	− .20	− .53	− .80	− .90
11	.....	(a)	(a)	− .60	3.73	3.85	1.95	.55	− .25	− .55	− .88	− .90
12	.....	(a)	(a)	− .60	4.00	3.75	1.88	.50	− .25	− .60	− .90	− .90
13	−0.80	(a)	(a)	− .60	3.40	3.70	1.80	.50	− .25	− .60	− .83	−1.10
14	.....	(a)	−0.90	− .55	2.78	4.05	1.73	.45	− .25	− .60	− .80	−1.00
15	.....	(a)	.....	− .55	2.30	4.25	1.70	.45	− .30	− .65	− .85	−1.00
16	.....	(a)	.....	− .60	2.28	4.20	1.63	.40	− .33	− .60	− .75	−1.00
17	.....	(a)	.....	− .60	2.48	4.13	1.55	.35	− .35	− .60	− .83	−1.00
18	.....	(a)	.....	− .60	2.40	3.90	1.53	.30	− .35	− .60	− .95	−1.00
19	.....	(a)	.....	− .50	2.17	3.80	1.50	.30	− .30	− .60	(a)	−1.00
20	−0.90	(a)	.....	− .20	2.25	3.90	1.45	.25	− .30	− .65	(a)	−1.00
21	.....	−0.90	−1.00	.00	2.38	3.90	1.40	.25	− .35	− .60	(a)	−1.00
22	.....	.....	.....	.20	2.55	3.95	1.38	.25	− .35	− .65	(a)	−1.00
23	.....	.....	.....	.65	2.73	3.88	1.30	.20	− .40	− .60	(a)	.....
24	.....	.....	.....	.40	2.90	3.73	1.25	.20	− .40	− .60	−1.10	−1.20
25	.....	.....	.....	.40	3.03	3.68	1.20	.20	− .40	− .65	−1.08	−1.10
26	.....	.....	.....	.30	3.65	3.60	1.20	.20	− .43	− .65	− .90	−1.15
27	.....	−0.90	.....	.20	4.20	3.43	1.20	.15	− .45	− .65	− .85	−1.15
28	.....	.....	.....	.30	4.65	3.23	1.15	.15	− .45	− .65	− .90	−1.35
29	.....	.....	.....	.40	4.38	3.10	1.10	.10	− .45	− .65	−1.00	−1.35
30	.....	.....	.....	.35	3.98	3.03	1.05	.05	− .45	− .70	−1.00	.....
31	.....	.....	−1.00	.....	3.80	.....	1.00	.00	.....	− .70	.....	(a)

a Frozen.

MISCELLANEOUS DISCHARGE MEASUREMENTS IN MONTANA.

During the year the following miscellaneous measurements of streams in Montana were made by Messrs. F. E. and G. H. Matthes:

Miscellaneous discharge measurements of streams in Montana.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-ft.*
June 18	St. Mary River	Main	F. E. Matthes.	2,294
August 6	do	do	G. H. Matthes.	750
October 14	do	do	do	552
June 16	do	Outlet of Lower Lake	F. E. Matthes.	750
June 19	North Fork of Milk River.	Bridge at Hall's ranch	do	12
June 21	Middle Fork of Milk River	Ford of road to Main	do	7
June 14	South Fork of Milk River.	Paul's ranch	do	31
June 8	Cutbank River	Ford of road to St. Mary Lake.	do	488
June 9	North Fork of Cutbank River.	Base of mountains	do	231
June 7	Two Medicine River	Outlet of Lower Lake	do	390
May 23	do	Holy Family Mission	do	1,067
May 29	do	Ford 12 miles below Piegan	do	1,261
May 28	Badger Creek	Two miles above Piegan	do	562
May 24	do	Ford at Piegan	do	273
May 26	Birch Creek	Four miles above Robare	do	387
Do	do	One-half mile above Robare	do	392

BIGHORN RIVER NEAR THERMOPOLIS, WYOMING.

This station, which was established by A. J. Parshall on May 28, 1900, is located about a half mile west of Thermopolis, at the ferry crossing the river. The gage, which consists of a horizontal rod extending out over the water, is fastened to a post set firmly in the bank. On the horizontal stick is attached the wire gage by means of which the heights of the river are recorded. The bench mark is the head of a nail in a stick driven in the ground 1 foot south of the post to which the gage rod is fastened and 2.58 feet below the top of the gage frame. The bench mark is 9.08 feet above gage datum. Discharge measurements have been made from a ferryboat, but during the coming season they will be made from the bridge which has recently been erected. The channel is straight for a distance above and below the station. Both banks are high and not subject to overflow. The bed of the stream is of gravel, and shifts during only extreme high water. Results of measurements for 1899 will be found in Water-Supply Paper No. 37, page 211. During 1900 the following discharge measurements were made by A. J. Parshall:

May 28: Gage height, 4.01 feet; discharge, 8,500 second-feet.
May 29: Gage height, 5.00 feet; discharge, 10,527 second-feet.
May 30: Gage height, 5.40 feet; discharge, 12,187 second-feet.
September 13: Gage height, 0.60 foot; discharge, 945 second-feet.
September 18: Gage height, 0.45 foot; discharge, 674 second-feet.

Daily gage height, in feet, of Bighorn River near Thermopolis, Wyoming, for 1900.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	4.00	3.40	1.55	1.20	12	5.20	2.65	1.50	0.70	23	4.10	1.60	1.40	.....
2	4.30	3.30	1.50	1.20	13	4.65	2.55	1.50	.60	24	4.45	1.60	1.30	.....
3	4.45	3.30	1.50	1.10	14	4.30	2.45	1.50	.55	25	4.50	1.60	1.30	.....
4	5.00	3.20	1.50	1.00	15	4.10	2.25	1.50	.50	26	5.00	1.60	1.30	.....
5	4.85	3.20	1.80	1.00	16	4.00	2.20	1.50	.....	27	5.25	1.60	1.30	.....
6	4.80	3.10	1.50	.90	17	3.80	2.20	1.50	.....	28	5.00	1.50	1.30	.....
7	5.70	3.20	1.50	.90	18	3.60	2.10	1.80	.....	29	4.25	1.50	1.20	.....
8	6.60	3.15	1.50	.90	19	3.50	2.05	1.40	.....	30	3.50	1.50	1.20	.....
9	5.90	3.00	1.50	.90	20	3.50	1.95	1.40	.....	31	.....	1.60	1.20	.....
10	5.85	2.80	1.50	.90	21	3.50	1.70	1.30	.....					
11	5.45	2.80	1.50	.70	22	3.90	1.60	1.30	.....					

CLEAR CREEK NEAR BUFFALO, WYOMING.

This station was established by the State engineer of Wyoming. A measuring flume was erected in order that accurate measurements of discharge might be obtained. Owing to the stability of the station it has not been necessary to make discharge measurements at this place, the computations being made from the rating table established several years ago. The station is described in Water-Supply Paper No. 37, page 212. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 191. Owing to the diversions of water which have taken place within the basin, of late years this station has not been considered as important as formerly, and it was discontinued on March 11, 1900, no measurements of discharge being made during that year.

Daily gage height, in feet, of Clear Creek near Buffalo, Wyoming, for 1900.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	0.40	0.30	0.30	12	0.35	0.30	------	23	0.30	0.30	------
2	.40	.30	.30	13	.35	.30	------	24	.30	.30	------
3	.40	.30	.30	14	.35	.30	------	25	.30	.30	------
4	.37	.30	.30	15	.35	.30	------	26	.30	.30	------
5	.37	.30	------	16	.32	.30	------	27	.30	.30	------
6	.37	.30	------	17	.32	.30	------	28	.30	.30	------
7	.35	.30	.35	18	.32	.30	------	29	.30	------	------
8	.35	.30	------	19	.30	.30	------	30	.30	------	------
9	.35	.30	------	20	.30	.30	------	31	.30	------	------
10	.35	.30	.35	21	.30	.30	------				
11	.35	.30	------	22	.30	.30	------				

BIG SIOUX RIVER NEAR WATERTOWN, SOUTH DAKOTA.

Big Sioux River rises in Grant County, South Dakota, about 30 miles north of Watertown. Its principal headwaters drain lands constituting part of the Sisseton and Wahpeton Indian Reservation. Its general course is southeast, and it empties into Missouri River near Sioux City, Iowa. The river is of interest on account of its water powers, a number of which have been developed, principally at Flandreau, Dell Rapids, and Sioux Falls, South Dakota, and at Akron, Iowa. The gaging station was established by O. V. P. Stout, the gage being put in September 15, 1900, by George W. Carpenter, county surveyor for Codington County. It is located on the farm of L. E. Spicer, about 4 miles above Watertown. The gage consists of an inclined rod securely fastened on the right bank of the stream. The observer is L. E. Spicer. During 1900 the following discharge measurements were made by O. V. P. Stout and G. H. Matthes:

July 17: Discharge, 5 second-feet.
July 18: Discharge, 10 second-feet.
November 12: Gage height, 1.15 feet; discharge, 7 second-feet.

The measurement of July 18 was not made at the gaging station, but in the town.

Lake Poinsett, which lies almost wholly in Hamlin County, South Dakota, has its outlet in Big Sioux River near Dempster, a short distance above Estelline. Immediately below the outlet of the lake a dam has been constructed on the Big Sioux to maintain the level of the lake within certain limits. A measurement of the inlet to the lake was made July 19, 1900, by O. V. P. Stout, and a discharge of 16.5 second-feet was found.

Big Sioux River at the bridge west of Estelline was also measured by Mr. Stout on July 19, 1900, and a discharge of 16.9 second-feet was found.

Daily gage height, in feet, of Big Sioux River near Watertown, South Dakota, for 1901

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	12	.....	1.25	.....	.....	23	1.30	1.25	1.20	1.20
2	.....	1.30	1.25	1.20	13	.....	.....	1.15	.....	24	.....	.....	.....	.....
3	.....	.....	.....	.....	14	.....	1.25	.....	1.20	25	1.30	.....	1.20	1.20
4	.....	.....	1.25	1.20	15	.....	.....	.....	.....	26	.....	1.25	.....	.....
5	.....	1.25	.....	.....	16	1.40	1.25	1.15	1.20	27	.....	.....	1.20	.....
6	.....	.....	1.20	.....	17	.....	.....	.....	.....	28	1.30	1.25	.....	1.15
7	.....	1.25	.....	1.20	18	1.30	.....	1.20	1.20	29	.....	.....	.....	.....
8	.....	.....	.....	.....	19	.....	1.25	.....	.....	30	1.30	1.25	1.20	1.15
9	.....	1.25	1.15	1.20	20	.....	.....	1.20	.....	31	.....	.....	.....	.....
10	.....	.....	.....	.....	21	1.30	1.25	.....	1.20					
11	.....	.....	1.15	1.20	22	.....	.....	.....	.....					

BIG SIOUX RIVER NEAR SIOUX FALLS, SOUTH DAKOTA.

This gaging station, which was established by O. V. P. Stout on July 21, 1900, is 2 miles west of Sioux Falls. The gage consists of an inclined rod securely fastened to bevel blocks supported on well-bedded cross-ties. The observer is George Beggs. During 1900 the following discharge measurement was made by O. V. P. Stout:

July 21: Gage height, 2.02 feet; discharge, 78 second-feet.

Daily gage height, in feet, of Big Sioux River near Sioux Falls, South Dakota, for 1900.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	1.20	1.60	1.80	12	1.40	1.40	1.70	1.80	22	1.30	1.40	1.20	.....
2	.....	1.20	1.80	1.80	13	1.50	1.40	1.70	1.80	23	1.30	1.60	1.10	.....
3	.....	1.20	1.80	1.80	14	1.50	1.30	1.70	1.80	24	1.50	1.60	1.10	.....
4	.....	1.20	1.80	1.80	15	1.40	1.50	1.70	1.70	25	1.40	1.60	1.10	.....
5	.....	1.10	1.80	1.80	16	1.40	1.40	1.70	1.70	26	1.40	1.60	1.90	.....
6	.....	1.30	1.80	1.80	17	1.30	1.40	1.70	1.70	27	1.30	1.50	1.80	.....
7	.....	1.20	1.70	1.80	18	1.40	1.50	1.70	.....	28	1.30	1.50	1.80	.....
8	.....	1.20	1.70	1.70	19	1.40	1.50	1.70	.....	29	1.30	1.70	1.80	.....
9	.....	1.20	1.70	1.70	20	1.30	1.50	1.70	.....	30	1.30	1.60	1.90	.....
10	1.40	1.30	1.70	1.80	21	1.30	1.40	1.90	.....	31	1.30	.....	1.90	.....
11	1.40	1.40	1.70	1.80										

MISCELLANEOUS DISCHARGE MEASUREMENTS OF CHEYENNE RIVER AND ITS TRIBUTARIES.

During the year a number of measurements of Cheyenne River and its tributaries were made by J. T. Stewart, as described in the table on the next page.

Miscellaneous discharge measurements of Cheyenne River and its tributaries.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1900.				*Sec.-feet.*
May 14	Cheyenne River	Edgemont, S. Dak	John T. Stewart.	14.6
May 17	do	do	do	10.3
May 29	do	do	do	.5
May 18	do	Above mouth of Cascade Creek	do	12.2
June 12	do	do	do	.7
May 19	do	Above mouth of Fall River	do	39.2
June 4	do	Mouth of Fall River	do	18.7
May 21	do	Below mouth of Beaver Creek, 7 miles southeast of Buffalo Gap, S. Dak.	do	47.4
June 5	do	Below mouth of Beaver Creek	do	49.0
May 15	Salt Creek	East of Newcastle, Wyo	do	.2
May 31	do	do	do	.2
May 15	Big Oil Creek	B. and M. Railway bridge	do	.2
May 29	do	do	do	.03
May 17	Little Oil Creek	Newcastle, Wyo	do	.05
May 29	do	do	do	.02
May 18	Cascade Creek	At mouth	do	24.6
June 2	do	do	do	19.9
Do	Hat Creek	do	do	.0
May 19	Fall River	Below Hot Springs, S. Dak	do	24.7
June 4	do	Hot Springs, S. Dak	do	28.6
May 19	do	At mouth	do	33.3
June 4	do	do	do	24.8
May 26	Iron Creek	Glendale, S. Dak	do	3.8
June 7	do	do	do	1.6
May 15	Stockade Beaver Creek.	Two miles above L. A. K. ranch, Wyo.	do	11.1
May 31	do	do	do	11.8
May 16	do	At mouth	do	9.4
May 30	do	do	do	3.5
May 15	Beaver Creek	Above mouth of Stockade Beaver Creek.	do	.0
May 30	do	do	do	.0
May 21	do	Three miles northwest of Buffalo Gap, S. Dak.	do	12.2
June 5	do	do	do	14.6
May 21	do	At mouth, 7 miles southeast of Buffalo Gap.	do	1.2
June 5	do	At mouth	do	6.0
May 21	Lame Johnny Creek	Seven miles northeast of Buffalo Gap.	do	.0
Do	do	East of Buffalo Gap	do	.0
May 28	French Creek	Custer, S. Dak	do	.0
May 22	do	Ten miles above Fairburn, S. Dak	do	12.8
June 6	do	Ten miles northeast of Fairburn, S. Dak.	do	4.9
May 22	do	Fairburn, S. Dak	do	3.3
June 7	do	do	do	.2
May 22	Squaw Creek	Otis, S. Dak	do	7.9
June 6	do	do	do	2.8
May 26	Battle Creek	Keystone, S. Dak	do	3.1
June 7	do	do	do	2.3
May 25	do	Hermosa, S. Dak	do	9.1
June 8	do	do	do	2.3
May 24	Spring Creek	North of Rockerville, S. Dak	do	6.5
June 9	do	do	do	.7
May 23	do	F. E. and M. V. Railway bridge, S. Dak.	do	.4
June 9	do	do	do	.1
May 24	Rapid Creek	Five and one-half miles above Rapid City, S. Dak.	do	48.8
June 8	do	do	do	26.3
May 25	do	Rapid City, S. Dak	do	64.2
June 8	do	do	do	29.9

NORTH PLATTE RIVER.

This river has its source in the mountains of North Park, in northern Colorado. Upon entering Wyoming the stream passes through a short, narrow canyon, and then flows northerly through the upper Platte Valley, which extends from the State line down to Fort Steele. On August 27, 1900, A. J. Parshall made measurements of the river

at two points in its upper reaches. The first measurement was made a short distance above the mouth of Grand Encampment Creek and immediately above the mouth of Brush Creek, and a discharge of 176 second-feet was found. The second measurement was made near Saratoga, Wyoming, immediately above the mouth of Spring Creek, and a discharge of 211 second-feet was found.

GRAND ENCAMPMENT CREEK AT PERYAM'S RANCH, WYOMING.

This station, which was established by A. J. Parshall May 16, 1900, is located at the bridge over the river at the ranch of the observer, W. T. Peryam. The rod is vertical, and is fastened to the timbers of the bridge. The channel is straight for a distance above and below the station. The right bank is high and is not subject to overflow, but the left bank is low and overflows at high stages. The bed of the stream is rocky. During 1900 the following measurements were made by A. J. Parshall:

May 16: Gage height, 2.00 feet; discharge, 2,050 second-feet.
June 8: Gage height, 2.00 feet; discharge, 2,184 second-feet.
June 21: Gage height, 1.20 feet; discharge, 885 second-feet.
July 5: Gage height, 0.60 foot; discharge, 192 second-feet.
July 18: Gage height, 0.30 foot; discharge, 39 second-feet.

Daily gage height, in feet, of Grand Encampment Creek at Peryam's ranch, Wyoming, for 1900.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	2.70	0.95	0.50	0.25	17	1.90	1.60	0.40	0.40	0.40
2	.....	2.60	.75	.50	.25	18	2.05	1.50	.40	.40	.30
3	.....	2.40	.75	.45	.20	19	1.90	1.50	.30	.30	.30
4	.....	2.30	.65	.45	.20	20	1.70	1.30	.30	.30	.30
5	.....	2.25	.60	.40	.25	21	1.80	1.20	.30	.30	.30
6	.....	2.30	.60	.40	.25	22	1.90	1.20	.35	.30	.30
7	.....	2.20	.60	.40	.30	23	2.30	1.30	.35	.30	.40
8	.....	2.05	.60	.50	.30	24	2.10	1.20	.40	.30	.40
9	.....	2.20	.60	.50	.30	25	2.40	1.20	.40	.40	.50
10	.....	2.25	.60	.50	.30	26	2.50	1.10	.40	.50	.50
11	.....	2.10	.60	.50	.30	27	2.90	1.00	.40	.50	.60
12	.....	1.90	.60	.45	.30	28	3.00	1.15	.45	.35	.50
13	.....	1.90	.50	.45	.30	29	3.20	1.00	.50	.30	.50
14	.....	1.70	.50	.45	.35	30	3.00	1.00	.50	.30	.50
15	.....	1.60	.45	.40	.40	31	3.00	.....	.50	.27	.....
16	2.00	1.70	.45	.40	.40						

LARAMIE RIVER AT WOODS, WYOMING.

This station, which was established in December, 1888, by the Territorial engineer of Wyoming, is located 26 miles from Laramie, and is reached by stage. It is described in Water-Supply Paper No. 37, page 214. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 193. The station was discontinued September 30, 1900. During the year one measurement ment of discharge was made by A. J. Parshall, as follows:

May 4: Gage height, 1.60 feet; discharge, 460 second-feet.

Daily gage height, in feet, of Laramie River at Woods, Wyoming, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Ju .	Aug.	Sept.
1				0.70	1.40	4.15	1.40	0.60	0.30
2				.70	1.40	4.05	1.30	.60	.30
3				.70	1.50	3.90	1.30	.60	.30
4				.80	1.55	3.80	1.20	.60	.30
5				.80	1.60	3.70	1.15	.70	.30
6				.65	1.80	3.60	1.10	.70	.30
7	1.10	1.20	1.30	.80	2.00	3.45	1.00	.65	.30
8				.80	2.00	3.45	1.00	.60	.35
9				.70	2.25	3.45	1.00	.60	.50
10				.70	2.55	3.45	1.00	.60	.55
11				.70	2.75	3.40	.95	.50	.45
12				.60	3.00	3.25	.90	.50	.35
13				.60	3.00	2.95	.90	.50	.40
14	1.20	1.20	1.20	.60	2.95	2.75	.80	.50	.40
15				.60	2.65	2.65	.80	.50	.40
16				.50	2.95	2.55	.80	.50	.35
17				.60	3.05	2.45	.80	.40	.30
18				.60	3.15	2.45	.80	.40	.30
19				.75	3.05	2.35	.80	.40	.40
20				.95	3.00	2.25	.80	.40	.40
21	1.20	1.30	1.00	1.30	2.95	2.10	.70	.40	.40
22				1.35	2.85	2.10	.70	.35	.40
23				1.20	3.15	1.95	.70	.30	.45
24				1.10	3.25	1.85	.70	.30	.40
25				1.00	3.45	1.75	.70	.30	.40
26				1.00	3.75	1.65	.60	.30	.40
27				1.15	3.95	1.55	.60	.30	.40
28	1.10	1.20	1.00	1.45	4.05	1.50	.60	.30	.45
29				1.55	4.15	1.40	.60	.30	.50
30				1.45	4.25	1.40	.60	.30	.50
31					4.30		.60	.30	

LARAMIE RIVER NEAR UVA, WYOMING.

This station was established in 1894 by the State engineer of Wyoming. It is described in Water-Supply Paper No. 37, page 216. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 194. The station was discontinued March 31, 1900, and no measurements of discharge were made during the year.

Daily gage height, in feet, of Laramie River near Uva, Wyoming, for 1900.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1				12				23			
2			1.6	13	1.4			24		1.5	2.1
3		1.6		14				25			
4				15				26			
5				16				27	1.5		
6	1.6			17		1.6	2.3	28			
7				18				29			
8				19	1.4			30			
9				20				31			1.9
10		1.7	1.8	21							
11				22							

NORTH PLATTE RIVER AT ORIN JUNCTION, WYOMING.

This station was established November 1, 1894, by the State engineer of Wyoming. It is described in Water-Supply Paper No. 37, page 217. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 196. The station was discontinued April 1, 1900, and no measurements of discharge were made during the year.

Daily gage height, in feet, of North Platte River at Orin Junction, Wyoming, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1				2.3	12			1.3		23				
2					13					24		2.2	1.7	
3		1.5	2.2		14					25				
4					15	(a)				26				
5					16					27				
6					17		2.2	2.5		28				
7					18					29	(a)			
8	(a)				19					30				
9					20					31				
10		1.5			21									
11					22	(a)								

a Frozen.

NORTH PLATTE RIVER NEAR GUERNSEY, WYOMING.

This station was established June 14, 1900, by A. J. Parshall. It is located at the county bridge about a half mile northwest of Guernsey. The bridge has eight piers, the sides are planked, and there is uniform flow under each span. The location is an excellent one for accurate measurements. The rod consists of a 4-inch by 4-inch by 12-foot scantling firmly attached to one of the piers of the bridge. As the station was to be a temporary one, a metallic tape, divided into feet and tenths, was securely fastened to the rod. The bench mark is a spike driven in a sleeper of the bridge 1 foot from the rod and at an elevation of 10.04 feet above the zero. The channel is straight for a distance above and below the station. Both banks are high and do not overflow at high stages. The bed of the stream is sandy, but probably does not shift much. The station was discontinued September 15, 1900. During 1900 the following measurements were made by A. J. Parshall:

June 14: Gage height, 4.40 feet; discharge, 9,792 second-feet.
June 26: Gage height, 2.40 feet; discharge, 5,018 second-feet.
July 10: Gage height, 0.50 foot; discharge, 1,805 second-feet.
July 13: Gage height, 0.25 foot; discharge, 1,376 second-feet.
August 2: Gage height, —0.20 foot; discharge, 778 second-feet.
August 21: Gage height, —0.70 foot; discharge, 430 second-feet.

Daily gage height, in feet, of North Platte River near Guernsey, Wyoming, for 1900.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1			—0.20	—0.90	17		.40	— .70	
2		1.50	— .20		18	3.40	1.10	— .80	
3		1.30	— .25	— .90	19	3.40	.75		
4		1.20	— .25	— .90	20	3.20	.25	— .90	
5		1.00		— .90	21	3.00	.10	— .80	
6		.90	— .30	— .95	22	2.85		— .70	
7		.80	— .30	— .95	23	2.70	.00	— .70	
8			— .40	— .95	24		.05	— .75	
9		.60	— .40		25	2.50	.10	— .80	
10		.50	— .60	— .95	26	2.40	.00		
11		.40	— .60	— .95	27	2.30	.10	— .80	
12		.30		— .95	28	2.20	.05	— .90	
13		.25	— .70	— .95	29	2.00		— .90	
14	4.40	.20	— .70	— .95	30	1.90	.15	— .90	
15	4.20		— .70	— .95	31		.10	— .90	
16	3.90	.70	— .70						

NORTH PLATTE RIVER AT GERING, NEBRASKA.

This station, which was established May 29, 1897, is located at the highway bridge at Gering. It is described in Water-Supply Paper No. 37, page 218. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 197. During 1900 the following measurements of discharge were made by R. H. Willis:

Discharge measurements of North Platte River at Gering, Nebraska.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
April 18	1.67	5,251	August 1	1.15	1,152
April 27	1.90	7,138	August 10	1.02	848
May 11	2.16	10,980	August 22	.93	529
May 23	2.46	10,909	August 30	.84	395
May 30	2.65	12,371	September 11	.96	385
June 12	2.86	13,706	September 20	.85	356
June 21	2.24	9,231	October 19	.32	486
June 28	1.80	6,321	October 20	.35	399
July 9	1.45	2,874	October 30	.45	522
July 19	1.55	3,947			

Daily gage height, in feet, of North Platte River at Gering, Nebraska, for 1900.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.25	2.75	1.70	1.00	0.78	0.48	0.35
2	.....	2.20	2.80	1.70	1.00	.77	.35	.36
3	.....	2.25	2.90	1.71	1.02	.78	.33	.36
4	.....	2.40	2.98	1.70	1.00	.79	.27	.37
5	.....	2.35	2.85	1.60	1.01	.76	.27	.39
6	.....	2.35	2.85	1.53	1.00	.77	.26	.40
7	.....	2.20	2.82	1.53	.97	.73	.27	.41
8	.....	2.15	2.80	1.44	.98	.76	.27	.40
9	.....	2.15	2.78	1.44	.95	.75	.27	.42
10	.....	2.05	.....	1.40	.96	.80	.26	1.05
11	.....	2.15	.....	1.30	.95	.85	.25	1.04
12	.....	2.16	2.71	1.21	.93	.87	.23	1.03
13	.....	2.30	2.71	1.10	.90	.90	.24	1.04
14	.....	2.36	2.86	1.12	.90	.90	.24	a1.05
15	.....	2.53	2.76	1.29	.86	.90	.23	.....
16	.....	2.62	2.56	1.21	.90	.85	.24	.....
17	.....	2.65	2.46	1.30	.90	.80	.24	.....
18	1.67	2.56	2.29	1.30	.90	.80	.23	.....
19	1.60	2.50	2.23	1.56	.88	.77	.32	.....
20	1.55	2.45	2.26	1.42	.88	.75	.31	.....
21	1.55	2.46	2.19	1.25	.88	.75	.31	.....
22	1.60	2.49	2.01	1.30	.84	.75	.30	.....
23	1.85	2.40	1.89	1.22	.82	.75	.30	.....
24	1.90	2.35	1.89	1.30	.80	.75	.31	.....
25	1.83	2.31	1.91	1.40	.71	.60	.31	.....
26	1.80	2.29	1.87	1.21	.73	.62	.32	.....
27	1.90	2.35	1.81	1.21	.76	.60	.33	.....
28	2.00	2.50	1.80	1.19	.75	.61	.34	.....
29	2.00	2.53	1.76	1.01	.74	.55	.34	.....
30	2.40	2.60	1.70	1.05	.75	.53	.36	.....
31	.....	2.69	.....	1.05	.75	.....	.37	.....

a Closed for winter November 14.

NORTH PLATTE RIVER AT CAMP CLARKE, NEBRASKA.

This station, which was established June 27, 1896, consists of a timber fastened to cross-ties bedded in the bank of the river. It is described in Water-Supply Paper No. 37, page 219. Results of

measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 198. During 1900 the following discharge measurements were made by R. H. Willis:

Discharge measurements of North Platte River at Camp Clarke, Nebraska.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
April 19	3.28	4,928	July 28	2.61	1,624
April 28	3.71	7,146	August 11	2.20	501
May 14	4.10	11,838	August 24	2.05	421
May 25	2.90	9,131	August 31	1.96	274
May 31	4.08	10,434	September 12	2.08	320
June 13	4.27	11,334	September 21	2.08	246
June 22	3.75	7,695	October 3	2.10	234
June 29	3.35	4,049	October 20	2.18	377
July 11	2.74	2,116	October 31	2.26	610
July 20	3.08	3,654			

Daily gage height, in feet, of North Platte River at Camp Clarke, Nebraska, for 1900.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.10	4.29	3.31	2.25	1.98	2.10	2.23
2	.....	3.85	4.31	3.27	2.33	1.92	2.05	2.23
3	.....	3.85	4.45	3.21	2.30	1.95	2.09	2.22
4	.....	4.05	4.49	3.15	2.38	1.96	2.08	2.24
5	.....	4.00	4.52	3.06	2.23	2.02	2.07	2.24
6	.....	3.98	4.52	2.95	2.24	1.97	2.15	2.25
7	.....	3.89	4.48	2.91	2.26	1.98	2.11	2.26
8	2.90	3.92	4.43	2.71	2.20	1.93	2.10	2.28
9	3.03	3.84	4.48	2.70	2.20	2.03	2.10	2.30
10	3.23	3.94	4.42	2.73	2.20	2.08	2.08	a 2.31
11	3.20	3.92	4.34	2.71	2.16	2.10	2.09	.....
12	3.27	3.99	4.38	2.62	2.15	2.09	2.11	.....
13	3.16	4.02	4.27	2.62	2.15	1.96	2.14	.....
14	3.28	4.10	4.25	2.62	2.15	1.98	2.16	.....
15	3.42	4.19	4.28	2.74	2.11	2.05	2.18	.....
16	3.35	4.27	4.17	2.72	2.11	2.02	2.15	.....
17	3.20	4.34	4.10	2.62	2.10	2.05	2.15	.....
18	3.30	4.23	3.90	2.73	2.07	2.07	2.16	.....
19	3.24	4.12	3.89	2.68	2.05	2.04	2.18	.....
20	3.22	4.05	3.84	3.05	2.07	2.01	2.19	.....
21	3.21	4.07	3.81	2.83	2.05	2.03	2.20	.....
22	3.26	4.09	3.75	2.77	2.03	2.02	2.21	.....
23	3.57	4.05	3.51	2.78	2.06	2.01	2.20	.....
24	3.57	3.91	3.52	2.83	2.03	2.15	2.20	.....
25	3.59	3.90	3.48	2.62	2.01	2.19	2.21	.....
26	3.48	3.82	3.43	2.70	2.00	2.20	2.21	.....
27	3.57	3.78	3.39	2.59	1.90	2.15	2.22	.....
28	3.71	3.91	3.42	2.59	1.90	2.15	2.21	.....
29	3.89	4.01	3.33	2.50	1.93	2.14	2.23	.....
30	3.79	4.11	3.31	2.40	1.95	2.10	2.25	.....
31	.....	4.15	.....	2.32	1.99	.....	2.25	.....

a Closed for winter.

NORTH PLATTE RIVER AT NORTH PLATTE, NEBRASKA.

This station, which was established in 1894, is 3.5 miles above the junction of South Platte River. It is described in Water-Supply Paper No. 37, page 220. Results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 199. During 1900 one discharge measurement was made by Adna Dobson, as follows:

December 20: Gage height, 2.30 feet; discharge, 1,223 second-feet.

Daily gage height, in feet, of North Platte River at North Platte, Nebraska, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.40	2.00	2.70	2.30	3.20	3.45	2.85	1.85	0.80	1.40	1.80	2.10
2	2.35	2.05	2.85	2.30	3.15	3.50	2.60	1.75	.80	1.40	1.80	2.20
3	2.20	2.20	3.00	2.20	3.35	3.50	2.60	1.60	.80	1.40	1.80	2.20
4	2.35	2.20	3.10	2.25	3.30	3.65	2.60	1.45	.80	1.40	1.80	2.25
5	2.40	2.25	3.10	2.30	3.35	3.80	2.90	1.50	.80	1.30	1.70	2.10
6	2.50	2.35	3.10	2.40	3.50	3.85	2.80	1.80	.80	1.30	1.70	2.30
7	2.60	2.35	2.80	2.50	3.50	3.85	2.80	2.30	.80	1.30	1.75	2.35
8	2.70	2.25	2.80	2.60	3.40	3.90	2.65	1.95	.80	1.30	1.80	2.30
9	2.80	2.20	2.80	2.50	3.25	3.80	2.45	1.95	.80	1.30	1.80	2.30
10	2.80	2.30	2.80	2.50	3.20	3.75	2.20	1.65	.95	1.30	1.70	2.20
11	2.80	2.40	2.75	2.55	3.20	3.70	2.15	1.60	.90	1.30	1.75	2.25
12	2.90	2.40	2.50	2.60	3.20	3.60	2.10	1.60	.90	1.40	1.85	2.30
13	2.90	2.30	2.30	2.65	3.25	3.50	2.20	1.50	.90	1.40	1.80	2.30
14	2.90	2.30	2.15	2.60	3.30	3.50	2.10	1.45	.80	1.40	1.85	2.30
15	2.95	2.60	2.00	2.70	3.30	3.55	2.10	1.30	.80	1.40	1.90	2.20
16	3.00	2.40	2.40	2.90	3.30	3.60	2.15	1.30	.90	1.40	1.85	2.20
17	3.00	2.30	2.80	2.90	3.30	3.60	2.10	1.25	.90	1.50	1.80	2.20
18	3.00	2.35	2.30	2.90	3.45	3.60	2.05	1.15	.95	1.50	1.75	2.20
19	2.85	2.40	2.10	2.80	3.60	3.45	1.90	1.10	.95	1.50	1.60	2.20
20	2.85	2.50	2.00	2.70	3.60	3.30	2.00	.95	.95	1.50	1.70	2.30
21	2.75	2.50	2.40	2.65	3.50	3.30	2.00	1.45	.90	1.50	1.95	2.30
22	2.60	2.65	2.50	2.70	3.50	3.20	2.00	1.50	.90	1.50	1.95	2.40
23	2.65	2.70	2.40	2.80	3.45	3.10	2.10	1.35	.90	1.50	2.00	2.00
24	2.70	2.80	2.50	2.90	3.40	3.10	2.35	1.50	.90	1.60	1.95	2.00
25	2.50	2.80	2.45	3.00	3.40	3.10	2.35	1.45	.90	1.70	2.20	2.40
26	2.55	2.70	2.40	3.10	3.35	3.00	2.50	1.40	.90	1.60	2.25	2.45
27	2.00	2.60	2.40	3.10	3.30	2.90	2.35	1.20	1.00	1.60	2.30	1.85
28	1.70	2.60	2.30	3.05	3.25	2.90	2.00	1.20	1.10	1.60	2.15	1.80
29	1.90	.....	2.30	2.90	3.20	2.80	2.00	1.00	1.10	1.65	2.00	1.60
30	2.00	.....	2.25	2.95	3.20	2.80	2.00	1.00	1.25	1.70	2.00	.....
31	2.00	.....	2.30	.....	3.40	.....	1.90	.90	.....	1.75	.....	.....

SOUTH PLATTE RIVER.

The South Platte rises in the high mountain peaks surrounding the basin known as South Park, near the center of the State of Colorado. These mountains vary in altitude from 14,000 feet, in the Park Range, to 9,000 feet, in South Park. From the point where the stream issues from the mountains at Platte Canyon it flows in a northerly direction through Denver to its junction with the Cache la Poudre near Greeley, thence in a northeasterly direction until it leaves the State a short distance to the northeast of Julesburg, and thence in an easterly direction to its junction with the North Platte near North Platte, Nebraska.

The tributaries may be divided into two classes: (1) Those which, like the headwaters of the South Platte, rise in the mountains, and (2) those which drain the plains east of the mountains. The principal tributaries of the first class, in their order down the river, are Bear Creek, Clear Creek, St. Vrain Creek, Boulder and South Boulder creeks, Big Thompson Creek, and Cache la Poudre River. Among those of the second class there may be named, as especially worthy of consideration, Cherry Creek, Lone Tree Creek, Boxelder Creek, Bijou Creek, Beaver Creek, and Pawnee Creek. There are many others of lesser note. The streams of the first class—those flowing from the mountains—resemble the upper reaches of the South Platte in that they furnish a perennial supply of water, which varies, however, with the season, the discharge being great during the flood stages and low

during the latter part of the summer and in the fall and winter. The streams from the plains, on the other hand, are intermittent in their nature, usually furnishing water only during storms or the melting of snows. In general it may be said that the normal perennial discharge of all of the streams of this division is claimed and used for irrigation, but great quantities of water go to waste during the flood stages and in times of storms. As there is a vast amount of land upon the plains adjacent to the South Platte that might be irrigated if there were a sufficient supply of water, the question of storage becomes one of great importance, and the Geological Survey is now studying this problem, examining such reservoir sites as are considered capable of storing considerable quantities of water. It is hoped that reservoirs will be constructed to prevent the loss of this great amount of water, which, if properly stored, would become one of the greatest assets of the arid region.

An interesting feature of the South Platte Basin is the fact that in all of its valleys there is a great return from seepage, which is increasing from year to year, as may be seen in the tables of seepage measurements of this river published by the State engineer of Colorado. The underground water supply of the plains in this basin is also being studied, and the results of the investigations will be of great interest in determining the possibilities of procuring water from artesian sources for stock purposes and possibly for the irrigation of small tracts of land. The surface flow of the intermittent streams of the plains may be made available for irrigation purposes by the construction of suitable reservoirs, a few of which are now being utilized by corporations and private parties. The most notable projects of this character which have been under way in the basin during the year are the Lake Cheesman dam, which is being constructed by the Denver Union Water Company, C. L. Harrison, chief engineer, and the Bijou Irrigation Company's reservoirs in the neighborhood of Orchard. The Lake Cheesman reservoir is especially noteworthy on account of the great height of its dam (215 feet) and the amount of water to be stored. The dam will be of solid masonry. The reservoir sites of the Bijou Irrigation Company are natural basins, along the rims of which embankments will be constructed, thus storing large quantities of water, which will be conducted from the river through canals. Any great extension of the irrigated area of this district must depend upon the construction of additional reservoirs and upon improvements in the use and distribution of water. The present system of distribution throughout this section, as in nearly all of the arid region, is very extravagant, in many cases there being several times the number of ditch lines that the most economical use would demand, while much water goes to waste in marshes and swamps which might be drained, and an increased supply thus be made available.

SOUTH FORK OF SOUTH PLATTE RIVER AT LAKE CHEESMAN, COLORADO.

During the year 1900 the engineers in charge of the construction of the dam at Lake Cheesman kept practically continuous records of the gage heights and discharge of Goose Creek and South Platte River above their junction, and also of the combined discharge below the junction, the latter measurements being made below the dam. The accompanying table of discharge measurements at the latter place was obtained through the courtesy of Mr. C. L. Harrison, at present chief engineer of the Denver Union Water Company. The discharge for February is estimated, but it may be considered approximately correct. Discharges for the other months are from actual measurements, which are usually made three times a day, but sometimes oftener. The results may be considered very nearly correct.

SOUTH PLATTE RIVER NEAR PLATTE CANYON, COLORADO.

This station was located about 2 miles above the Colorado and Southern Railroad station at Platte Canyon. It was maintained by the Denver Union Water Company for some time previous to any cooperation on the part of the Survey, which began April 1, 1899. The gage rod was a 2-inch by 2-inch inclined timber on the right-hand side of the stream, the graduations being marked with brass nails. Measurements of discharge were made from the footbridge constructed by the water company at the rod. Readings were taken until June 2, 1900, inclusive, when extremely high water carried away the gage rod, which has not yet been replaced. Only two measurements were made in 1900. The channel at this point is rocky, but the high water changed it materially, so that it will be best for a new location to be selected. A station at this place is of great importance, and one should be maintained with care. A cable should be stretched across the river, with a traveling car, at such a height as to preclude the danger of its being washed away by floods. The figures given in the table show the actual discharge of the river at Platte Canyon before any water is diverted for irrigation or other purpose, except that taken out by the Denver Union Water Company a short distance above the station, for the supply of the city of Denver.

Readings were taken by James Proctor, of Littleton, Colorado, who is in charge of the pumping station of the Denver Union Water Company at that place. While the station was being maintained gage readings were furnished to the officers of the United States Weather Bureau at Denver, who had them published in the papers.

A description of the station was published in Water-Supply Paper No. 37, page 224. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 201. During 1900 the following measurements were made by A. L. Fellows:

March 5: Gage height, −0.40 foot; discharge, 87 second-feet.
April 18: Gage height, 1.55 feet; discharge, 467 second-feet.

Daily gage height, in feet, of South Platte River near Platte Canyon, Colorado, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.3	—0.6	—0.5	0.2	4.7	5.6	17	—0.5	—0.8	0.5	1.4	5.3	.....
2	.2	— .6	— .4	.2	4.6	5.6	18	— .5	— .8	.5	1.6	5.4	.....
3	.1	— .7	— .3	.2	5.1	(a)	19	— .4	— .8	.5	1.9	5.4	.....
4	.1	— .7	— .3	.3	(b)	.....	20	— .4	— .8	.4	2.6	4.5	.....
5	.1	— .7	— .3	.4	(b)	.....	21	— .4	— .7	.3	3.3	4.5	.....
6	.1	— .7	— .5	.6	(b)	.....	22	— .4	— .7	.3	3.7	4.8	.....
7	.0	— .7	— .4	.6	(b)	.....	23	— .3	— .6	.3	3.8	4.8	.....
8	.0	— .7	— .2	.8	(b)	.....	24	— .3	— .7	.4	3.8	4.6	.....
9	—.2	— .7	— .1	.8	(b)	.....	25	— .4	— .7	.4	3.9	4.6	.....
10	—.4	— .7	— .2	.9	(b)	.....	26	— .5	— .7	.4	3.8	4.8	.....
11	—.3	— .8	— .1	.7	(b)	.....	27	— .4	— .7	.4	3.8	4.9	.....
12	—.5	— .8	+ .2	.8	(b)	.....	28	— .4	— .7	.3	4.2	5.2	.....
13	—.4	— .9	.4	1.0	(b)	.....	29	— .3	.....	.3	5.1	5.3	.....
14	—.4	— .9	.6	1.1	(b)	.....	30	— .4	.....	.3	4.8	5.4	.....
15	—.4	— .9	.5	1.6	(b)	.....	31	— .6	.....	.2	.....	5.5	.....
16	—.5	— .9	.6	1.6	5.3	.....							

a Gage washed away. *b* Gage out.

SOUTH PLATTE RIVER AT DENVER, COLORADO.

This station is located at the Fifteenth street bridge in the city of Denver, a short distance below the mouth of Cherry Creek. It was established July 15, 1895, and has been maintained continuously. For a portion of the last year two rods were in use, one on the left bank and the other on the right bank a short distance below the bridge. Both were inclined rods. The rod on the left bank was washed out by the high water of June, 1900, which also removed the sand bar in front of the rod on the right-hand side, making it available at low-water stages, which it had not been before, and since that time the readings have been taken from the latter rod. The bench mark is a cross on the north corner of the top of the east abutment of the Fifteenth street bridge, and is 15.15 feet above gage datum. The river at this point is confined between slag embankments, but owing to the shifting sandy bottom the channel is very changeable, rendering necessary frequent changes in the rating tables. The observations have been made by the water commissioners of water district No. 2, in which Denver is located, W. J. Southland and his successor, S. M. Matlock. During 1900 eleven gagings were made at this point. The daily gage height, with corresponding discharge, was published in the Denver papers by the United States Weather Bureau. A description of the station was published in Water-Supply Paper No. 37, page 225. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 202. During 1900 the following measurements were made by A. L. Fellows and R. W. Hawley:

Discharge measurements of South Platte River at Denver, Colorado.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*	1900.	*Feet.*	*Sec.-ft.*
March 6	5.50	244	July 25	5.45	257
April 12	5.90	377	August 7	5.56	285
April 16	7.24	1,439	August 29	4.90	90
April 20	7.10	1,395	October 20	5.50	226
April 23	8.32	3,516	October 22	5.30	161
June 11	8.50	3,270			

Daily gage height, in feet, of South Platte River at Denver, Colorado, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.30	5.35	5.25	5.05	9.40	8.75	6.65	5.00	4.75	4.90	5.00	5.00
2	5.35	5.45	5.35	5.00	9.40	8.92	6.55	5.10	a4.75	4.80	5.10	5.10
3	5.35	5.20	5.25	5.10	9.40	8.90	6.35	5.20	a4.75	4.80	5.10	5.20
4	5.30	5.25	5.30	5.05	9.40	9.00	6.35	5.40	4.75	4.90	5.40	5.20
5	5.25	5.25	5.45	5.30	9.35	8.90	6.30	5.45	4.85	4.90	5.30	5.20
6	5.35	5.35	5.45	5.50	9.35	8.80	6.30	5.50	4.70	4.85	5.30	5.30
7	5.35	5.40	5.25	5.60	9.35	8.60	6.30	5.50	4.85	4.70	5.20	5.20
8	5.40	5.30	5.20	5.50	9.40	8.50	6.30	5.55	5.05	4.80	5.30	5.30
9	5.35	5.25	5.20	6.00	9.45	8.50	6.20	5.45	4.90	4.90	5.30	5.30
10	5.45	5.25	5.20	5.95	9.40	8.55	6.20	5.45	4.85	4.90	5.30	5.10
11	5.60	5.20	5.30	6.60	9.50	8.55	6.10	5.50	4.95	4.90	5.30	5.20
12	5.40	5.25	5.20	6.45	9.50	8.50	5.70	5.35	5.60	4.90	5.30	5.20
13	5.30	5.25	5.40	6.20	9.40	8.45	5.55	5.35	5.60	4.90	5.20	5.30
14	5.35	5.30	5.40	6.30	9.00	8.40	5.45	5.10	5.35	4.90	5.20	5.30
15	5.45	5.30	5.40	6.65	8.75	8.15	5.40	5.15	5.00	4.90	5.10	5.30
16	5.40	5.40	5.25	7.35	8.50	8.00	5.40	5.05	5.05	5.20	5.10	5.20
17	5.35	5.35	5.30	7.60	8.40	7.95	5.50	4.90	5.20	5.10	5.10	5.20
18	5.45	5.40	5.35	6.80	8.48	7.70	5.35	4.95	5.15	5.00	5.20	5.20
19	5.35	5.45	5.25	6.75	8.30	7.60	5.10	4.80	5.25	5.00	5.20	5.30
20	5.30	5.50	5.40	7.70	8.40	7.58	5.15	4.95	5.10	5.00	5.20	5.30
21	5.40	5.45	5.30	7.75	8.60	7.35	5.00	4.90	5.10	5.20	5.30	5.40
22	5.30	5.35	5.25	7.95	8.50	7.25	5.00	5.00	5.10	5.20	5.40	5.40
23	5.40	5.25	5.25	8.40	8.50	7.45	5.15	4.95	4.90	5.20	5.40	5.30
24	5.35	5.25	5.20	8.40	8.35	7.55	5.15	5.05	4.85	5.10	5.50	5.30
25	5.45	5.30	5.30	8.40	8.40	7.55	5.85	5.20	5.00	5.00	5.50	5.20
26	5.35	5.35	5.25	8.40	8.30	7.50	5.60	5.10	5.20	5.10	5.50	5.20
27	5.25	5.40	5.35	8.05	8.45	7.45	5.55	5.00	5.20	5.10	5.40	5.30
28	5.35	5.30	5.40	8.10	8.50	7.25	5.60	4.95	5.20	4.90	5.40	5.40
29	5.35	.....	5.35	9.75	8.75	7.05	5.50	4.90	5.00	4.90	5.30	5.45
30	5.40	.....	5.10	9.50	8.70	6.70	5.30	4.80	4.90	4.90	5.20	5.50
31	5.30	.....	5.10	.....	8.75	.....	5.00	4.70	.....	4.90	.....	5.40

a Estimated.

SOUTH PLATTE RIVER AT ORCHARD, COLORADO.

This station is on the lower part of the South Platte, below all of the mountain drainage tributary to that stream. The gage rod, which is vertical, is fastened to a pile at a wagon bridge about a quarter of a mile southwest of the Union Pacific Railroad station at Orchard. The station was first established in November, 1895, and has been maintained during the greater part of the time since. During the last year the gage rod had to be moved twice, owing to changes in the channel. The left bank of the river is high, but the right bank is low and is likely to overflow. The bed of the stream is sandy and shifting, but the cross section did not change materially during 1900. The station has been of great value in demonstrating the fact that large quantities of water go to waste during floods and during the winter season, a great portion being seepage or return water. As a result of the investigations at this place, a large irrigation enterprise has been undertaken—namely, that of diverting water from the river near Hardin for the purpose of irrigating lands in the vicinity of Fort Morgan, the water to be stored in large reservoirs, which are referred to elsewhere (page 279, Bijou Irrigation Company's reservoirs). The existence of a large flow having been demonstrated, it is now thought best that the station should be changed to a point farther upstream, probably at Kersey, where another large ditch might possibly be taken out. A description of the station was published in Water-Supply Paper No. 37, page 226. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 203. During

1900 the following measurements were made by A. L. Fellows and R. W. Hawley:

March 7: Gage height, 2.85; discharge, 668 second-feet.
April 21: Gage height, 5 feet; discharge, 4,674 second-feet.
July 23: Gage height, 1.35 feet; discharge, 156 second-feet.
October 27: Gage height, 2.70 feet; discharge, 324 second-feet.

Daily gage height, in feet, of South Platte River at Orchard, Colorado, for 1900.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.00	2.90	3.20	2.70	8.50	6.50	2.70	1.20	1.10	2.40	2.70	2.80
2	4.00	2.90	3.30	2.70	8.50	6.50	2.50	1.20	1.10	2.50	2.70	2.80
3	3.90	2.90	3.30	2.90	8.00	6.50	2.40	1.15	1.10	2.60	2.70	2.80
4	3.90	2.90	3.20	3.00	8.00	6.50	2.30	1.10	1.10	2.60	2.75	2.80
5	3.90	2.90	3.00	3.20	8.00	6.30	2.20	1.10	1.20	2.65	2.75	2.80
6	3.90	2.90	2.85	3.30	8.20	6.00	2.10	1.10	1.30	2.70	2.80	2.80
7	3.90	2.90	2.85	3.40	8.00	5.90	2.00	1.10	1.30	2.70	2.80	2.80
8	3.90	2.90	2.85	3.40	7.80	5.80	2.00	1.10	1.30	2.70	2.80	2.80
9	3.60	2.90	2.85	3.50	7.50	5.70	1.90	1.10	1.30	2.70	2.80	2.80
10	3.60	2.90	2.85	3.60	7.30	5.60	1.80	1.10	1.30	2.70	2.80	2.80
11	3.60	3.00	2.85	3.75	7.50	5.50	1.70	1.10	1.30	2.70	2.85	2.80
12	3.60	3.00	2.80	3.90	8.00	5.40	1.60	1.10	1.30	2.70	2.85	2.80
13	3.60	3.00	2.80	4.00	8.20	5.30	1.50	1.10	1.30	2.70	2.90	2.80
14	3.50	3.30	2.80	4.10	8.00	5.20	1.40	1.10	1.30	2.70	2.90	2.80
15	3.50	3.30	2.80	4.50	7.80	5.10	1.30	1.10	1.30	2.70	2.80	2.80
16	3.40	3.30	2.80	5.00	7.00	4.90	1.35	1.10	1.30	2.70	2.80	2.80
17	3.30	3.30	2.80	6.25	6.80	4.80	1.35	1.10	1.30	2.70	2.80	2.80
18	3.20	3.50	2.80	6.70	6.00	4.75	1.35	1.10	1.30	2.70	2.80	2.80
19	3.00	3.50	2.70	5.50	5.80	4.70	1.35	1.10	1.30	2.70	2.80	2.80
20	2.80	3.50	2.70	5.20	6.00	4.60	1.35	1.10	1.30	2.70	2.80	2.80
21	2.80	3.50	2.70	5.00	7.00	4.50	1.35	1.10	1.30	2.70	2.80	2.80
22	2.90	3.40	2.70	5.30	6.00	4.30	1.35	1.10	1.30	2.70	2.80	2.80
23	2.90	3.40	2.70	6.50	6.00	4.20	1.35	1.10	1.40	2.70	2.80	2.80
24	2.90	3.40	2.70	6.40	6.00	4.00	1.30	1.10	1.50	2.70	2.80	2.80
25	2.90	3.30	2.70	6.30	6.00	3.90	1.30	1.10	1.65	2.70	2.80	2.80
26	2.90	3.20	2.70	6.10	6.00	3.80	1.30	1.10	1.80	2.70	2.80	2.80
27	2.90	3.20	2.70	6.00	6.30	3.70	1.30	1.10	1.95	2.70	2.80	2.80
28	2.90	3.20	2.70	6.00	6.50	3.50	1.30	1.10	2.10	2.70	2.80	2.80
29	2.90	------	2.70	6.30	6.70	3.00	1.35	1.10	2.20	2.70	2.80	2.80
30	2.90	------	2.70	7.30	6.80	2.80	1.40	1.10	2.30	2.70	2.80	2.80
31	2.90	------	2.70	------	6.70	------	1.40	1.10	------	2.70	------	2.80

SOUTH PLATTE RIVER AT JULESBURG, COLORADO.

Although no station has yet been established at this place, one is greatly needed. A rod was attached to the wagon bridge about a mile southeast of the Union Pacific Railroad station at Julesburg, but no one was found who would make the observations, so that no record has been kept. A station here would be of great value, as the bridge referred to is not far from the State line, and a knowledge of the discharge passing from Colorado into Kansas could thus be obtained. The channel is very wide, as it is throughout the lower portion of the river, and on this account the results obtained would necessarily be approximate; but they would nevertheless be valuable. Within the last two years four measurements have been made at this place, as follows:

Discharge measurements of South Platte River at Julesburg, Colorado.

	Sec.-ft.
September 14, 1899	2
November 12, 1899	1,120
March 8, 1900	2,291
November 2, 1900	76

On December 20, 1900, the South Platte was measured at North Platte, Nebraska, by Adna Dobson, and a discharge of 963 second-feet was found.

BEAR CREEK NEAR MORRISON, COLORADO.

Bear Creek is one of the smaller tributaries of the South Platte, heading in the vicinity of Mount Evans, about 30 miles southwest of Denver, and entering the main stream about 8 miles above that city. Although usually of small volume, the stream drains a considerable portion of very mountainous country, which is subject to more or less violent cloudbursts, so that floods sometimes come down this creek, causing great destruction to property and even the loss of life. All of the normal flow of the stream is used for irrigation, and it is only during high-water stages that a large amount of water passes through it. Records of its flow have been kept for a portion of each irrigation season since April, 1888, with the exception of the years 1892, 1893, and 1894. The present station was established April 16, 1899. It is located just above the little town of Morrison. The gage rod, which is a 2-inch by 4-inch timber placed vertically and marked in feet and tenths, is fastened to the upper side of the dam which diverts water into the mains of the Denver Union Water Company. The bench mark is the top of a granite bowlder about 100 feet above the rod on the left-hand side of the stream, and it is 10.33 feet above the gage datum. As in previous years, the station was maintained through cooperation with the Denver Union Water Company. Owing to the formation of a gravel bar in the summer of 1900, the conditions were for some time radically changed from the normal, and during the month of September no gagings were taken. The observer is S. Hebrew, an employee of the Denver Union Water Company. Tables of gage heights and discharge measurements for 1899 will be found in Water-Supply Paper No. 37, pages 227 and 228. Table of the monthly flow for that year will be found in the Twenty-first Annual Report, Part IV, page 204. During 1900 the following measurements were made by A. L. Fellows:

March 9: Gage height, 1.40 feet; discharge, 17 second-feet.
April 14: Gage height, 2.85 feet; discharge, 47 second-feet.
April 25: Gage height, 5.80 feet; discharge, 367 second-feet.
August 7: Gage height, 3.20 feet; discharge, 63 second-feet.
September 6: No gage height taken (conditions abnormal); discharge, 24 second-feet.

Daily gage height, in feet, of Bear Creek near Morrison, Colorado, for 1900.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.70	5.95	4.75	3.55	2.00	2.60	1.90	1.35
2	.....	6.25	6.25	4.65	3.45	(a)	2.55	1.85	1.35
3	.....	6.30	6.55	4.55	3.30	.....	2.45	1.80	1.45
4	.....	6.20	6.60	4.55	4.00	.....	2.40	1.80	1.55
5	.....	6.20	6.40	4.35	4.00	.....	2.35	1.70	.....
6	.....	6.30	6.10	4.30	3.75	.....	2.30	1.70	.....
7	.....	6.40	6.25	4.35	3.70	.....	2.25	1.70	.....
8	.....	6.50	6.25	4.30	3.60	.....	2.30	1.60	.....
9	.....	6.50	6.15	4.25	3.50	.....	2.20	1.60	.....
10	.....	6.70	6.50	4.20	3.40	.....	2.20	1.60	.....
11	.....	6.90	6.40	4.15	3.30	.....	2.20	1.60	.....
12	.....	6.75	6.10	4.10	3.05	.....	2.10	1.60	.....
13	.....	6.65	5.95	4.10	2.85	.....	2.10	1.50	.....
14	3.00	6.45	5.95	4.05	2.65	.....	2.10	1.50	.....
15	2.90	6.20	5.85	4.00	2.45	.....	2.00	1.50	.....
16	2.95	6.05	5.85	4.20	2.35	.....	2.00	1.40	.....
17	3.65	5.90	5.70	4.10	2.25	.....	2.00	1.40	.....
18	3.65	5.90	5.70	4.05	2.20	.....	2.00	1.30	.....
19	4.50	5.90	5.60	4.00	2.10	.....	2.00	1.30	.....
20	4.80	6.05	5.60	3.90	2.20	.....	1.90	1.20	.....
21	5.30	5.95	5.55	3.80	2.25	.....	1.90	1.20	.....
22	5.80	5.95	5.55	3.75	2.30	.....	1.90	1.20	.....
23	5.85	6.05	5.50	4.00	2.30	.....	1.85	1.10	.....
24	5.80	6.05	5.40	4.35	2.20	.....	1.80	1.10	.....
25	5.90	6.15	5.25	4.40	2.10	.....	1.80	1.20	.....
26	6.15	6.20	5.25	4.25	2.10	.....	1.70	1.35	.....
27	6.25	6.20	5.15	4.15	2.10	.....	1.70	1.40	.....
28	6.30	6.10	5.15	4.05	2.10	.....	1.70	1.50	.....
29	7.00	6.10	5.05	4.00	2.05	.....	1.80	1.45	.....
30	6.90	6.05	4.95	3.85	2.00	2.70	2.00	1.40	.....
31	.....	6.00	.....	3.75	2.00	.....	2.00	.....	.....

(a) Gage heights not taken from September 2 to 29, inclusive, on account of dam on stream raising the water.

CLEAR CREEK AT FORKSCREEK, COLORADO.

Clear Creek rises on the eastern slope of the Rocky Mountains, in the vicinity of Grays and James peaks, about 40 miles west of Denver, and flows easterly, entering the South Platte 6 miles below the center of that city. Like the other streams of this region, for a long distance it flows through mountainous country, the water being used for power purposes and for placer mining. At Golden the creek enters an open and fertile valley, and so large a proportion of the water is diverted, by means of irrigation canals, for the cultivation of the land lying along the stream, that little of the normal flow passes into the South Platte, except that returned by seepage. During the flood stages, however, considerable water enters the main stream. The gaging station is located at the Forkscreek railroad station on the Colorado and Southern Railway, in Clear Creek Canyon, just below the junction of the North and South forks of Clear Creek. It was established May 29, 1899, and has been continued through the irrigation seasons of 1899 and 1900. The gage consists of a weight fastened to a wire running over a pulley at the edge of the embankment upon which the railway station is located. It is referred to bench marks back of the embankment. The stream flows rapidly through this part of the canyon, the channel being rocky and the fall great. Both banks are high and rocky. There is no suitable means for crossing the river at the gaging station, the railway bridge over the stream being con-

structed at an acute angle. It is possible, however, to secure fairly good results by means of measurements made at the two bridges above the forks, thus securing data of the flow of each branch as well as the total flow. At low water the stream may be gaged by wading. During the last two years the observer has been C. N. Davis, railway station agent at Forkscreek. He has voluntarily made the readings and sent daily reports to the local forecast official in Denver, who has had them published in the morning papers. A description of the station was published in Water-Supply Paper No. 37, page 228. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 205. During 1900 the following measurements were made by A. L. Fellows:

March 10: Gage height, 1.60 feet; discharge, 55 second-feet.
April 13: Gage height, 1.70 feet; discharge, 73 second-feet.
April 24: Gage height, 2.60 feet; discharge, 290 second-feet.
August 27: Gage height, 1.78 feet; discharge, 130 second-feet.

Daily gage height, in feet, of Clear Creek at Forkscreek, Colorado, for 1900.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.60	2.80	4.40	3.60	2.40	1.70	1.60	1.60	1.55
2	.....	1.60	2.80	4.35	3.50	2.35	1.70	1.60	1.60	1.55
3	.....	1.60	2.80	4.05	3.25	2.25	1.70	1.60	1.60	1.55
4	.....	2.10	2.85	4.20	3.25	2.25	1.70	1.60	1.55	1.55
5	.....	2.10	3.00	4.10	3.20	2.30	1.70	1.60	1.55	.....
6	.....	2.15	3.25	4.20	3.20	2.25	1.65	1.60	1.55	.....
7	.....	2.05	3.30	4.35	3.20	2.20	1.60	1.60	1.55	.....
8	.....	1.85	3.40	4.55	3.10	2.15	1.60	1.60	1.55	.....
9	.....	1.80	3.55	4.55	3.10	2.10	1.60	1.60	1.55	.....
10	1.65	1.85	3.90	4.45	3.00	2.10	1.70	1.60	1.55	.....
11	1.70	1.80	4.30	4.05	3.00	2.10	1.65	1.60	1.55	.....
12	1.65	1.80	4.55	3.95	2.85	2.10	1.60	1.60	1.55	.....
13	1.70	1.75	4.20	4.00	2.80	2.00	1.60	1.60	1.55	.....
14	1.70	1.80	3.75	3.90	2.75	2.00	1.60	1.70	1.55	.....
15	1.55	1.80	3.15	3.90	2.75	2.00	1.60	1.65	1.55	.....
16	1.60	1.85	3.45	4.05	2.70	1.90	1.60	1.60	1.55	.....
17	1.65	1.85	3.80	4.05	2.70	1.90	1.55	1.60	1.55	.....
18	1.60	1.80	3.70	4.00	2.65	1.90	1.50	1.60	1.55	.....
19	1.50	2.00	3.70	4.00	2.55	1.90	1.50	1.60	1.55	.....
20	1.60	2.35	3.75	4.00	2.50	1.90	1.50	1.60	1.55	.....
21	1.60	2.35	3.75	4.00	2.50	1.90	1.50	1.60	1.55	.....
22	1.60	2.65	3.60	4.00	2.50	1.90	1.50	1.60	1.55	.....
23	1.60	2.60	3.75	4.00	2.50	1.90	1.50	1.60	1.55	.....
24	1.60	2.60	3.65	3.90	2.50	1.85	1.50	1.60	1.55	.....
25	1.60	2.70	4.05	3.85	2.50	1.80	1.60	1.60	1.55	.....
26	1.60	2.55	4.05	3.80	2.50	1.80	1.60	1.60	1.55	.....
27	1.60	2.55	4.10	3.60	2.50	1.80	1.60	1.60	1.55	.....
28	1.60	2.60	4.35	3.60	2.50	1.80	1.60	1.60	1.55	.....
29	1.60	2.90	4.40	3.60	2.50	1.80	1.60	1.55	1.55	.....
30	1.60	2.90	4.45	3.70	2.40	1.80	1.60	1.55	1.55	.....
31	1.60	.....	4.30	.....	2.40	1.75	.....	1.60	.....	.....

SOUTH BOULDER CREEK NEAR MARSHALL, COLORADO.

South Boulder Creek, a tributary of Boulder Creek, is the next mountain stream of importance north of Clear Creek. The gaging station, which was established in April, 1888, and has been maintained during a portion of each year since, except during 1893 and 1894, is located at the mouth of the canyon from which the stream issues about 3 miles west of the Colorado and Southern Railway station at Marshall. The rod consists of an inclined timber on the

north bank of the stream near the house of C. E. Barber. Above the station two ditches divert water, namely, the South Boulder and Coal Creek ditch and the Community ditch, and their discharges must be added to the discharge at the station, in order to obtain the total run-off of the basin. The channel of the stream, which is rocky and full of bowlders, does not change materially. Gagings are usually made by wading, but at high water they are made from the footbridge just above the rod. The observer during 1900 was Miss Blanche Barber, who lives near by. A description of the station was published in Water-Supply Paper No. 37, page 229. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 206. During 1900 the following measurements were made by A. L. Fellows:

July 28: Gage height, 1.40 feet; discharge, 35 second-feet.
August 28: Gage height, 1.10 feet; discharge, 10 second-feet.

Daily gage height, in feet, of South Boulder Creek near Marshall, Colorado, for 1900.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	3.45	2.40	1.45	1.00	17	.....	2.55	1.80	1.30	1.05
2	.....	3.45	2.30	1.50	1.05	18	.....	2.65	1.75	1.30	1.10
3	.....	3.45	2.30	1.50	1.00	19	.....	2.70	1.70	1.30	1.05
4	.....	3.40	2.20	1.50	1.05	20	.....	2.65	1.70	1.25	1.00
5	.....	3.20	2.25	1.60	1.05	21	.....	2.85	1.70	1.30	1.05
6	4.00	3.20	2.15	1.50	1.05	22	.....	2.75	1.70	1.25	1.15
7	4.00	3.20	2.15	1.50	1.05	23	.....	2.70	1.70	1.30	1.15
8	4.00	3.20	2.10	1.45	1.05	24	.....	2.65	1.60	1.35	1.10
9	4.00	3.05	2.05	1.40	1.00	25	.....	2.60	1.55	1.35	1.15
10	4.00	3.00	1.80	1.40	1.20	26	.....	2.45	1.55	1.30	1.20
11	4.00	2.95	1.80	1.40	1.10	27	.....	2.50	1.60	1.20	1.10
12	4.00	2.90	1.80	1.30	1.10	28	.....	2.45	1.40	1.20	1.10
13	(a)	2.90	1.80	1.40	1.10	29	.....	2.45	1.40	1.10	1.10
14	.....	2.90	1.80	1.35	1.00	30	.....	2.40	1.70	1.10	1.00
15	.....	2.60	1.85	1.35	1.05	31	.....	.....	1.60	1.00	.....
16	.....	2.70	1.80	1.30	1.00						

a Regular readings did not begin until June 1.

BOULDER CREEK NEAR BOULDER, COLORADO.

The general character of Boulder Creek, one of the tributaries of St. Vrain Creek, is similar to that of the latter stream. The gaging station is located 1½ miles above the town of Boulder, where the stream issues from the mountains. There are two small irrigation ditches above the station, but the amount of water diverted does not exceed 5 or 6 second-feet, and may, therefore, be disregarded. The channel of the stream contains so many large bowlders that accurate measurements are difficult to obtain, either here or at any other point. During high water measurements are made from the bridge, but at low-water stages the stream can be gaged by wading. The entire normal flow is used for irrigation, but large quantities of water go to waste during the flood season. Plans are being considered for the construction of large reservoirs to store the flood waters for the irrigation of lands now arid. The gage rod is an inclined timber spiked to stakes driven

into the bank. The bench mark is the top of a large stone 22 feet west of the gage and 5.72 feet above the zero of the rod. Both banks are high and rocky, and are not subject to overflow. The observer for 1900 was Mrs. Carrie Osgood, who lives near by. A description of the station was published in Water-Supply Paper No. 37, page 231. The results of measurements for 1897, 1898, and 1899 will be found in the Twenty-first Annual Report, Part IV, page 207. During 1900 the following measurements were made by A. L. Fellows:

April 28: Gage height, 2.10 feet; discharge, 483 second-feet.
July 27: Gage height, 1.40 feet; discharge, 220 second-feet.
August 28: Gage height, 0.62 foot; discharge, 49 second-feet.

Daily gage height, in feet, of Boulder Creek near Boulder, Colorado, for 1900.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.35	2.85	2.00	1.22	0.60	0.45	17	2.25	2.42	1.40	0.75	0.55	0.62
2	2.35	2.75	1.95	1.22	.60	.45	18	2.20	2.42	1.40	.78	.55	.60
3	2.30	2.75	1.95	1.22	.62	.42	19	2.15	2.35	1.38	.72	.55	.60
4	2.40	2.65	1.82	1.20	.62	.45	20	2.22	2.40	1.40	.73	.50	.58
5	2.62	2.68	1.70	1.18	.60	.42	21	2.20	2.35	1.32	.70	.50	.55
6	2.52	2.72	1.60	1.18	.60	.48	22	2.22	2.38	1.35	.68	.50	.52
7	2.55	2.68	1.50	1.12	.60	.50	23	2.20	2.40	1.38	.65	.48	.45
8	2.70	2.78	1.45	1.08	.62	.48	24	2.18	2.35	1.35	.75	.45	.43
9	2.68	2.75	1.40	.98	1.17	.50	25	2.18	2.30	1.32	.73	.50	.40
10	2.70	2.78	1.40	.98	.95	.48	26	2.25	2.25	1.38	.72	.65	.37
11	2.65	2.60	1.50	.98	.90	.50	27	2.52	2.22	1.38	.68	.65	.33
12	2.75	2.58	1.62	.92	.88	.67	28	2.70	2.20	1.38	.60	.55	.30
13	2.62	2.45	1.52	.90	.82	.75	29	2.75	2.10	1.25	.60	.52	.32
14	2.48	2.40	1.52	.85	.80	.60	30	2.70	2.08	1.22	.62	.55	.35
15	2.35	2.40	1.60	.80	.65	.55	31	2.78	.....	1.22	.60	.....	.25
16	2.30	2.42	1.55	.78	.60	.70							

ST. VRAIN CREEK NEAR LYONS, COLORADO.

St. Vrain Creek and its tributaries derive their supply of water from the eastern slope of the Front Range, between Longs Peak and James Peak, which are about 30 miles apart. The general trend of the drainage is northeasterly, the St. Vrain flowing into South Platte River about 6 miles below the town of Platteville. The principal tributaries of the stream are the North and South forks and Boulder Creek. South Boulder Creek is a tributary of the latter stream. In their upper portions these creeks flow through mountainous areas where the water is used only for power purposes and for placer mining, but at the foothills each stream emerges into a broad, approximately level valley, devoted entirely to farming, water being furnished by means of irrigation canals leading from the streams. Three stations are maintained on the main stream and its tributaries, namely, at Lyons, on the St. Vrain, at Boulder, on the Boulder, and at Marshall, on the South Boulder. The station at Lyons is about a half mile southeast of the town, and is below the intersection of the North and South forks.

Records of the flow of the creek at or near Lyons have been kept since April, 1888, except during the years 1893 and 1894, but the station was not put in its present condition until May 5, 1899, since when

records have been kept throughout each irrigation season. The rod is an inclined timber on the left bank of the stream, opposite the Tower Hotel, fastened to pieces of timber driven into the slag embankment. The stream has an excellent channel of gravel and bowlders, and is not likely to change. Measurements have usually been made by wading, but at high water they are made from the bridge about a quarter of a mile below the gage rod. The bench mark is a spike 2 feet from the west side of the trunk of a large cottonwood tree 150 feet north of the rod. Supply ditch diverts water above the station, and its discharge should be added to that of the creek in order to obtain the total run-off of the basin. The observer during the year 1900 was L. H. Dickson, commissioner of the St. Vrain water district, who kept up the readings during the irrigation season. Weekly records of the discharge at this point have been furnished to the Longmont papers. During the greater part of the irrigation season the entire discharge of St. Vrain Creek is utilized, but during the flood period considerable water usually goes to waste. Much of the water is, however, stored in reservoirs, and is used to advantage at low stages of the stream. A description of the station was published in Water-Supply Paper No. 37, page 232. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 208. During 1900 the following measurements were made by A. L. Fellows:

March 13: Gage height, 2.06 feet; discharge, 35 second-feet.
April 27: Gage height, 3.68 feet; discharge, 513 second-feet.
July 27: Gage height, 2.70 feet; discharge, 193 second-feet.

Daily gage height, in feet, of St. Vrain Creek near Lyons, Colorado, for 1900.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			4.10	4.50	3.50	2.55	2.15	2.10	2.05
2			4.00	4.30	3.45	2.55	2.15	2.10	2.05
3			3.90	4.50	3.35	2.50	2.15	2.10	2.05
4			4.00	4.40	3.25	2.50	2.15	2.08	2.05
5			4.15	4.20	3.10	2.50	2.15	2.08	2.05
6			4.10	4.10	3.10	2.55	2.15	2.08	2.05
7			4.15	4.30	3.10	2.50	2.15	2.10	2.05
8		3.20	4.10	4.35	3.10	2.47	2.23	2.10	2.05
9	1.90		4.30	4.40	3.00	2.47	2.23	2.10	2.05
10	1.90		4.15	4.30	2.95	2.45	2.23	2.10	2.05
11			4.15	3.90	3.05	2.45	2.75	2.08	2.00
12			4.10	3.85	3.05	2.40	2.70	2.05	2.00
13	2.06		4.10	3.80	3.05	2.35	2.45	2.05	
14			3.95	3.95	3.05	2.30	2.35	2.05	
15		2.06	3.75	3.80	3.05	2.30	2.25	2.05	
16		1.90	3.65	3.85	3.05	2.30	2.20	2.30	
17	1.85	1.85	3.70	3.85	3.00	2.30	2.15	2.25	
18		1.90	3.70	3.90	2.90	2.25	2.15	2.20	
19		1.85	3.65	3.95	2.90	2.25	2.12	2.20	
20		1.90	3.50	4.00	2.80	2.25	2.12	2.25	
21		1.90	3.60	4.00	2.75	2.35	2.12	2.20	
22	1.90	4.20	3.80	3.95	2.70	2.25	2.10	2.18	
23		3.80	3.70	4.00	2.70	2.25	2.10	2.15	
24		3.90	3.95	3.90	2.80	2.23	2.08	2.15	
25		3.80	3.60	3.80	2.75	2.23	2.10	2.15	
26		3.80	4.00	3.65	2.70	2.20	2.18	2.15	
27		3.70	4.20	3.55	2.70	2.17	2.15	2.15	
28		3.75	4.60	3.55	2.70	2.15	2.18	2.10	
29		4.80	4.60	3.50	2.70	2.15	2.10	2.10	
30	1.95	4.30	4.70	3.45	2.65	2.15	2.10	2.10	
31			4.50		2.65	2.15		2.05	

NOTE.—Regular readings did not begin until April 15.

BIG THOMPSON CREEK NEAR ARKINS, COLORADO.

This stream drains the country immediately north of that drained by the headwaters of St. Vrain Creek, and is one of the largest tributaries of South Platte River, into which it empties about 4 miles above the town of Evans. Little Thompson Creek is an important tributary of Big Thompson Creek, and the country drained by these two streams makes up irrigation district No. 4. The junction of these creeks is near the lower end of the district, a short distance above the point where their combined waters enter the South Platte.

Records of the flow of this stream were begun in April, 1888, and have been maintained for a portion of each year since, with the exception of the years 1893 and 1894. The station was established at its present location on April 1, 1899. The only diversion above the gaging station is Handy ditch, a record of the gage heights of which is kept by the water commissioner of that district, J. M. Wolaver, who has also kept the records of Big Thompson Creek at this point during the year 1900. It is necessary to include the discharge of Handy ditch in order to obtain the total run-off of the basin. The rod is a vertical 2-inch by 4-inch timber fastened to the downstream side of the right-hand end of the wagon bridge on the ranch of John Chasteen. The bench mark is 25 feet south of the gage, and is a nail in the root of a cottonwood stump, the head of the nail being 9.35 feet above the zero of gage. The channel of the stream is lined with bowlders and is very rough, but, not being likely to change, it furnishes a good point for obtaining accurate measurements. A permanent station could be located here to advantage. Like the other tributaries of the South Platte, nearly all of the normal flow of Big Thompson and Little Thompson creeks is used for irrigation, and during the high-water stages the greater part of the volume is diverted into large reservoirs, from which it is used to advantage later in the season. A description of the station was published in Water-Supply Paper No. 37, page 233. The results of measurements for 1899 will be found in the Twenty-first Annual Report, Part IV, page 209. During 1900 the following measurements were made by A. L. Fellows:

April 26: Gage height, 1.91 feet; discharge, 512 second-feet.
July 26: Gage height, 1.35 feet; discharge, 322 second-feet.

Daily gage height, in feet, of Big Thompson Creek near Arkins, Colorado, for 1900.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.20	3.50	3.50	2.00	1.10	0.70	17	1.60	2.70	2.90	1.50	0.80	0.60
2	.20	3.40	3.60	1.80	1.10	.70	18	1.60	2.80	2.80	1.40	.80	.60
3	.30	3.40	3.40	1.80	1.10	.70	19	2.00	2.80	2.80	1.40	.80	.60
4	.50	3.30	3.20	1.70	1.10	.70	20	2.00	2.50	2.80	1.40	.80	.60
5	.60	2.80	2.90	1.70	1.10	.70	21	2.20	2.60	2.80	1.20	.80	.60
6	.60	2.60	3.00	1.70	1.10	.70	22	1.90	2.65	2.80	1.20	.80	.60
7	.70	2.60	3.40	1.70	1.10	.70	23	1.80	2.75	2.90	1.20	.80	.60
8	.90	2.70	3.40	1.80	1.10	.70	24	1.80	2.75	2.80	1.30	.70	.60
9	.90	2.80	3.50	1.80	1.00	.70	25	1.80	2.80	2.80	1.30	.70	.60
10	.90	3.10	3.10	1.70	1.00	.70	26	1.90	3.10	2.70	1.20	.70	.60
11	1.00	3.10	3.00	1.70	.90	.70	27	1.90	3.30	2.60	1.20	.70	.60
12	1.00	3.00	2.90	1.60	.80	.70	28	2.10	3.50	2.50	1.30	.70	.70
13	1.10	2.90	3.00	1.60	.80	.70	29	3.60	3.60	2.40	1.30	.70	.70
14	1.10	2.90	3.00	1.60	.80	.70	30	3.50	3.70	2.30	1.20	.70	.70
15	1.90	2.90	3.00	1.60	.80	.70	31	.....	3.50	.....	1.10	.70	.....
16	1.80	2.70	3.00	1.70	.80	.60							

Daily gage height, in feet, of Handy ditch near Arkins, Colorado, for 1900.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	1.20	0.40	0.32	12	.....	0.72	0.32	0.30	23	2.20	0.40	0.32	.30
2	.....	1.20	.40	.30	13	.....	.72	.32	.30	24	2.20	.40	.32	.30
3	.....	1.20	.40	.30	14	.....	.72	.32	.30	25	2.20	.40	.32	.30
4	.....	1.20	.40	.30	15	.....	.72	.32	.30	26	2.20	.40	.32	.30
5	.....	.80	.40	.30	16	.....	.72	.32	.30	27	2.20	.40	.32	.30
6	.....	.80	.40	.30	17	2.20	.72	.32	.30	28	1.20	.40	.32	.30
7	.....	.80	.40	.30	18	2.20	.72	.32	.30	29	1.20	.40	.32	.30
8	.....	.72	.45	.30	19	2.20	.72	.32	.30	30	1.20	.40	.32	.....
9	.....	.72	.45	.30	20	2.20	.72	.32	.30	31	.....	.40	.32	.....
10	.....	.72	.40	.30	21	2.20	.72	.32	.30					
11	.....	.72	.40	.30	22	2.20	.72	.32	.30					

CACHE LA POUDRE RIVER NEAR FORT COLLINS, COLORADO.

This stream is the northernmost of the large tributaries of the South Platte which issue from the east front of the Rocky Mountains. During the irrigating season its discharge is augmented by the supply diverted from the headwaters of Laramie River, which lie immediately to the west of the headwaters of the Cache la Poudre, the diversion being made through Sky Line canal. Measurements of the discharge of the Cache la Poudre Basin, therefore, include some of the Laramie waters. Practically the entire flow of the Cache la Poudre is used for irrigation purposes, even the greater part of the flood waters being stored for use later in the season. It is along the valley of the Cache la Poudre that the earliest and best irrigation of the State has been carried on.

The gaging station, which was established in 1884, is about 15 miles above Fort Collins. Since its establishment it has been maintained under the direction of Prof. L. G. Carpenter, of the Colorado State Agricultural College. The records are from the figures published by Professor Carpenter in the daily papers. The figures of daily discharge for the years 1895 to 1899, inclusive, will be found in Water-Supply Paper No. 37, pages 235 to 237.

Daily discharge, in second-feet, of Cache la Poudre River near Fort Collins, Colorado, for 1900.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2,551	3,951	1,360	369	204	140
2	.....	2,508	3,938	1,276	355	199	137
3	.....	2,447	4,080	1,176	341	160	122
4	.....	2,251	3,600	1,042	374	143	122
5	.....	2,461	3,104	958	460	133	122
6	.....	2,354	3,602	871	435	126	122
7	.....	2,447	4,376	853	392	124	122
8	.....	2,486	4,227	827	315	137	122
9	.....	2,586	4,193	795	299	133	122
10	.....	2,777	4,180	752	292	260	141
11	.....	3,012	3,224	705	276	255	141
12	.....	2,992	2,978	666	260	151	141
13	.....	2,811	2,813	641	247	157	141
14	.....	2,652	3,001	625	235	156	141
15	.....	2,411	2,797	597	214	144	141
16	.....	2,049	2,968	599	218	138	141
17	.....	2,143	2,923	576	218	133	.....
18	427	2,258	2,622	531	218	126	.....
19	556	2,093	2,789	525	214	118	.....
20	823	2,271	2,567	525	212	113	.....
21	1,168	2,582	2,573	481	210	122	.....
22	1,554	2,525	2,441	460	248	122	.....
23	1,245	2,490	2,460	475	195	121	.....
24	1,263	2,884	2,329	736	200	121	.....
25	1,223	2,939	2,140	767	198	126	.....
26	1,154	3.240	2,036	719	215	141	.....
27	1,204	3,561	1,813	641	212	144	.....
28	1,807	4,071	1,674	592	201	140	.....
29	2,934	4,560	1,540	558	204	140	.....
30	2,530	4,416	1,325	527	199	141	.....
31	.....	4,204	.....	506	204	.....	.....
Mean	1,376	2,808	2,942	721	265	149	132

[Continued in Water-Supply Paper No. 50, where will be found tables of computations of seepage on numerous streams in Colorado.]

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1895.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Part II, Papers of an economic character, 1895; octavo, 598 pp.

Contains a paper on the public lands and their water supply, by F. H. Newell, illustrated by a large map showing the relative extent and location of the vacant public lands; also a report on the water resources of a portion of the Great Plains, by Robert Hay.

A geological reconnoissance of northwestern Wyoming, by George H. Eldridge, 1894; octavo, 72 pp. Bulletin No. 119 of the United States Geological Survey; price, 10 cents.

Contains a description of the geologic structure of portions of the Bighorn Range and Bighorn Basin, especially with reference to the coal fields, and remarks upon the water supply and agricultural possibilities.

Report of progress of the division of hydrography for the calendar years 1893 and 1894, by F. H. Newell, 1895; octavo, 176 pp. Bulletin No. 131 of the United States Geological Survey; price, 15 cents.

Contains results of stream measurements at various points, mainly within the arid region, and records of wells in a number of counties in western Nebraska, western Kansas, and eastern Colorado.

1896.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Part II, Economic geology and hydrography, 1896; octavo, 864 pp.

Contains papers on "The underground water of the Arkansas Valley in eastern Colorado," by G. K. Gilbert; "The water resources of Illinois," by Frank Leverett, and "Preliminary report on the artesian waters of a portion of the Dakotas," by N. H. Darton.

Artesian-well prospects in the Atlantic Coastal Plain region, by N. H. Darton, 1896; octavo, 230 pp., 19 plates. Bulletin No. 138 of the United States Geological Survey; price, 20 cents.

Gives a description of the geologic conditions of the coastal region from Long Island, N. Y., to Georgia, and contains data relating to many of the deep wells.

Report of progress of the division of hydrography for the calendar year 1895, by F. H. Newell, hydrographer in charge, 1896; octavo, 356 pp. Bulletin No. 140 of the United States Geological Survey; price, 25 cents.

Contains a description of the instruments and methods employed in measuring streams and the results of hydrographic investigations in various parts of the United States.

1897.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Part IV, Hydrography, 1897; octavo, 756 pp.

Contains a "Report of progress of stream measurements for the calendar year 1896," by Arthur P. Davis; "The water resources of Indiana and Ohio," by Frank Leverett; "New developments in well boring and irrigation in South Dakota," by N. H. Darton, and "Reservoirs for irrigation," by J. D. Schuyler.

1899.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Part IV, Hydrography, 1899; octavo, 814 pp.

Contains a "Report of progress of stream measurements for the calendar year 1898," by F. H. Newell and others; "The rock waters of Ohio," by Edward Orton, and "Preliminary report on the geology and water resources of Nebraska west of the one hundred and third meridian," by N. H. Darton.

Part II of the Nineteenth Annual contains a paper on "Principles and conditions of the movements of ground water," by F. H. King, and one on "Theoretical investigation of the motion of ground waters," by C. S. Slichter.

1900.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Part IV, Hydrography, 1900; octavo, 660 pp.

Contains a "Report of progress of stream measurements for the calendar year 1898," by F. H. Newell, and "Hydrography of Nicaragua," by A. P. Davis.

1901.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Part IV, Hydrography, 1900; octavo, 768 pp.

Contains a "Report of progress of stream measurements for the calendar year 1899," by F. H. Newell; "Preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming," by N. H. Darton; and "The High Plains and their utilization," by W. D. Johnson.

Bulletins can be obtained only by prepayment of cost, as noted above. Money should be transmitted by postal money order or express order, payable to the Director of the United States Geological Survey. Postage stamps, checks, and drafts can not be accepted. Correspondence should be addressed to

The Director, U. S. Geol. Survey, Washington, D. C.

WATER-SUPPLY AND IRRIGATION PAPERS.

1. Pumping water for irrigation, by Herbert M. Wilson, 1896.
2. Irrigation near Phœnix, Arizona, by Arthur P. Davis, 1897.
3. Sewage irrigation, by George W. Rafter, 1897.
4. A reconnoissance in southeastern Washington, by Israel C. Russell, 1897.
5. Irrigation practice on the Great Plains, by E. B. Cowgill, 1897.
6. Underground waters of southwestern Kansas, by Erasmus Haworth, 1897.
7. Seepage waters of northern Utah, by Samuel Fortier, 1897.
8. Windmills for irrigation, by E. C. Murphy, 1897.
9. Irrigation near Greeley, Colorado, by David Boyd, 1897.
10. Irrigation in Mesilla Valley, New Mexico, by F. C. Barker, 1898.
11. River heights for 1896, by Arthur P. Davis, 1897.
12. Underground waters of southeastern Nebraska, by N. H. Darton, 1898.
13. Irrigation systems in Texas, by W. F. Hutson, 1898.
14. New tests of pumps and water lifts used in irrigation, by O. P. Hood, 1898.
15, 16. Operations at river stations, 1897, Parts I, II, 1898.
17. Irrigation near Bakersfield, California, by C. E. Grunsky, 1898.
18. Irrigation near Fresno, California, by C. E. Grunsky, 1898.
19. Irrigation near Merced, California, by C. E. Grunsky, 1899.
20. Experiments with windmills, by Thomas O. Perry, 1899.
21. Wells of northern Indiana, by Frank Leverett, 1899.
22. Sewage irrigation, Part II, by George W. Rafter, 1899.
23. Water-right problems of Bighorn Mountains, by Elwood Mead, 1899.
24, 25. Water resources of the State of New York, Parts I, II, by G. W. Rafter, 1899.
26. Wells of southern Indiana (continuation of No. 21), by Frank Leverett, 1899.
27, 28. Operations at river stations, 1898, Parts I, II, 1899.
29. Wells and windmills in Nebraska, by Erwin Hinckley Barbour, 1899.
30. Water resources of the Lower Peninsula of Michigan, by Alfred C. Lane, 1899.
31. Lower Michigan mineral waters, by Alfred C. Lane, 1899.
32. Water resources of Puerto Rico, by H. M. Wilson, 1900.
33. Storage of water on Gila River, Arizona, by J. B. Lippincott, 1900.
34. Geology and water resources of southeastern S. Dak., by J. E. Todd, 1900.
35–39. Operations at river stations, 1899, Parts I–V, 1900.
40. The Austin dam, by Thomas U. Taylor, 1900.
41, 42. The windmill: its efficiency and use, Parts I, II, by E. C. Murphy, 1901.
43. Conveyance of water in irrigation canals, etc., by Samuel Fortier, 1901.
44. Profiles of rivers, by Henry Gannett, 1901.
45. Water storage on Cache Creek, California, by Albert E. Chandler, 1901.
46. Reconn. of Kern and Yuba rivers, Cal., by F. H. Olmsted and M. Manson, 1901.
47–52. Operations at river stations, 1900, Parts I–VI, 1901.

Other papers are in various stages of preparation. Provision has been made for printing these by the following clause in the sundry civil act making appropriations for the year 1896–97:

Provided, That hereafter the reports of the Geological Survey in relation to the gaging of streams and to the methods of utilizing the water resources may be printed in octavo form, not to exceed 100 pages in length and 5,000 copies in number; 1,000 copies of which shall be for the official use of the Geological Survey, 1,500 copies shall be delivered to the Senate, and 2,500 copies shall be delivered to the House of Representatives, for distribution. (Approved, June 11, 1896; Stat. L., vol. 29, p. 453.)

The endeavor is made to send these pamphlets to persons who have rendered assistance in their preparation through replies to schedules or who have furnished data. Requests made for a certain paper and stating a reason for asking for it are granted whenever practicable, but it is impossible to comply with general demands, such as to have all of the series sent.

Application for these papers should be made either to members of Congress or to

THE DIRECTOR, UNITED STATES GEOLOGICAL SURVEY, WASHINGTON, D. C.