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

WATER-SUPPLY PAPER 304

SURFACE WATER SUPPLY OF THE UNITED STATES

1911

PART IV. ST. LAWRENCE RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

C. C. COVERT AND R. H. BOLSTER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

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

WATER-SUPPLY PAPER 304

SURFACE WATER SUPPLY OF THE UNITED STATES

1911

PART IV. ST. LAWRENCE RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

C. C. COVERT AND R. H. BOLSTER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

CONTENTS.

ILLUSTRATIONS.

SURFACE WATER SUPPLY OF THE ST. LAWRENCE RIVER BASIN, 1911.

By C. C. COVERT and R. H. BOLSTER.

AUTHORITY FOR THE WORK.

This volume is Part IV of a series of 12 reports presenting results of measurements of flow made on certain streams in the United States during the calendar year 1911. The reports are listed in the following table:

Papers on surface water supply of the United States, 1911.

Part.[a]	No.	Title.
I	301	North Atlantic coast.
II	302	South Atlantic coast and eastern Gulf of Mexico.
III	303	Ohio River basin.
IV	304	St. Lawrence River basin.
V	305	Upper Mississippi River and Hudson Bay basins.
VI	306	Missouri River basin.
VII	307	Lower Mississippi River basin.
VIII	308	Western Gulf of Mexico.
IX	309	Colorado River basin.
X	310	Great Basin.
XI	311	Pacific coast in California.
XII	312	North Pacific coast.

[a] For the purpose of uniformity in the presentation of reports, a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into 12 parts, whose boundaries coincide with natural drainage lines indicated by the parts of the report.

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

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

The work was begun in 1888 in connection with special studies of water supply for irrigation.

Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations.

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

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1913, inclusive	150,000

In the execution of the work many private and State organizations have cooperated. Acknowledgments for such cooperation are made on pages 13–14, and also in connection with the description of each station affected by the cooperative work.

PUBLICATIONS.

Measurements of stream flow have been made at nearly 2,000 points in the United States, and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. During 1911 gaging stations were maintained by the Survey and the cooperating organizations at about 1500 points in the United States, and many discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country, and will be made available in the regular surface water supply papers from time to time. A complete list of the gaging stations maintained by the Survey to and including 1910, and a list of the papers relating to the water supply of the country, have been published by the Survey as Water-Supply Paper 280. An index to the reports containing stream-flow measurements prior to 1904 has been published as Water-Supply Paper 119.

For each calendar year there has been prepared a report embodying the stream-flow data collected during that year, which has been published either as a part of the Annual Report of the Director, as a bulletin, or as a water-supply paper, as shown by the following table:

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

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

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	Complete data, except descriptions	1906.
WS 241 to 252	Complete data	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.

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

The table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1911. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1911, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, and 301, which contain records for the New England streams from 1903 to 1911.

Numbers of water-supply papers containing results of stream measurements, 1899–1911.

	1899 [a]	1900 [b]	1901	1902	1903	1904
North Atlantic coast (St. John River to York River)	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125, [f] 126
South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi)	[g] 35, 36	48	65, 75	[g] 82, 83	[g] 97, 98	[f] 126, 127
Ohio River basin	36	48, [h] 49	65, 75	83	98	128
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129
Hudson Bay and upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, 100	[j] 128, 130
Missouri River	[k] 36, 37	49, [l] 50	66, 75	84	99	130, [m] 131
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131
Western Gulf of Mexico	37	50	66, 75	84	99	132
Colorado River	[n] 37, 38	50	66, 75	85	100	133
Great Basin	38, [p] 39	51	66, 75	85	100	133, [q] 134
Pacific coast in California	38, [r] 39	51	66, 75	85	100	134
North Pacific coast	38	51	66, 75	85	100	135

	1905	1906	1907–8	1909	1910	1911
North Atlantic coast (St. John River to York River)	[d] 165, [e] 166, [f] 167	[d] 201, [e] 202, [f] 203	241	261	281	301
South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi)	[f] 167, 168	[f] 203, 204	242	262	282	302
Ohio River basin	169	205	243	263	283	303
St. Lawrence River and Great Lakes	170	206	244	264	284	304
Hudson Bay and upper Mississippi River	171	207	245	265	285	305
Missouri River	172	208	246	266	286	306
Lower Mississippi River	[j] 169, 173	[j] 205, 209	247	267	287	307
Western Gulf of Mexico	174	210	248	268	288	308
Colorado River	175, [o] 177	211	249	269	289	309
Great Basin	176 [q] 177	212, [q] 213	250, [q] 251	270, [q] 271	290	310
Pacific coast in California	177	213	251	271	291	311
North Pacific coast	[s] 177, 178	214	252	272	292	312

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

DEFINITION OF TERMS.

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

MAP OF UNITED STATES, SHOWING MEAN ANNUAL PRECIPITATION

Blue lines and figures indicate average annual precipitation in depth in inches

Prepared by Henry Gannett
mainly from data of the
United States Geological Survey

ENGRAVED AND PRINTED BY THE U.S. GEOLOGICAL SURVEY

MAP OF UNITED STATES, SHOWING MEAN ANNUAL RUN-OFF

Blue lines and figures indicate average annual run-off in depth in inches

Prepared by Henry Gannett
mainly from data of the
United States Geological Survey

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

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

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

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

CONVENIENT EQUIVALENTS.

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

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

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

NOTE.—For partial month multiply the values for one day by the number of days.

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

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

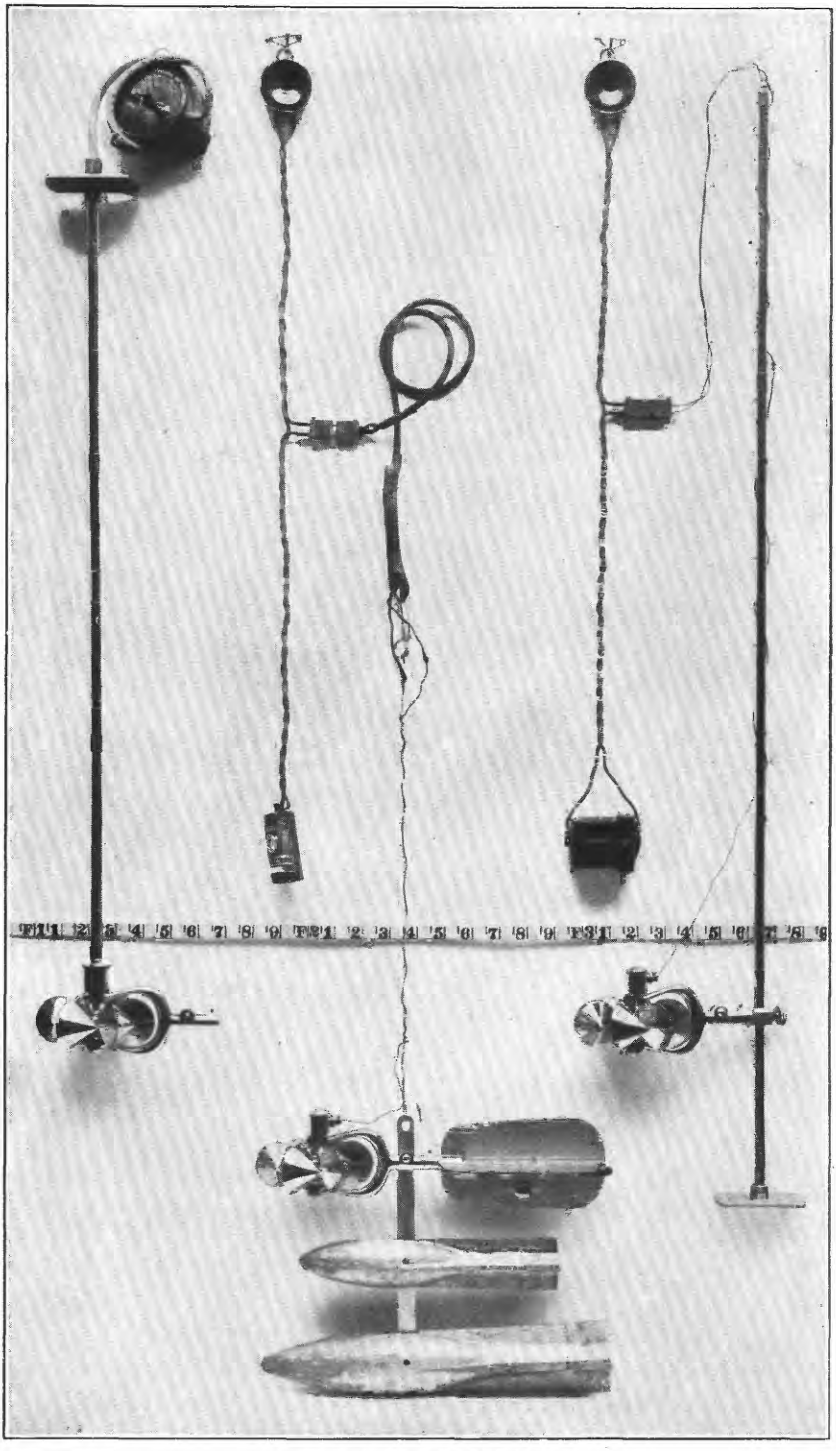
NOTE.—For partial month multiply the values for one day by the number of days.

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second feet for 1 day.
1,000,000,000 cubic feet equals 414 second-feet for one 28 day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29 day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30 day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31 day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers..
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

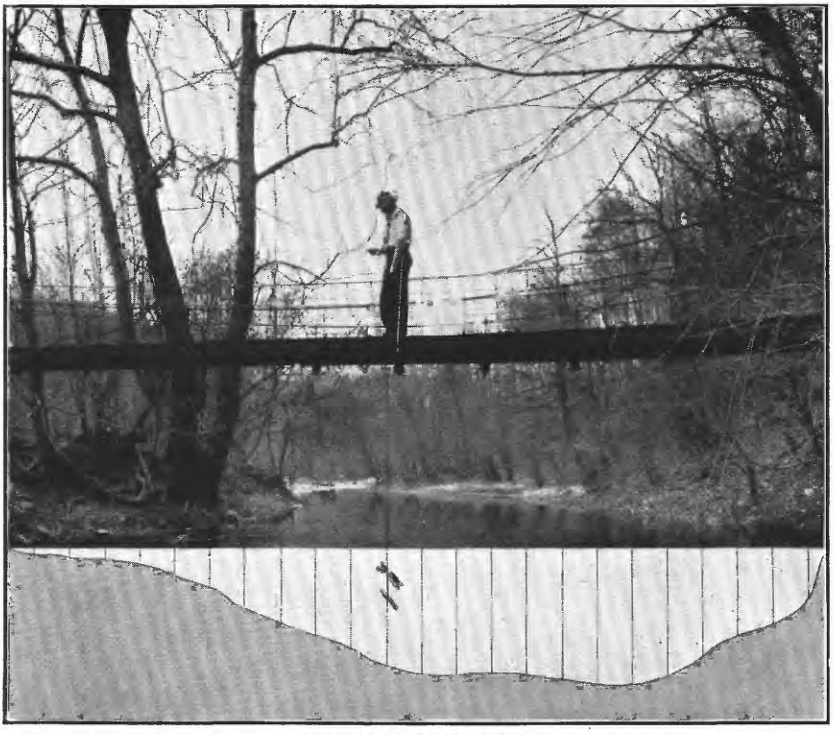
To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

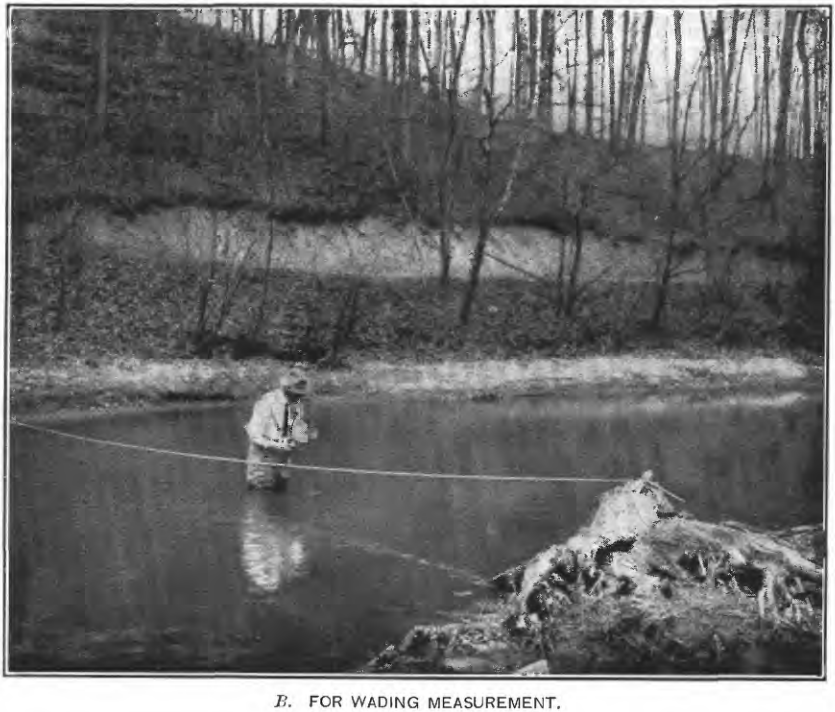
For each regular current-meter gaging station the following data, so far as available, are given: Description of the station, list of discharge measurements, table of daily gage heights, table of daily discharge, table of monthly and yearly discharges and run-off. For stations located at weirs or dams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



SMALL PRICE CURRENT METERS.



A. FOR BRIDGE MEASUREMENT.



B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.

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

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

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

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

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

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

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the

day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on pages 8–9, are based.

The field methods used in the collection of the data presented in this series of reports are described in the introductory sections of Water-Supply Papers 261 to 272, inclusive, "Surface water supply of the United States, 1909." Plates I and II show the average precipitation and run-off in the United States, as determined from the measurements of stream flow made by the Geological Survey and records of rainfall collected by the Weather Bureau. Plate III shows typical gaging stations. Plate IV shows current meters[1] used in the work.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

The accuracy of stream-flow data depends primarily on the natural conditions at the gaging station and on the methods and care with which the data are collected. Errors of the first group depend on the degree of permanency of channel and of permanency of the relation between discharge and stage.

Errors of the second class are due, first, to errors in observation of stage; second, to errors in measurements of flow, and, third, to errors due to misinterpretation of stage and flow data.

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

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

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

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

Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use, and they should therefore be considered as only approximate, particularly for periods of irrigation or of low water. For these errors it is as a rule not feasible to make adequate correction.

In general, the base data collected each year by the Survey engineers are published, not only to comply with the law, but to afford any engineer the means of examining and adjusting to his own needs the results of the computations. The table of monthly discharge is so arranged as to give only a general idea of the flow at the station and should not be used for other than preliminary estimates. The determinations of daily discharge allow more detailed studies of the variation in flow by which the period of deficiency may be determined.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published, and the engineer who makes use of the figures presented in these papers should verify all ratings and make such adjustments for earlier years as may seem necessary.

COOPERATION AND ACKNOWLEDGMENTS.

LAKE SUPERIOR DRAINAGE BASIN.

The work in Minnesota during 1911 has been done with State cooperation under the terms of an act of the legislature of 1909, as embodied in joint resolution 19, which reads as follows:

Whereas the water supplies, water powers, navigation of our rivers, drainage of our lands, and the sanitary condition of our streams and their watersheds generally form one great asset and present one great problem: Therefore, be it resolved by the House of Representatives, the Senate concurring, That the State Drainage Commission be, and is hereby, directed to investigate progress in other States toward the solution of said problem in such States, to investigate and determine the nature of said problem in this State.

The work has been carried on in conjunction with the State Drainage Commission, George A. Ralph, chief engineer.

Special acknowledgment is due to the Great Northern Power Co. for records on the St. Louis River near Thompson, Minn., and for records of discharge of various storage reservoirs in the St. Louis basin.

LAKE MICHIGAN, LAKE HURON, AND LAKE ERIE DRAINAGE BASINS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: State Geological Survey of Michigan; L. W. Anderson, city engineer, Grand Rapids, Mich.; Eastern Michigan Edison Co., Ann Arbor, Mich.; D. W. Mead, Madison, Wis.; Gardner S. Williams, Ann Arbor, Mich.; William G. Fargo, Jackson, Mich.

LAKE ONTARIO AND ST. LAWRENCE RIVER DRAINAGE BASINS IN NEW YORK.

Cooperation with the State water supply commission of New York was made possible by the provisions of the "Fuller bill," chapter 569, laws of 1907, and carried on under agreements between the State water supply commission and the United States Geological Survey.

New York State cooperation, under the direction of the State engineer and surveyor, has been carried on by cooperative agreements authorized by an act of the State legislature, being paragraph 11 of chapter 420, laws of 1900.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: United States Engineer Corps; John A. Bensel, State engineer and surveyor; Alex. E. Kastl, special deputy State engineer, representing New York State cooperation; State Water Supply Commission of New York, Henry H. Persons, president; and State of New York Conservation Commission, George E. van Kennen, chairman; E. A. Fisher, city engineer and board of park commissioners, Rochester; Plattsburg Gas & Electric Co., Plattsburg.

ST. LAWRENCE RIVER DRAINAGE BASIN IN VERMONT.

The work in Vermont during 1911 has been done in cooperation with the State of Vermont, John A. Mead, governor.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: Newport Electric Light Co.; Prof. C. S. Carleton, of Norwich University; Lane Manufacturing Co.; Colton Manufacturing Co.; Corry, Deavitt & Frost Electric Co.; Sweat-Comings Manufacturing Co.

DIVISION OF WORK.

The field data in the Lake Superior drainage basin were collected under the direction of Robert Follansbee and W. G. Hoyt, district engineers, by C. R. Adams and S. B. Soulé.

The field data in the Lake Michigan, Lake Huron, and Lake Erie drainage basins were collected under the direction of A. H. Horton, district engineer, by cooperating parties.

The field data in the St. Lawrence drainage basin in New York and Vermont were collected under the direction of C. C. Covert by W. G. Hoyt, G. H. Canfield, F. J. Shuttleworth, C. S. de Golyer, and Frank Weber.

The ratings, special estimates, and studies of the completed data were made by A. H. Horton, R. Follansbee, W. G. Hoyt, C. C. Covert, R. H. Bolster, and J. G. Mathers. The computations and preparation of the data for publication were made under the direction of R. H. Bolster by W. G. Hoyt, J. G. Mathers, H. J. Dean, A. H. Tuttle, M. I. Walters, Alexander McMillan, Octave de Carre, G. H. Canfield, C. S. de Golyer, and Frank Weber.

STREAMS TRIBUTARY TO LAKE SUPERIOR.

BRULE RIVER AT MOUTH, MINNESOTA.

Location.—About 300 feet above the steel highway bridge and about 1,700 feet above the mouth of the river.

Records available.—May 5 to October 28, 1911.

Drainage area.—282 square miles.

Gage.—Staff, installed August 2 and read semiweekly by a forest ranger; daily readings impracticable.

Channel.—The channel above the gage is permanent.

Discharge measurements.—At low stages measurements are made by wading medium and high stage measurements are made from a highway bridge.

Accuracy.—Relation between gage height and discharge is affected by wash from the lake which extends to the control point.

Discharge measurements of Brule River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5 [a]	Follansbee and Hawley	1.47	527
June 21 [b]	Hawley and Rosing	.48	82.2
Aug. 2 [b]	Smith and Godin	.57	105
Oct. 2 [b]	S. B. Soulé	.35	62.1

[a] Made at bridge. [b] Made by wading.

Daily gage height, in feet, of Brule River at mouth, Minnesota, for 1911.

[Hans Kasper, observer.]

May	5	1.47
June	21	.48
Aug.	2	.57
	10	.58
	15	.75
Sept.	19	1.32
	23	1.45
	27	1.60
Oct.	2	.35
	7	.35
	8	.35
	16	.38
	20	.38
	28	.38

DEVIL TRACK RIVER AT MOUTH, MINNESOTA.

Location.—At a highway bridge about 200 feet above the mouth of the river.

Records available.—May 5 to October 2, 1911.

Drainage area.—75 square miles.

Gage.—Staff, installed August 3 and read semiweekly by a forest ranger; daily readings impracticable.

Channel.—The channel of the river above the gage is permanent.

Discharge measurements.—Low-stage measurements are made by wading; at high and medium stages measurements are made from the highway bridge.

Accuracy.—Relation between gage height and discharge affected by wash from the lake which extends to the control point.

Discharge measurements of Devil Track River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5	Follansbee and Hawley	0.69	96.3
July 3[a]	Hawley and Smith	−.35	10.9
Aug. 3	C. L. Smith	.40	43.2
Oct. 2	S. B. Soulé	.90	96.7

[a] Dam closed.

NOTE.—Measurements made by wading.

Daily gage height, in feet, of Devil Track River at mouth, Minnesota, for 1911.

[Hans Kasper, observer.]

May	5	0.69
July	3	−.35
Aug.	3	.40
	10	.40
	14	.85
Sept.	19	1.10
	27	1.08
Oct.	2	.90

CASCADE RIVER AT MOUTH, MINNESOTA.

Location.—About 50 feet below the two-span wooden highway bridge, 150 feet above the mouth of the river.

Records available.—May 5 to October 5, 1911.

Drainage area.—84 square miles.

Gage.—Staff fastened to a wharf on the right side of the river 50 feet below the highway bridge.

Channel.—Fairly permanent.

Discharge measurements.—At low stages made by wading about 50 feet below the gage; at high and medium stages from the highway bridge.

Accuracy.—Relation between gage height and discharge affected by backwater from a bar at the mouth of the river.

Discharge measurements of Cascade River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6[a]	Follansbee and Hawley	13.40	329
June 28[b]	W. W. Hawley	13.40	61.6
Aug. 4[b]	Smith and Godin	14.10	45.6
Oct. 5[a]	S. B. Soulé	14.35	109

[a] Measurement made from highway bridge. [b] Measurement made by wading below bridge.

Daily gage height, in feet, of Cascade River at mouth, Minnesota, for 1911.

[J. D. Foley, observer.]

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1	.....	13.5	11	13.8	.....	21	13.75	.....
2	.....	13.5	12	13.83	.....	22	13.8	.....
3	.....	13.6	13	13.7	.....	23	13.7	.....
4	.....	.....	14	13.7	.....	24	13.65	.....
5	.....	.....	15	13.65	.....	25	13.6	.....
6	13.4	.....	16	13.75	.....	26	13.5	.....
7	13.5	.....	17	13.8	.....	27	13.55	.....
8	13.55	.....	18	13.75	.....	28	13.5	.....
9	13.7	.....	19	13.75	.....	29	13.5	.....
10	13.65	.....	20	13.7	.....	30	13.55	.....
						31	13.5	.....

POPLAR RIVER AT MOUTH, MINNESOTA.

Location.—About 200 feet above the mouth of the river.

Records available.—May 6 to November 4, 1911.

Drainage area.—144 square miles.

Gage.—A staff, reading from 12 to 15 feet, fastened to a stump on the right bank.

Channel.—Divided into three parts by two islands; bed rocky, containing coarse sand and small bowlders.

Discharge measurements.—At low stages made by wading just above the mouth of the river; high-stage measurements will be made from a cable (not yet installed).

Artificial control.—The flow of the river is controlled to some extent by two dams, the nearest being the dam of the National Power & Paper Co., 2½ miles above the station.

Accuracy.—Relation between gage height and discharge at times affected by backwater from a deposit of gravel which is washed up into the mouth of the river during storms on Lake Superior.

Discharge measurements of Poplar River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6	Follansbee and Hawley	12.75	142
July 3	Hawley and Smith	12.37	[a]61.5
Aug. 4	Smith and Godin	12.53	[a]65.4
Oct. 5	S. B. Soulé	12.94	82.6

[a] Logging dam closed.

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Poplar River at mouth, Minnesota, for 1911.

[C. A. A. Nelson, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	12.70	12.00	12.60	12.80	13.38	12.90	16	13.00	12.15	12.05	12.52	13.00	12.82	.....
2	.....	12.68	12.60	12.60	12.72	13.38	13.40	17	13.12	12.08	12.05	12.48	13.10	12.92	.....
3	.....	12.65	12.35	12.55	12.70	13.28	13.50	18	13.12	12.65	12.10	12.42	13.05	12.98	.....
4	.....	12.60	12.20	12.50	12.70	13.15	13.60	19	13.05	13.15	12.15	12.38	13.00	12.98	.....
5	.....	12.60	12.20	12.50	12.72	13.02	.....	20	13.02	12.05	12.18	12.32	13.00	12.90	.....
6	12.75	12.58	11.95	12.50	13.05	12.92	.....	21	12.98	12.90	12.20	12.35	12.95	12.82	.....
7	12.70	12.55	11.70	12.52	13.25	12.82	.....	22	12.92	12.22	12.30	12.40	12.90	12.78	.....
8	12.70	12.55	11.88	12.60	13.08	12.92	.....	23	12.92	12.60	12.95	12.45	12.98	12.80	.....
9	12.70	12.50	11.98	12.68	12.92	12.95	.....	24	12.90	12.20	12.70	12.40	13.08	12.80	.....
10	12.75	13.05	12.05	12.60	12.90	12.90	.....	25	12.88	12.00	12.60	12.55	13.18	12.80	.....
11	12.88	13.18	12.10	12.55	12.85	12.88	.....	26	12.82	12.00	12.60	12.75	13.12	12.80	.....
12	12.95	13.08	12.02	12.50	12.82	12.85	.....	27	12.75	12.00	12.52	12.90	13.08	12.78	.....
13	12.90	12.70	11.05	12.50	12.80	12.80	.....	28	12.75	12.02	12.48	12.92	13.05	12.75	.....
14	12.85	12.90	11.05	12.48	12.75	12.75	.....	29	12.68	12.50	12.40	13.00	13.15	12.70	.....
15	12.85	12.55	12.00	12.50	12.92	12.70	.....	30	12.62	12.55	12.40	12.92	13.30	12.70	.....
								31	12.70	.....	12.52	12.88	.....	12.70	.....

BEAVER BAY RIVER AT BEAVER BAY, MINN.

Location.—At the highway bridge 600 feet above the mouth of the river.

Records available.—July 26 to December 31, 1911.

Drainage area.—120 square miles.

Gage.—Staff, reading from 0 to 5 feet, attached to the vertical rock wall on the left bank directly beneath the bridge; datum unchanged.

Channel.—Permanent; one at all stages; bed composed of solid rock; banks high and rocky.

Discharge measurements.—Made from a boat or by wading.

Winter flow.—Relation between gage height and discharge little if any affected by ice, as the stream rarely freezes at the rapids.

Accuracy.—The only temporary change in conditions would be caused by logs or drift lodging on the rapids below the gage. Records are believed to be good.

Discharge measurements of Beaver Bay River at Beaver Bay, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 8[a]	Follansbee and Hawley		81.7
July 26[a]	do	1.78	62.4
Aug. 6	Smith and Godin	2.00	87.4
Oct. 7	S. B. Soulé	2.42	176
Dec. 8[b]	do	1.18	29.4
8[b]	do	1.17	27.2

[a] Measurement made from boat. [b] River partly frozen over.

Daily gage height, in feet, of Beaver Bay River at Beaver Bay, Minn., for 1911.

[Louis Lorntson, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.2	1.6	2.4	1.55	.....	16	.....	1.65	2.3	2.05	2.4	.....
2	.....	3.1	1.2	2.25	1.45	.....	17	.....	1.5	2.1	2.8	.....	.....
3	.....	2.7	1.1	2.3	1.35	.....	18	.....	1.45	1.95	2.7	.....	1.48
4	.....	2.3	1.6	2.85	1.2	1.25	19	.....	1.35	2.0	2.4	.....	.....
5	.....	2.05	4.65	2.7	1.2	.....	20	.....	1.25	2.0	2.2	1.7	.....
6	.....	1.85	4.6	2.55	1.45	.....	21	.....	1.35	2.0	2.0	.....	1.35
7	.....	3.1	4.2	2.35	1.65	.....	22	.....	1.5	2.05	2.0	.....	.....
8	.....	3.4	3.7	2.2	1.65	1.2	23	.....	1.4	2.0	2.0	1.7	.....
9	.....	3.2	3.2	2.1	2.0	.....	24	.....	1.25	1.9	1.9	.....	.....
10	.....	3.1	2.95	1.95	2.4	.....	25	.....	1.2	1.8	1.85	.....	.....
11	.....	2.95	2.95	1.9	2.25	1.7	26	1.75	1.1	1.8	1.75	.....	1.25
12	.....	2.65	2.75	1.85	1.95	.....	27	1.4	1.1	1.9	1.75	1.4	.....
13	.....	2.15	2.45	1.8	2.25	.....	28	1.58	1.05	2.1	1.75	.....	1.2
14	.....	1.9	2.3	1.8	2.25	1.65	29	2.05	1.0	2.65	1.6	.....	.....
15	.....	1.8	2.5	1.75	2.3	.....	30	1.85	1.05	2.6	1.55	1.3	.....
							31	1.8	1.4	.....	1.6	.....	.....

NOTE.—Ice started to form in the river Oct. 27 and was present the rest of the year.

ST. LOUIS RIVER AND TRIBUTARIES.

ST. LOUIS RIVER NEAR THOMSON, MINN.

Location.—Just below the tailrace of the Great Northern power house, 3 miles east of Thomson, in sec. 11, T. 48 N., R. 16 W.

Records available.—October 5, 1909, to December 31, 1911.

Drainage area.—3,420 square miles.

Gage.—Chain; datum unchanged; read 4 times each day—at 8 and 11 a. m., 2 and 5 p. m.; average of the 4 readings taken as the mean for the day.

Channel.—Permanent.

Discharge measurements.—Made from a car and cable 1,500 feet below the staff gage.

Artificial control.—The flow at the station is to a certain extent regulated by reservoirs above. The dam at Thomson is designed to hold 24 hours' supply of water for the power plant, and logging dams control the discharge from a large part of the entire area above the station. The gage heights show considerable fluctuations caused by opening and shutting the turbine gates at the power plant. As the plant is operated on a 24-hour schedule, though with varying load, the fluctuations at the gage are not so great as they would be if the turbines were closed part of the time.

Winter flow.—Previous to November, 1910, gage heights at this station were not affected by ice, but the stage at that time was extremely low and the water froze, making gage heights useless as indications of discharge. During the winter of 1910–11 the daily discharge was determined from the power company's record of water passing the turbines; no flow over the spillway during the period.

Accuracy.—The station affords excellent conditions for determinations of discharge, and the records should be good; errors are possible in the record of the mean gage height for the day.

Cooperation.—Gage heights are furnished through the courtesy of the Great Northern Power Co.

Discharge measurements of St. Louis River near Thomson, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 15	C. R. Adams	4.40	6,590
Aug. 31	S. B. Soulé	1.82	1,760

Daily gage height, in feet, of St. Louis River near Thomson, Minn., for 1911.

[Floyd Williams, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.41	2.69	2.59	2.04	3.51	2.18	.....
2	.....	.....	3.13	3.71	.....	3.39	2.58	.....
3	.....	2.20	2.62	3.15	1.39	3.38	.....	2.24
4	.....	2.08	2.46	.....	.....	3.23	.....	2.25
5	.....	1.72	2.26	2.70	1.06	3.10	1.87	2.24
6	.....	1.57	3.03	3.24	1.06	3.09	3.26	2.10
7	.....	1.34	.....	3.14	1.37	3.02	3.80	.....
8	.....	1.52	2.02	2.62	2.50	3.15	5.26	2.23
9	.....	.....	1.91	2.26	2.28	3.85	5.26	1.88
10	0.26	1.49	2.22	2.35	.....	3.87	.....	1.85
11	.34	1.66	2.62	2.26	1.28	3.86	4.71	1.79
12	.....	2.14	2.02	2.39	.73	4.39	4.63	1.97
13	.43	3.62	1.92	2.50	.57	.....	4.73	1.66
14	.53	4.45	.....	3.08	.48	4.38	.....	1.84
15	.44	4.36	1.90	3.48	.47	3.82	4.16	1.82
16	.75	.....	3.25	3.92	.....	3.46	4.16	2.06
17	.82	4.03	4.86	3.20	.44	3.42	4.15	2.36
18	.79	4.04	5.78	.....	.37	2.80	4.14	1.76
19	.90	3.96	5.29	2.88	.21	2.48	4.02	1.74
20	.88	4.12	5.55	2.24	.07	.....	3.59	2.00
21	.91	3.97	.....	1.91	.03	2.42	2.82	2.17
22	.98	4.01	4.88	1.91	.....	2.12	2.48	.....
23	1.02	4.28	4.78	1.52	.19	2.46	2.41	2.19
24	1.05	4.28	4.27	1.18	.57	2.48	2.52	1.59
25	1.32	4.32	4.26	.....	.99	2.49	2.07	1.37
26	.....	4.12	3.80	2.34	1.25	.....	1.89	1.77
27	1.52	3.81	4.24	1.84	1.24	.....	1.78	1.78
28	1.89	3.61	2.82	2.02	1.64	2.40	2.01	1.72
29	2.16	3.12	2.48	2.25	1.89	1.98	2.22	1.64
30	2.35	.....	1.70	2.33	1.52	1.83	2.35	1.54
31	2.48	.....	2.35	.....	1.87	1.90	.....	1.55

NOTE.—Ice present Jan. 1 to Mar. 9 and Nov. 1 to Dec. 31.

Daily discharge, in second-feet, of St. Louis River near Thomson, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	259	316	340	2,490	2,870	2,730	2,020	4,200	2,200	2,350	1,160	583
2	278	301	344	2,350	3,540	4,610	1,660	3,990	2,720	2,300	902	578
3	261	302	322	2,220	2,770	3,580	1,300	3,970	2,420	2,270	842	541
4	240	278	318	2,070	2,560	3,130	1,140	3,710	2,120	2,280	783	521
5	213	274	351	1,650	2,300	2,880	984	3,500	1,820	2,270	772	587
6	218	285	349	1,490	3,380	3,730	984	3,480	3,760	2,100	1,060	560
7	228	275	320	1,250	2,690	3,560	1,280	3,370	4,820	2,180	1,020	580
8	192	285	320	1,440	2,000	2,770	2,610	3,580	9,420	2,260	1,020	584
9	205	282	370	1,420	1,870	2,300	2,320	4,940	9,420	1,830	1,090	593
10	247	283	410	1,400	2,240	2,410	1,760	4,990	8,400	1,800	1,070	635
11	236	285	452	1,590	2,770	2,300	1,190	4,960	7,530	1,730	1,100	565
12	231	307	477	2,140	2,000	2,460	702	6,480	7,260	1,940	791	601
13	235	316	503	4,420	1,880	2,610	590	6,460	7,600	1,590	542	496
14	230	308	564	6,680	1,870	3,460	533	6,450	6,700	1,790	685	572
15	223	302	509	6,390	1,860	4,150	527	4,860	5,790	1,760	715	562
16	234	301	718	5,900	3,740	5,120	518	4,110	5,790	2,050	883	586
17	285	306	772	5,420	8,040	3,660	509	4,040	5,760	2,420	893	543
18	292	304	748	5,450	11,200	3,400	468	3,030	5,730	1,700	785	536
19	291	316	840	5,230	9,530	3,150	385	2,580	5,390	1,670	796	601
20	309	318	823	5,670	10,400	2,270	316	2,540	4,360	1,980	709	559
21	290	342	849	5,250	9,250	1,870	298	2,500	3,060	2,180	754	557
22	291	332	912	5,360	8,110	1,870	285	2,120	2,580	2,200	711	674
23	304	362	948	6,140	7,770	1,440	375	2,560	2,490	2,210	692	708
24	284	379	975	6,140	6,120	1,100	590	2,580	2,640	1,510	633	810
25	296	367	1,230	6,270	6,080	1,780	921	2,600	2,060	1,280	706	597
26	287	338	1,340	5,670	4,820	2,400	1,160	2,560	1,840	1,710	946	518
27	322	362	1,440	4,840	6,020	1,790	1,150	2,520	1,720	1,720	768	488
28	318	337	1,840	4,400	3,060	2,000	1,560	2,480	1,990	1,650	763	444
29	303	.....	2,170	3,530	2,580	2,280	1,840	1,950	2,240	1,560	777	515
30	317	.....	2,410	3,200	1,630	2,380	1,440	1,770	2,410	1,460	800	447
31	308	.....	2,580	.....	2,410	.....	1,820	1,860	.....	1,470	.....	459

NOTE.—Daily discharge Jan. 1 to Mar. 8 and Nov. 1 to Dec. 31 determined from records of flow through the turbines. Daily discharge Mar. 10 to Oct. 30 determined from a discharge rating curve, well defined between 600 and 7,000 second-feet. Discharge interpolated for days for which no gage heights are available,

Monthly discharge of St. Louis River near Thomson, Minn., for 1911.

[Drainage area, 3,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	322	192	265	0.077	0.09	A.
February	379	274	313	.092	.10	A.
March	2,580	318	856	.250	.29	B.
April	6,680	1,250	3,920	1.15	1.28	A.
May	11,200	1,630	4,430	1.30	1.50	A.
June	5,120	1,100	2,770	.810	.90	A.
July	2,610	285	1,070	.313	.36	B.
August	6,480	1,770	3,570	1.04	1.20	A.
September	9,420	1,720	4,400	1.29	1.44	A.
October	2,420	1,460	1,910	.558	.64	A.
November	1,160	542	839	.245	.27	A.
December	810	444	568	.166	.19	A.
The year	11,200	192	2,080	.608	8.26	

WHITEFACE RIVER AT MEADOWLANDS, MINN.

Location.—At the highway bridge at Meadowlands, in sec. 14, T. 53 N., R. 19 W., half a mile below the nearest tributary, a very small stream entering from the east.

Records available.—June 7, 1909, to December 31, 1911.

Drainage area.—442 square miles.

Gage.—Vertical staff; datum unchanged.

Channel.—Shifting during high water.

Discharge measurements.—Made from the highway bridge except during low stages, when measurements are made by wading.

Artificial control.—The flow is controlled to a large extent by logging dams above. The operation of the gates of these dams causes fluctuations in gage height amounting to several feet at the gaging station.

Accuracy.—On account of the shifting character of the channel the discharge has been computed from a number of rating curves, some of which have been applied indirectly. The records can not be considered better than fair. The records of extreme stage are of little value.

Discharge measurements of Whiteface River at Meadowlands, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 26	Robt. Follansbee	5.94	325
May 19	C. J. Emerson	9.59	1,820
June 5	Follansbee and Soulé	5.42	304
July 27	S. B. Soulé	5.63	519
28	....do	4.24	156
Sept. 29	....do	5.22	373

Daily gage height, in feet, of Whiteface River at Meadowlands, Minn., for 1911.

[A. F. Johnson, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7.40	4.85	5.20	7.45	6.05	5.15	4.50
2	.....	5.90	6.25	4.70	5.65	5.20	5.12	4.50
3	.....	5.00	7.50	6.05	4.95	4.95	5.00	4.40
4	.....	4.95	6.65	5.25	6.45	5.10	5.00	4.35
5	.....	6.30	5.45	4.70	5.85	7.55	5.00	4.25
6	.....	4.20	6.65	4.80	6.85	8.75	4.90	4.20
7	.....	4.10	7.65	4.70	8.20	8.80	4.90	4.20
8	.....	5.80	7.25	4.15	8.65	8.40	4.90	4.20
9	.....	7.70	6.15	3.85	7.15	8.70	4.82	4.20
10	.....	5.65	6.50	3.80	5.60	7.70	4.80	4.20
11	.....	3.90	6.80	3.45	6.55	7.05	4.86	4.10
12	6.35	4.70	7.35	3.40	7.35	6.95	5.20	4.10
13	7.35	4.70	7.85	3.40	7.40	6.40	5.35	.....
14	7.80	5.20	6.45	3.40	6.55	5.90	5.30	.....
15	7.45	5.80	5.20	3.40	5.50	6.20	5.30	.....
16	8.10	9.10	7.05	3.40	5.15	6.10	6.40	.....
17	8.35	10.63	7.88	3.40	6.50	5.80	5.18	.....
18	7.95	10.67	7.55	3.32	7.40	6.10	4.90	.....
19	7.85	9.93	5.85	3.35	6.50	6.30	4.85	.....
20	6.40	10.77	5.75	3.40	5.55	6.05	4.80	.....
21	7.05	10.13	6.00	3.40	5.10	5.80	4.80	.....
22	7.20	9.27	5.85	3.40	5.45	5.95	4.70	.....
23	7.80	8.60	6.55	3.40	5.18	6.05	4.70	.....
24	7.30	7.07	5.80	3.40	6.08	5.60	4.70	.....
25	6.90	6.78	4.65	3.75	5.45	5.25	4.80	.....
26	5.95	6.48	4.70	4.85	4.95	5.00	4.80	.....
27	5.85	6.25	6.40	5.60	4.80	4.90	4.70	.....
28	6.05	5.65	5.00	4.50	4.70	4.70	4.70	.....
29	7.00	5.45	6.05	4.80	5.50	5.10	4.60	.....
30	7.60	5.15	5.25	5.45	6.95	5.25	4.60	.....
31	.....	4.90	.....	6.10	7.15	.....	4.50	.....

NOTE.—Ice present January to Apr. 11 and from early in November to Dec. 31.

Daily discharge, in second-feet, of Whiteface River at Meadowlands, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	880	195	345	1,120	608	352	215
2	.....	320	515	240	485	365	345	215
3	.....	140	945	590	305	305	315	200
4	.....	125	650	355	748	340	315	192
5	.....	440	310	240	545	1,160	315	178
6	.....	80	650	285	888	1,640	295	170
7	.....	75	1,000	265	1,420	1,660	295	170
8	.....	295	890	160	1,600	1,500	295	170
9	.....	970	530	115	1,000	1,620	279	170
10	.....	255	640	110	470	1,220	275	170
11	.....	70	735	65	782	960	275	155
12	455	100	930	60	1,080	922	365	155
13	821	100	1,130	60	1,100	730	402	.....
14	1,010	170	620	60	782	560	390	.....
15	862	295	295	60	440	660	390	.....
16	1,140	1,600	875	60	352	625	730	.....
17	1,240	2,310	1,200	60	765	530	360	.....
18	1,080	2,330	1,060	60	1,100	625	295	.....
19	1,030	1,980	485	65	765	695	285	.....
20	475	2,370	445	65	455	608	275	.....
21	725	2,070	515	70	340	530	275	.....
22	760	1,690	475	70	428	575	255	.....
23	1,010	1,390	680	70	360	608	255	.....
24	805	795	460	70	618	470	255	.....
25	645	695	205	120	428	378	275	.....
26	325	590	245	320	305	315	275	.....
27	305	530	690	515	275	295	255	.....
28	365	360	310	215	255	255	255	.....
29	680	310	590	275	440	340	235	.....
30	920	250	360	428	922	378	235	.....
31	.....	200	.....	625	1,000	.....	215	.....

NOTE.—Daily discharge determined from a fairly well-defined discharge rating curve; curve applied indirectly prior to Aug. 1, as channel was obstructed.

Monthly discharge of Whiteface River at Meadowlands, Minn., for 1911.

[Drainage area, 442 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
April 12–30	1,240	305	771	1.74	1.23	C.
May	2,370	70	767	1.74	2.01	C.
June	1,200	195	621	1.40	1.56	C.
July	625	60	197	.446	.51	C.
August	1,600	255	696	1.57	1.81	B.
September	1,660	255	716	1.62	1.81	B.
October	730	215	311	.704	.81	B.
November 1–12	215	155	180	.407	.18	B.

CLOQUET RIVER AT INDEPENDENCE, MINN.

Location.—At the highway bridge at Independence post office, in sec. 26, T. 52 N., R. 17 W., just below a small tributary entering from the north.

Records available.—June 28, 1909, to December 31, 1911.

Drainage area.—698 square miles.

Gage.—Vertical staff; datum unchanged since establishment.

Channel.—Permanent; relation of gage height to discharge affected by log jams.

Discharge measurements.—Made from the bridge.

Artificial control.—Cloquet River is used extensively for log driving, and the run-off from by far the greater part of the drainage area above Independence is controlled

by logging dams. This control causes violent fluctuations in the gage height during the day, amounting at times to several feet, and consequently the mean daily gage height for the days when the dam is in use—which is the mean of three readings taken morning, noon, and night—can be considered only approximate. During the open season of 1911 a wing dam of logs, placed at the rapids just below the bridge for the purpose of aiding the log drive, caused backwater at the gage. The amount of this backwater was lessened at low stages, as the wing dam rested on the rocks between which a large part of the water flowed. This wing dam was practically permanent, and as the effect at different stages was determined by discharge measurements the accuracy of estimates is not materially affected.

Winter flow.—Prior to the later part of 1911 observations have been discontinued during the winter on account of ice; monthly mean flow computed from the records of flow at the Island Lake logging dam on the Cloquet and the discharge of Wild Rice Lake on Beaver River.

Cooperation.—Records at Island Lake dam and Wild Rice Lake furnished by the Great Northern Power Co.

Discharge measurements of Cloquet River at Independence, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 21	C. J. Emerson	8.28	2,240
June 6	Follansbee and Soulé	7.36	1,510
July 28[a]	S. B. Soulé	4.30	98
Sept. 30	....do	6.28	734
Dec. 10[b]	....do	4.74	43

[a] Measurement made by wading. [b] Measurement made under complete ice cover.

Daily gage height, in feet, of Cloquet River at Independence, Minn., for 1911.

[Fred Haakensen and Herbert Haakensen, observers.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.67	9.58	4.28	8.08	7.10	6.04	5.02	.....
2	.....	5.53	6.93	4.20	7.17	5.28	6.34	4.90	.....
3	.....	4.80	5.28	4.12	6.44	4.95	6.01	4.76	.....
4	.....	4.52	5.12	4.12	6.13	4.60	6.62	5.20	4.00
5	.....	4.38	7.06	4.11	5.98	5.98	6.21	5.77	.....
6	.....	4.30	7.39	6.06	5.95	5.53	6.44	5.95	.....
7	.....	4.26	5.33	8.19	6.02	7.03	6.03	5.88	4.00
8	.....	4.28	4.77	7.70	6.02	7.27	6.12	5.72	.....
9	.....	5.62	4.56	6.62	5.65	6.40	5.93	5.72	.....
10	.....	6.09	4.52	4.85	4.94	6.93	6.62	5.81	4.74
11	.....	4.87	4.94	4.39	4.80	8.07	5.85	5.85	3.90
12	.....	4.58	4.75	4.23	4.74	7.88	5.78	5.14	.....
13	.....	4.54	6.68	4.10	4.68	7.36	6.35	4.50	.....
14	.....	4.55	5.97	4.08	4.67	7.61	5.54	.....	3.00
15	.....	6.83	8.53	4.02	5.29	7.27	5.68	.....	.....
16	.....	6.39	7.56	4.01	5.55	7.75	6.54	4.65	.....
17	.....	7.22	7.24	3.98	4.85	8.21	6.26	.....	.....
18	.....	6.68	7.66	3.94	4.63	8.04	5.81	.....	3.95
19	.....	6.84	5.32	3.92	4.52	8.09	6.44	.....	.....
20	5.66	8.75	4.68	3.90	4.47	6.26	6.54	4.50	.....
21	5.20	8.09	4.43	3.90	4.63	4.98	6.58	.....	3.20
22	6.06	8.53	4.26	3.90	4.77	4.76	6.24	.....	.....
23	7.05	7.53	4.15	4.15	4.80	4.61	4.90	4.50	.....
24	7.51	7.82	5.53	4.33	4.83	4.58	5.37	.....	.....
25	7.29	7.74	7.49	4.39	4.72	4.56	5.14	.....	.....
26	7.14	8.62	5.55	4.33	4.61	4.56	4.80	.....	.....
27	7.11	7.78	4.79	4.19	5.68	5.55	4.88	4.00	.....
28	5.59	5.64	4.69	4.29	5.78	6.55	5.59	.....	3.78
29	4.85	4.94	4.50	4.29	4.93	6.29	6.26	.....	.....
30	4.66	5.82	4.35	4.28	4.63	6.31	6.15	4.00	.....
31	.....	5.16	.....	8.71	5.68	.....	6.31	.....	.....

NOTE.—Ice present Jan. 1 to Apr. 19 and from Nov. 13 to Dec. 31. On June 5 a log wing dam was constructed just below the gaging station, which changed the control for the remainder of the year.

Daily discharge, in second-feet, of Cloquet River at Independence, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,560	6,010	88	2,070	1,300	608	235
2	.....	612	1,890	78	1,350	311	764	204
3	.....	277	480	70	826	217	594	171
4	.....	191	402	70	650	138	944	286
5	.....	156	1,260	69	581	581	690	490
6	.....	138	1,520	617	568	396	826	568
7	.....	130	327	2,160	599	1,240	604	536
8	.....	134	173	1,770	599	1,430	645	469
9	.....	662	131	944	442	800	558	469
10	.....	992	124	192	214	1,170	944	506
11	.....	302	214	103	180	2,070	524	524
12	.....	207	169	82	167	1,910	494	269
13	.....	196	986	68	154	1,500	770	.....
14	.....	199	576	66	152	1,700	400	.....
15	.....	1,760	2,430	62	314	1,430	453	.....
16	.....	1,260	1,660	61	404	1,810	891	.....
17	.....	2,280	1,400	59	192	2,180	718	.....
18	.....	1,580	1,740	56	144	2,040	506	.....
19	.....	1,770	324	55	124	2,080	826	.....
20	686	4,630	154	54	115	718	891	.....
21	440	3,570	109	54	144	225	917	.....
22	968	4,280	85	54	173	171	707	.....
23	2,040	2,710	73	73	180	140	204	.....
24	2,680	3,150	396	94	187	134	340	.....
25	2,380	3,030	1,600	103	162	131	269	.....
26	2,170	4,420	404	94	140	131	180	.....
27	2,120	3,090	178	77	453	404	199	.....
28	644	674	156	89	494	898	418	.....
29	294	327	120	89	212	734	718	.....
30	232	789	97	88	144	746	660	.....
31	.....	421	.....	2,580	453	.....	746	.....

NOTE.—Daily discharge computed from two well-defined rating tables, one of which was applied prior to June 5 and the second one beginning that date.

Monthly discharge of Cloquet River at Independence, Minn., for 1911.

[Drainage area, 698 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 90	0.129	0.15	C.
February	.....	.....	[a] 100	.143	.15	C.
March	.....	.....	[a] 130	.186	.21	C.
April	2,680	232	[b] 800	1.15	1.28	B.
May	4,630	130	1,470	2.11	2.43	B.
June	6,010	73	840	1.20	1.34	B.
July	2,580	54	326	.467	.54	B.
August	2,070	115	406	.582	.67	B.
September	2,180	131	958	1.37	1.53	B.
October	944	180	613	.878	1.01	B.
November	.....	.....	[c] 250	.358	.40	D.
December	.....	.....	[c] 50	.072	.08	D.
The year	.....	.....	504	.722	9.79	

[a] Estimated from records of flow from Island Lake dam and from Wild Rice reservoir, as maintained by the Great Northern Power Co. A small allowance has been made for flow of intervening streams.

[b] Mean discharge Apr. 1–19 estimated at 492 second-feet, from climatologic records and by comparison with records of flow of St. Louis River.

[c] Estimated from climatologic records, one measurement in December and by comparison with records of flow of St. Louis River.

STREAMS TRIBUTARY TO LAKE MICHIGAN.

ESCANABA RIVER NEAR ESCANABA, MICH.

Location.—At highway bridge between Escanaba and Gladstone, Mich., about 9 miles north of Escanaba and 4 miles above mouth of river.

Records available.—August 25, 1903, to March. 31, 1909; June 1, 1909, to December 31, 1911. Discharge measurements only April, May, and July, 1903.

Drainage area.—800 square miles.

Gage.—Standard chain attached to bridge; new gage installed November 15, 1910.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Affected by ice which exists some years for nearly 4 months.

Accuracy.—Relation between gage height and discharge, during the logging season, affected by backwater from log jams. All gage readings for 1911 are correct, provided the new chain (installed Nov. 15, 1910) has not stretched, and provided, also, that the structure to which the gage is attached has not changed since July 16, 1908.

Daily gage height, in feet, of Escanaba River near Escanaba, Mich., for 1911.

[Olive Beauchamp, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.9	3.3	.....	4.4	3.3	2.0	4.9	2.6	2.9	2.7	5.0
2	.....	.....	.....	.....	3.6	3.3	2.0	5.7	2.6	2.9	2.7	5.2
3	.....	.....	.....	.....	3.5	2.9	2.1	6.0	2.5	2.8	2.7	4.7
4	2.7	.....	.....	.....	3.4	2.9	2.1	5.7	2.5	2.9	2.6	4.8
5	.....	.....	.....	3.6	3.3	2.9	2.1	5.7	2.6	3.0	2.6	4.7
6	.....	.....	.....	.....	3.2	3.1	2.5	4.0	2.6	3.6	2.6	4.6
7	.....	.....	.....	.....	3.2	2.9	2.6	4.1	2.9	4.4	2.7	4.3
8	.....	2.9	3.3	.....	3.1	2.8	2.5	3.9	3.1	4.4	2.7	4.4
9	.....	.....	.....	.....	2.9	2.6	2.5	4.0	3.0	4.4	3.0	4.5
10	.....	.....	.....	.....	2.8	2.6	2.3	3.9	2.9	4.0	3.0	4.8
11	3.0	.....	.....	3.2	2.7	2.6	2.4	3.8	2.7	3.4	3.1	4.8
12	.....	.....	.....	3.5	2.6	2.6	2.3	3.8	2.7	3.4	3.4	4.9
13	.....	.....	.....	4.8	2.5	2.8	2.2	3.6	2.7	3.3	3.7	4.9
14	.....	.....	.....	4.2	2.5	3.1	2.1	3.4	2.6	3.2	3.6	4.6
15	.....	2.9	3.3	4.5	3.0	3.4	2.1	3.2	2.6	3.1	3.6	3.9
16	.....	.....	.....	6.8	3.1	3.3	2.1	3.1	2.7	3.1	3.4	3.7
17	.....	.....	.....	4.5	3.4	3.4	2.1	3.0	2.7	3.3	3.4	3.5
18	2.9	.....	.....	4.4	3.8	2.6	2.2	2.9	2.6	3.4	3.6	3.4
19	.....	.....	.....	4.8	4.3	2.4	2.1	2.7	2.5	3.5	3.2	3.2
20	.....	.....	.....	5.2	4.4	2.4	2.1	2.7	2.4	3.6	3.0	3.2
21	.....	.....	.....	6.6	4.3	2.3	2.1	2.8	2.4	3.3	3.1	3.2
22	.....	3.3	3.4	4.5	4.2	2.3	2.2	2.9	2.4	3.3	2.9	3.2
23	.....	.....	.....	4.4	4.3	2.5	3.0	2.8	2.4	3.3	2.9	3.0
24	.....	.....	.....	4.3	4.1	2.3	3.2	2.8	2.5	3.2	2.8	3.0
25	2.9	.....	.....	4.4	4.0	2.2	3.2	2.7	2.5	3.2	2.8	3.2
26	.....	.....	.....	4.2	3.9	2.3	3.2	2.6	2.5	3.1	2.8	5.0
27	.....	.....	.....	4.1	3.7	2.3	3.3	2.6	2.5	3.1	2.8	5.0
28	.....	.....	.....	4.0	3.5	2.2	3.5	2.7	2.5	2.9	3.0	6.0
29	.....	.....	4.3	4.2	3.4	2.2	3.6	2.7	2.6	2.9	3.0	5.9
30	.....	.....	.....	4.4	3.3	2.1	3.4	2.6	2.8	2.8	5.0	5.9
31	.....	.....	.....	.....	3.7	.....	3.5	2.6	.....	2.8	.....	5.9

NOTE.—Relation of gage height to discharge affected by ice Jan. 1 to Apr. 10, and probably Nov. 30 to Dec. 31; gage heights during these periods read to water surface. No information regarding ice jams.

Daily discharge, in second-feet, of Escanaba River near Escanaba, Mich., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3,030	,420	300	4,000	710	970	790
2	.....	1,810	1,420	300	5,860	710	970	790
3	.....	1,680	970	350	6,640	630	880	790
4	.....	1,550	970	350	5,860	630	970	710
5	.....	1,420	970	350	5,860	710	1,070	710
6	.....	1,300	1,180	630	2,380	710	1,810	710
7	.....	1,300	970	710	2,530	970	3,030	790
8	.....	1,180	880	630	2,230	1,180	3,030	790
9	.....	970	710	630	2,380	1,070	3,030	1,070
10	.....	880	710	480	2,230	970	2,380	1,070
11	1,300	790	710	550	2,090	790	1,550	1,180
12	1,680	710	710	480	2,090	790	1,550	1,550
13	3,790	630	880	410	1,810	790	1,420	1,950
14	2,690	630	1,180	350	1,550	710	1,300	1,810
15	3,210	1,070	1,550	350	1,300	710	1,180	1,810
16	8,870	1,180	1,420	350	1,180	790	1,180	1,550
17	3,210	1,550	1,550	350	1,070	790	1,420	1,550
18	3,030	2,090	710	410	970	710	1,550	1,810
19	3,790	2,860	550	350	790	630	1,680	1,300
)	4,650	3,030	550	350	790	550	1,810	1,070
21	8,290	2,860	480	350	880	550	1,420	1,180
22	3,210	2,690	480	410	970	550	1,420	970
23	3,030	2,860	630	1,070	880	550	1,420	970
24	2,860	2,530	480	1,300	880	630	1,300	880
25	3,030	2,380	410	1,300	790	630	1,300	880
26	2,690	2,230	480	1,300	710	630	1,180	880
27	2,530	1,950	480	1,420	710	630	1,180	880
28	2,380	1,680	410	1,680	790	630	970	1,070
29	2,690	1,550	410	1,810	790	710	970	1,070
30	3,030	1,420	350	1,550	710	880	880	1,900
31	.....	1,950	.....	1,680	710	.....	880	.....

NOTE.—Daily discharge determined from a discharge rating curve well defined above 300 second-feet.

Monthly discharge of Escanaba River near Escanaba, Mich., for 1911.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	275	0.344	0.40	D.
February	.....	.....	300	.375	.39	D.
March	.....	.....	500	.625	.72	D.
April	8,870	.....	2,600	3.25	3.63	C.
May	3,030	630	1,730	2.16	2.49	B.
June	1,550	350	821	1.03	1.15	B.
July	1,810	300	727	.909	1.05	B.
August	6,640	710	2,010	2.51	2.89	B.
September	1,180	550	731	.914	1.02	B.
October	3,030	880	1,470	1.84	2.12	B.
November	1,950	710	1,150	1.44	1.61	B.
December	.....	.....	1,000	1.25	1.44	D.
The year	8,870	.....	1,110	1.39	18.31	

NOTE.—Discharge for periods during which ice was present estimated from climatologic records and by comparison with the record of flow of Menominee River. Mean discharge Apr. 1 to 10 estimated at 800 second-feet.

MENOMINEE RIVER NEAR IRON MOUNTAIN, MICH.

Location.—At the Homestead highway bridge, 3½ miles south of Iron Mountain, Mich.

Records available.—September 4, 1902, to March 31, 1909; June 5, 1909, to December 31, 1911.

Drainage area.—2,420 square miles.

Gage.—Standard chain, attached to the bridge May 18, 1904; the original gage was a staff on the right abutment of the bridge.

Channel.—Probably permanent.

Artificial control.—The flow of the river is to a certain extent controlled by logging dams.

Winter flow.—Affected by ice.

Accuracy.—Relation between gage height and discharge affected by ice for several months each year and also by backwater from log jams that form below the station

Cooperation.—Maintained in 1911 by Oliver Iron Mining Co.

Daily gage height, in feet, of Menominee River near Iron Mountain, Mich., for 1911.

[A. S. St. Arnald, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	3.0	4.4	4.2	5.2	2.6	7.8	2.9	2.5	3.0	3.1
2	1.7	.....	2.7	4.1	3.8	4.3	2.1	7.8	3.1	2.5	3.0	3.0
3	.....	.....	2.7	3.9	2.5	2.9	2.3	8.6	2.7	2.7	2.9	3.0
4	.....	.....	2.4	3.4	3.2	4.2	1.8	8.2	2.4	2.7	2.8	2.8
5	.....	2.1	2.4	3.3	2.4	3.8	1.6	7.1	2.1	3.6	2.8	2.7
6	.....	.....	2.4	3.3	2.1	4.3	1.9	5.7	3.0	4.7	2.8	2.5
7	.....	.....	2.4	3.4	2.4	3.6	2.8	5.2	3.4	7.1	2.8	3.0
8	1.9	.....	2.4	3.5	2.9	3.1	2.2	6.6	3.4	7.2	3.0	3.0
9	.....	.....	2.7	3.9	3.2	3.4	2.0	6.6	3.4	6.7	3.0	3.0
10	.....	.....	3.0	3.9	3.6	2.8	1.9	6.5	3.2	6.0	3.2	3.4
11	.....	.....	3.0	3.9	3.9	4.3	1.9	6.0	3.2	5.3	3.2	3.9
12	.....	2.1	3.0	4.8	3.9	2.6	1.8	5.3	2.4	5.3	3.6	4.5
13	.....	.....	2.7	5.7	3.9	2.3	1.6	4.8	2.4	4.7	3.5	4.7
14	.....	.....	3.0	6.6	3.8	2.0	1.6	4.3	2.9	4.2	3.3	4.9
15	1.8	.....	3.0	6.9	2.8	2.2	1.4	3.9	2.9	4.0	3.3	4.7
16	.....	.....	3.0	6.9	2.7	2.6	1.2	3.5	2.9	3.7	3.4	4.4
17	.....	.....	3.0	6.9	3.8	2.1	1.2	3.4	2.6	4.5	3.3	4.2
18	.....	.....	3.0	6.2	5.7	3.7	1.2	3.4	2.6	4.5	3.2	4.2
19	.....	2.3	3.0	6.2	9.2	1.3	1.3	3.1	2.1	5.7	3.0	4.0
20	.....	2.3	3.0	6.6	11.0	1.4	2.0	2.7	1.9	5.5	3.0	4.0
21	.....	2.3	3.0	6.2	10.8	1.9	1.6	2.3	1.9	5.4	3.2	3.0
22	2.0	2.3	3.0	7.0	10.8	2.7	1.8	3.3	1.4	5.3	3.2	3.0
23	.....	2.3	3.4	7.1	11.3	3.2	1.8	3.3	1.6	5.3	3.0	3.0
24	.....	2.3	3.6	4.5	10.0	3.5	2.0	3.0	1.8	4.7	3.1	3.0
25	.....	2.5	3.6	5.5	10.0	2.4	2.4	2.8	2.1	4.1	3.1	3.0
26	.....	2.5	3.8	4.9	8.7	1.9	2.7	2.8	1.5	4.0	3.0	3.0
27	.....	2.5	3.8	3.4	8.6	2.1	3.7	3.1	1.7	3.9	3.0	3.0
28	.....	3.0	4.4	5.1	8.9	2.5	3.2	3.1	1.9	3.6	3.0	3.2
29	2.1	.....	5.0	4.8	7.2	2.1	3.2	2.6	2.0	3.6	3.1	3.2
30	.....	.....	4.8	4.8	8.1	2.3	3.8	2.6	2.5	3.1	3.1	3.3
31	.....	.....	4.6	.....	6.6	.....	4.4	2.6	.....	3.1	.....	3.3

NOTE.—Relation of gage height to discharge apparently affected by ice Jan. 1 to Mar. 27; gage heights during December assumed unaffected. No information regarding backwater from log jams.

Daily discharge, in second-feet, of Menominee River near Iron Mountain, Mich., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3,260	3,110	3,930	1,940	6,520	2,150	1,880	2,220	2,290
2	.....	3,040	2,810	3,180	1,620	6,520	2,290	1,880	2,220	2,220
3	.....	2,880	1,880	2,150	1,756	7,330	2,010	2,010	2,150	2,220
4	.....	2,510	2,360	3,110	1,440	6,979	1,820	2,010	2,080	2,080
5	.....	2,440	1,820	2,810	1,340	5,760	1,626	2,660	2,080	2,010
6	.....	2,440	1,620	3,180	1,500	4,400	2,220	3,500	2,080	1,880
7	.....	2,510	1,820	2,660	2,080	3,930	2,510	5,760	2,080	2,220
8	.....	2,580	2,150	2,290	1,680	5,260	2,510	5,800	2,220	2,220
9	.....	2,880	2,360	2,510	1,560	5,260	2,510	5,360	2,220	2,220
10	.....	2,880	2,660	2,080	1,500	5,160	2,360	4,680	2,360	2,510

Daily discharge, in second-feet, of Menominee River near Iron Mountain, Mich., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	2,880	2,880	3,180	1,500	4,680	2,360	4,020	2,360	2,880
12	.....	3,580	2,880	1,940	1,440	4,020	1,820	4,020	2,660	3,340
13	.....	4,400	2,880	1,750	1,340	3,580	1,820	3,500	2,580	3,500
14	.....	5,260	2,810	1,560	1,340	3,180	2,150	3,110	2,440	3,660
15	.....	5,560	2,080	1,680	1,220	2,880	2,150	2,960	2,440	3,500
16	.....	5,560	2,010	1,940	1,120	2,580	2,150	2,740	2,510	3,260
17	.....	5,560	2,810	1,620	1,120	2,510	1,940	3,340	2,440	3,110
18	.....	4,870	4,400	2,740	1,120	2,510	1,940	3,340	2,360	3,110
19	.....	4,870	8,120	1,180	1,180	2,290	1,620	4,400	2,220	2,960
20	.....	5,260	10,300	1,220	1,560	2,010	1,500	4,200	2,220	2,960
21	.....	4,870	10,100	1,500	1,340	1,750	1,500	4,110	2,360	2,220
22	.....	5,660	10,100	2,010	1,440	2,440	1,220	4,020	2,360	2,220
23	.....	5,760	10,700	2,360	1,440	2,440	1,340	4,020	2,220	2,220
24	.....	3,340	9,070	2,580	1,560	2,220	1,440	3,500	2,290	2,220
25	.....	4,200	9,070	1,820	1,820	2,080	1,620	3,040	2,290	2,220
26	.....	3,660	7,440	1,500	2,010	2,080	1,280	2,960	2,220	2,220
27	.....	2,510	7,330	1,620	2,740	2,290	1,390	2,880	2,220	2,220
28	3,260	3,840	7,680	1,880	2,360	2,290	1,500	2,660	2,440	2,360
29	3,750	3,580	5,860	1,620	2,360	1,940	1,560	2,660	2,360	2,360
30	3,580	3,580	6,860	1,750	2,810	1,940	1,880	2,290	2,290	2,440
31	3,420	.....	5,260	.....	3,260	1,940	.....	2,290	.....	2,440

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

Monthly discharge of Menominee River near Iron Mountain, Mich., for 1911.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	850	0.351	0.40	D.
February	.....	.....	1,000	.413	.43	D.
March	3,750	.....	1,500	.620	.71	D.
April	5,760	2,440	3,870	1.60	1.78	B.
May	10,700	1,620	4,940	2.04	2.35	B.
June	3,930	1,180	2,180	.901	1.01	B.
July	3,260	1,120	1,690	.698	.80	B.
August	7,330	1,750	3,570	1.48	1.71	A.
September	2,510	1,220	1,870	.773	.86	A.
October	5,860	1,880	3,410	1.41	1.63	A.
November	2,660	2,080	2,300	.950	1.06	A.
December	3,660	1,880	2,560	1.06	1.22	A.
The year	10,700	.....	2,490	1.03	13.96	

NOTE.—Discharge for period during which ice was present estimated from climatologic records and by comparison with records of flow of Escanaba River.
Mean discharge Mar. 1 to 27 estimated at 1,200 second-feet.

WOLF RIVER AND TRIBUTARIES.

WOLF RIVER AT KESHENA, WIS.

Location.—At the highway bridge at Keshena, 3 miles below the mouth of the West Branch.

Records available.—May 9, 1907, to March 31, 1909, and February 10, 1911, to December 31, 1911.

Drainage area.—797 square miles.

Gage.—A vertical staff read twice daily up to October 1, 1911, and three times daily—morning, noon, and night—since that date; mean of the three readings taken as the mean for the day.

Channel.—Permanent.

Discharge measurements.—Made from bridge.

Artificial control.—The flow of the river is controlled by logging dams.

Winter flow.—River freezes over during the winter months.

Accuracy.—The relation of gage height to discharge is affected by ice during the winter, and during the low-water season by the operation of a power plant at the sawmill 1 mile above the station. Conditions favor the accurate determination of discharge.

Cooperation.—Station maintained in cooperation with the United States Indian Office, at whose request it was reestablished.

Discharge measurements of Wolf River at Keshena, Wis., in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Jan. 24[a]	Robert Follansbee	103	216	2.02	363
Feb. 10[a]	C. R. Adams	103	218	2.10	377
Mar. 18[b]	do	107	284	2.13	539
June 26	S. B. Soulé	112	248	1.15	428
Dec. 22[b]	C. J. Emerson	102	462	4.45	872

[a] Complete ice cover. [b] Partial ice cover.

Daily gage height, in feet, of Wolf River at Keshena, Wis., for 1911.

[Neil Gauthier, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.10	2.12	2.40	2.90	1.48	1.20	1.28	3.43	2.40	5.62
2	.....	2.14	2.15	1.99	3.21	1.45	1.39	1.50	2.85	2.46	5.46
3	.....	2.12	2.05	2.20	2.42	1.22	1.21	1.22	3.31	2.34	5.11
4	.....	2.06	1.92	2.01	2.29	1.49	1.50	1.32	3.79	2.18	5.36
5	.....	2.02	1.62	1.50	3.08	1.18	1.52	1.30	4.85	2.18	5.26
6	.....	2.09	1.36	2.10	2.99	1.32	1.25	1.25	5.24	2.10	5.40
7	.....	2.14	1.42	1.85	2.80	1.22	1.38	1.52	4.48	2.56	5.56
8	.....	2.16	1.41	2.19	2.59	1.62	1.75	1.32	3.77	3.49	5.54
9	.....	2.25	1.62	2.22	2.52	1.58	1.85	1.28	3.70	5.28	5.09
10	2.10	2.32	1.95	1.62	1.71	1.38	1.61	1.55	3.82	6.35	5.36
11	2.11	2.42	1.92	1.70	1.62	1.55	1.51	1.50	3.41	6.74	5.80
12	2.08	2.38	1.78	1.69	2.30	1.48	1.60	1.25	3.38	6.38	5.88
13	2.16	2.32	1.78	2.40	1.08	1.26	1.48	1.30	3.50	6.18	5.85
14	2.22	2.25	2.18	2.18	1.10	1.30	1.30	1.70	3.46	5.89	5.72
15	2.30	2.21	1.98	2.21	1.16	1.25	1.31	1.78	3.22	5.72	5.62
16	2.30	2.45	1.82	1.30	1.28	1.29	1.25	1.35	3.22	6.54	5.00
17	2.32	2.12	1.76	2.36	1.08	1.18	1.18	1.85	3.05	6.35	4.59
18	2.34	2.21	2.65	2.28	.95	1.00	1.22	1.90	2.98	6.24	4.60
19	2.31	2.02	2.48	1.98	1.28	1.05	1.25	1.45	3.00	6.10	4.36
20	2.31	2.02	2.68	2.55	1.46	1.38	1.35	2.10	2.95	5.77	4.25
21	2.20	2.28	2.98	1.84	1.12	1.22	1.58	1.62	2.77	5.72	4.45
22	2.12	2.38	2.08	2.22	1.84	1.45	1.48	1.42	3.24	6.35	4.45
23	2.13	2.22	1.94	2.18	2.22	1.22	1.38	1.31	3.31	6.60	4.38
24	2.16	2.32	1.26	2.26	2.86	1.32	1.60	1.42	3.29	6.38	4.42
25	2.28	2.42	2.95	2.45	2.34	1.60	1.26	1.92	2.68	5.66	4.35
26	2.22	2.45	2.30	1.91	2.15	1.28	1.22	2.35	2.72	6.03	4.34
27	2.21	2.25	2.89	2.25	1.20	1.28	1.42	.....	2.78	6.41	4.38
28	2.12	2.38	2.58	1.78	2.06	1.25	1.48	.....	2.56	6.16	4.41
29	.....	2.36	2.41	2.28	1.55	1.38	1.25	.....	2.22	6.36	4.67
30	.....	2.16	2.92	1.94	1.52	1.12	1.38	.....	2.43	6.31	5.07
31	.....	2.30	.....	1.70	.....	1.50	1.22	.....	2.09	.....	5.28

NOTE.—Relation of gage height to discharge apparently affected by ice from Jan. 1 to about Apr. 17 and Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Wolf River at Keshena, Wis., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	962	1,220	567	459	489	1,550	962
2	.....	776	1,410	554	532	575	1,190	991
3	.....	869	972	467	463	467	1,470	934
4	.....	784	910	571	575	505	1,780	860
5	.....	575	1,330	451	583	497	2,510	860
6	.....	824	1,270	505	478	478	2,800	824
7	.....	716	1,170	467	528	583	2,250	1,040
8	.....	864	1,060	622	674	505	1,770	1,580
9	.....	878	1,020	606	716	489	1,720	2,830
10	.....	622	658	528	618	594	1,800	.....
11	.....	654	622	594	579	575	1,530	.....
12	.....	650	915	567	614	478	1,510	.....
13	.....	962	413	482	567	497	1,590	.....
14	.....	860	421	497	497	654	1,560	.....
15	.....	874	444	478	501	687	1,410	.....
16	.....	497	489	493	478	516	1,410	.....
17	.....	943	413	451	451	716	1,310	.....
18	1,090	906	364	383	467	737	1,270	.....
19	1,000	771	489	402	478	556	1,280	.....
20	1,100	1,040	559	528	516	824	1,250	.....
21	1,270	712	429	467	606	622	1,150	.....
22	815	878	712	554	567	544	1,430	.....
23	754	860	878	467	528	501	1,470	.....
24	482	897	1,200	505	614	544	1,460	.....
25	1,250	986	934	614	482	746	1,100	.....
26	915	741	846	489	467	938	1,120	.....
27	1,220	892	459	489	544	1,060	1,160	.....
28	1,050	687	806	478	567	1,180	1,040	.....
29	967	906	594	528	478	1,310	878	.....
30	1,230	754	583	429	528	1,430	976	.....
31	.....	654	.....	575	467	.....	820	.....

NOTE.—Daily discharge determined from a rating curve well defined below 1,900 second-feet. Discharge Sept. 27 to 30 interpolated.

Monthly discharge of Wolf River at Keshena, Wis., for 1911.

[Drainage area, 797 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	350	0.439	0.51	D.
February	.....	.....	400	.502	.52	D.
March	.....	.....	500	.627	.72	D.
April	1,270	.....	749	.940	1.05	C.
May	1,040	497	806	1.01	1.16	A.
June	1,410	364	786	.986	1.10	A.
July	622	383	510	.640	.74	A.
August	716	451	536	.673	.78	A.
September	1,430	467	677	.849	.95	A.
October	2,800	820	1,470	1.84	2.12	A.
November	.....	.....	1,520	1.91	2.13	C.
December	.....	.....	1,000	1.25	1.44	D.
The year	.....	.....	777	.975	13.22	

NOTE.—Discharge for periods during which ice was present estimated from four discharge measurements made under ice conditions, climatologic records, and by comparison with records of flow of the West Branch of Wolf River. Mean discharge Apr. 1 to 17 estimated at 550 second-feet; mean discharge Nov. 12 to 30 estimated at 1,300 second-feet.

WEST BRANCH OF WOLF RIVER AT NEOPIT, WIS.

Location.—At the dam and power plant at Neopit, a station of the Wisconsin & Northern Railroad, 20 miles north of Shawano.

Records available.—January 25 to December 31, 1911

Drainage area.—Not measured.

Gages.—Vertical staff.

Determination of flow.—An attempt to measure the flow by current-meter measurements made a short distance below the dam proved unsatisfactory and it was decided to rate the turbine and spillway. The power is developed by means of a timber dam about 14 feet high, which backs the water upstream for a considerable distance and forms a service reservoir. The spillway is a rectangular opening about 13 feet wide, which is closed by means of stop planks. Little water leaks through the dam, but considerable passes between the planks when all are in place. The power house is at the dam and is equipped with a 35-inch Leffel-Samson turbine, belted to a 60-kilowatt generator which is used chiefly for lighting. The turbine takes water from the service reservoir through a rectangular flume which is 9 feet wide by 6 feet deep and is lined with smooth planks. The turbine was rated by means of current-meter measurements in the flume. The spillway and leakage through the boards were rated by measurements in the sluiceway. Gages were placed in the pond and below the dam to show the head on the turbine. Readings of the head gage, daily gage, voltage, amperage, and number of planks removed from the spillway were recorded seven times each day—at 6, 7, and 10 a. m., 12 m., 3, 6, and 10 p. m.; these readings were then weighted in accordance with the elapsed interval.

Accuracy.—A current-meter measurement made December 21, 1911, indicated that the records were being carefully taken and are reliable.

Cooperation.—Station established at the request of the United States Indian Office, as Neopit is on the Menominee Indian Reservation.

Daily discharge, in second-feet, of West Branch of Wolf River at Neopit, Wis., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	60	64	106	99	56	43	75	70	144	134	169
2	.....	60	60	79	65	230	95	80	88	108	156	171
3	.....	60	75	97	137	62	91	77	61	11	144	147
4	.....	60	63	99	100	31	62	80	83	200	150	133
5	.....	60	70	97	91	116	100	61	105	183	157	133
6	.....	60	74	91	75	121	99	60	81	442	174	138
7	.....	60	69	81	54	87	70	139	101	395	199	180
8	.....	60	72	95	133	70	139	143	108	247	145	162
9	.....	60	102	70	102	73	97	94	69	176	175	156
10	.....	60	96	103	90	115	91	108	113	203	202	267
11	.....	60	78	85	409	27	61	45	94	171	207	209
12	.....	60	70	89	201	59	65	92	51	139	190	223
13	.....	60	61	95	87	59	112	94	89	106	159	206
14	.....	60	135	106	19	63	50	81	156	222	135	198
15	.....	60	70	117	132	79	92	92	119	155	210	163
16	.....	60	56	77	153	70	102	70	134	229	136	158
17	.....	60	89	102	135	66	111	63	133	225	140	142
18	.....	60	117	97	114	35	63	79	164	196	146	151
19	.....	57	89	102	94	67	107	126	201	180	185	145
20	.....	62	103	264	107	42	84	111	128	168	202	106
21	.....	60	92	108	107	42	48	96	89	136	136	129
22	.....	60	55	239	124	80	67	77	144	155	156	166
23	.....	63	78	59	116	39	90	73	112	178	170	178
24	.....	56	110	61	126	44	97	68	111	205	167	148
25	60	65	101	116	101	109	93	70	121	210	156	120
26	60	58	79	96	100	52	87	93	77	161	129	125
27	60	64	93	76	94	51	61	60	131	178	166	124
28	60	57	123	73	87	97	99	76	97	156	164	126
29	60	.....	118	157	104	61	79	65	141	162	138	131
30	60	.....	121	87	26	108	56	78	148	154	137	146
31	60	.....	114	.....	64	.....	99	85	.....	149	.....	140

NOTE.—Daily discharge computed from ratings of the turbine, spillway, and leakage. See description.

Monthly discharge of West Branch of Wolf River at Neopit, Wis., for 1911.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
January 25–31	60	60	60.0	B.
February	65	56	60.1	B.
March	135	55	87.0	B.
April	264	59	104	B.
May	409	19	111	B.
June	230	27	73.7	B.
July	139	43	84.2	B.
August	143	60	84.2	B.
September	201	51	111	B.
October	442	108	189	B.
November	210	129	162	B.
December	267	106	158	B.

GRAND RIVER AT GRAND RAPIDS, MICH.

Location.—At Fulton Street Bridge in Grand Rapids, Mich.

Records available.—March 12, 1901, to December 31, 1911.

Drainage area.—4,900 square miles.

Gage.—Staff, attached to bridge. In November, 1907, a new staff gage with zero corresponding to the city datum was attached to the abutment of the bridge. Readings on this gage were first reported in December, 1907. The zero of the gage in use prior to November, 1907, was 0.55 foot below the city datum; all gage readings, however, were corrected to the city datum and all published gage heights are therefore referred to the same datum.

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

Winter flow.—Somewhat affected by ice.

Artificial control.—The operation of power plants above the station may modify the low-water flow.

Accuracy.—The two or three measurements made at this station since 1905 indicate that the 1905 discharge curve is not applicable after that year.

Cooperation.—Records furnished by the city engineer of Grand Rapids.

Daily gage height, in feet, of Grand River at Grand Rapids, Mich., for 1911.

[F. F. Smith, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.20	2.52	−0.02	1.45	−0.40	−0.65	−1.30	−1.35	.....	1.32	3.10
2	.....	2.20	2.10	.....	2.48	− .25	.....	−1.12	−1.35	4.15	1.15	3.05
3	−0.65	1.75	1.72	− .10	1.90	− .20	−0.75	−1.10	.....	4.48	1.15	.....
4	− .50	1.45	1.45	− .02	1.62	.....	.....	−1.10	.....	4.15	1.20	2.98
5	− .30	.....	.....	.65	1.45	.95	−0.35	−1.25	−1.30	4.00	.....	2.72
6	− .20	1.15	0.92	1.50	1.22	2.75	− .50	.....	−1.30	4.00	0.95	2.35
7	− .05	1.00	.65	2.92	.....	3.52	− .45	−1.45	−1.30	4.95	1.00	2.70
8	.....	0.80	.48	2.97	0.65	3.32	− .85	−1.45	−1.30	.....	1.20	2.80
9	− .10	.80	.28	.....	.30	2.45	.....	−1.45	−1.25	4.50	1.30	3.25
10	− .15	.70	.18	2.72	.10	2.05	−1.00	−1.40	.....	4.35	1.22	.....
11	− .15	.60	.08	2.47	.05	.....	−0.95	−1.40	−1.25	4.10	1.40	3.50
12	.05	.....	.....	2.45	− .02	1.12	−1.00	−1.35	−1.25	3.38	.....	3.90
13	.30	.40	.25	2.87	− .02	0.55	−0.95	.....	−1.15	3.38	5.00	3.98
14	.40	2.10	.55	2.62	.....	.35	− .85	−1.35	−1.15	3.15	5.30	3.75
15	.....	4.60	.48	2.42	− .32	.27	− .82	−1.35	−1.00	.....	4.88	3.55
16	.50	5.38	.35	.....	− .62	.22	.....	−1.35	−0.90	2.20	4.62	3.28
17	.70	6.58	.18	2.05	− .80	.32	−1.10	−1.35	.....	2.52	4.45	.....
18	.75	7.98	.08	1.87	− .70	.....	−1.20	−1.35	− .90	2.88	5.55	2.80
19	.65	.....	.....	2.32	− .60	− .40	−1.10	−1.35	− .90	2.88	.....	2.30
20	.60	7.42	− .02	2.65	− .35	− .80	−1.25	.....	− .82	2.50	6.75	2.10
21	.25	7.00	− .10	2.40	.....	− .90	−1.15	−1.35	− .78	2.80	6.55	1.75
22	.....	.....	− .15	1.97	1.15	− .80	−1.10	−1.40	− .78	.....	6.30	1.95
23	.05	4.98	− .18	.....	1.90	− .85	.....	−1.35	− .78	3.45	6.15	2.80
24	− .08	4.15	− .12	1.22	2.10	− .88	− .92	−1.35	.....	3.60	4.75	.....
25	− .28	3.40	− .02	0.90	1.40	.....	−1.00	−1.35	− .75	3.30	4.15	.....
26	− .40	.....	.....	.85	0.85	.65	−1.20	−1.35	− .75	2.95	.....	2.70
27	.08	3.22	.02	.70	.32	− .35	−1.30	.....	− .65	2.85	3.35	2.90
28	1.00	2.92	− .02	.35	.....	− .60	−1.30	−1.35	− .70	2.48	3.20	2.60
29	.....	.....	− .12	.05	− .37	− .60	−1.30	−1.35	− .25	.....	3.50	0.80
30	1.95	.....	− .10	.....	.....	− .60	.....	−1.35	0.45	1.72	.....	1.05
31	1.90	.....	− .08	.....	− .27	.....	−1.30	−1.35	.....	1.52	.....	.....

NOTE.—Relation between gage height and discharge probably to some extent affected by ice during January, February, March, and December.

MANISTEE RIVER NEAR SHERMAN, MICH.

Location.—At north bridge, 1 mile from Sherman, Mich., immediately above the mouth of Wheeler Creek.

Records available.—July 10, 1903, to December 31, 1911.

Drainage area.—900 square miles.

Gage.—Standard chain; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Special studies are necessary to determine the winter flow as the stream freezes over. The constancy of flow is remarkable, and is due to the fact that the supply is derived from springs and ground water. The maximum recorded mean flow for any month from 1903 to 1908 is only two and one-half times the minimum recorded flow. Consequently a fairly close estimate of the discharge for the periods during which ice is present can be made by using climatological data and the general records.

Accuracy.—Observations in 1910-11 indicate that the relation of gage height to discharge remains unchanged, but may at times be affected by backwater from log jams.

Cooperation.—Station maintained in cooperation with William G. Fargo.

The following discharge measurement was made by V. H. Reineking:
September 20, 1911: Gage height, 2.00 feet; discharge, 904 second-feet.

Daily gage height, in feet, of Manistee River near Sherman, Mich., for 1911.

[M. I. and M. Munn, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.20	2.30	2.30	3.55	3.50	4.00	2.42	2.15	1.99	2.46	2.68	2.88
2	2.30	2.30	2.38	3.28	4.00	3.95	2.40	2.19	1.97	2.50	2.68	2.96
3	2.30	2.30	2.35	3.04	4.10	3.75	2.40	2.14	1.96	2.64	2.64	2.98
4	2.30	2.30	2.30	3.00	4.05	3.80	2.35	2.10	1.98	2.85	2.56	2.84
5	2.40	2.22	2.22	3.32	3.82	3.80	2.25	2.10	2.00	2.78	2.56	2.77
6	2.40	2.20	2.20	3.70	3.58	3.65	2.42	2.10	2.08	3.30	2.63	2.76
7	2.40	2.12	2.20	3.70	3.42	3.45	2.38	2.10	2.19	3.99	2.81	2.81
8	2.50	2.10	2.20	3.60	3.25	3.26	2.29	2.10	2.26	3.90	2.92	2.87
9	2.50	2.10	2.28	3.60	3.12	3.19	2.28	2.20	2.20	3.78	2.86	3.05
10	2.50	2.10	2.50	3.65	3.09	3.12	2.27	2.25	2.18	3.62	2.88	3.78
11	2.50	2.20	2.70	3.72	3.06	3.05	2.29	2.21	2.20	3.40	3.00	4.78
12	2.50	2.30	2.90	3.86	2.90	3.00	2.30	2.19	2.30	3.14	4.32	4.98
13	2.50	2.30	3.00	4.12	2.70	3.00	2.24	2.12	2.15	2.98	4.22	5.06
14	2.50	2.45	3.10	4.62	2.78	3.00	2.20	2.09	2.20	2.88	4.12	4.89
15	2.50	2.50	3.20	5.28	2.80	2.92	2.20	2.05	2.18	2.78	3.94	4.65
16	2.50	2.50	3.12	5.58	3.00	2.83	2.20	2.07	2.14	2.70	3.69	4.20
17	2.50	2.50	2.95	5.50	3.68	2.94	2.15	2.07	2.14	3.02	3.65	3.76
18	2.40	2.45	2.85	5.10	4.20	3.05	2.14	2.04	2.10	3.14	3.60	3.55
19	2.40	2.40	2.90	4.72	4.45	2.85	2.15	2.02	2.07	3.08	3.55	3.45
20	2.50	2.40	2.95	4.45	4.50	2.65	2.14	2.08	2.01	2.98	3.40	3.22
21	2.50	2.35	3.23	4.25	4.45	2.60	2.10	2.02	2.08	2.83	3.28	3.12
22	2.50	2.30	3.50	4.12	5.02	2.52	2.08	2.05	2.04	2.88	3.22	3.02
23	2.50	2.35	3.82	4.02	5.60	2.50	2.06	2.03	2.02	3.14	3.12	3.04
24	2.50	2.40	3.48	3.92	5.70	2.50	2.18	1.99	2.00	3.25	3.06	3.04
25	2.50	2.42	3.40	3.75	5.68	2.50	2.28	1.97	2.01	3.25	3.04	3.01
26	2.40	2.50	3.36	3.55	5.15	2.65	2.29	1.96	2.06	3.19	2.92	2.96
27	2.40	2.45	3.55	3.42	4.60	2.70	2.28	1.94	2.04	3.08	2.94	2.92
28	2.50	2.38	3.75	3.34	4.10	2.60	2.25	1.95	2.03	2.92	2.98	2.80
29	2.50	.....	3.85	3.30	3.82	2.50	2.21	2.10	2.34	2.88	2.97	2.62
30	2.40	.....	3.79	3.30	3.50	2.50	2.15	2.07	2.40	2.78	2.98	2.68
31	2.35	.....	3.70	.....	3.70	.....	2.11	2.02	.....	2.69	.....	2.87

NOTE.—Ice present Jan. 5 to 28; relation of gage height to discharge apparently but little affected. A log jam formed above the station July 11 and caused a slight lowering of stage.

Daily discharge, in second-feet, of Manistee River near Sherman, Mich., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	952	987	987	1,480	1,460	1,680	1,030	934	880	1,050	1,130	1,210
2	987	987	1,020	1,370	1,680	1,660	1,020	948	873	1,060	1,130	1,240
3	987	987	1,000	1,270	1,730	1,570	1,020	931	870	1,110	1,110	1,240
4	987	987	987	1,250	1,700	1,590	1,000	917	876	1,190	1,080	1,190
5	1,020	959	959	1,380	1,600	1,590	970	917	883	1,170	1,080	1,160
6	1,020	952	952	1,550	1,500	1,530	1,030	917	910	1,380	1,110	1,160
7	1,020	924	952	1,550	1,430	1,440	1,020	917	948	1,680	1,180	1,180
8	1,060	917	952	1,500	1,360	1,360	984	917	973	1,640	1,220	1,200
9	1,060	917	980	1,500	1,300	1,330	980	952	952	1,580	1,200	1,270
10	1,060	917	1,060	1,530	1,290	1,300	976	970	945	1,510	1,210	1,580
11	1,060	952	1,140	1,560	1,280	1,270	984	956	952	1,420	1,250	2,050
12	1,060	987	1,210	1,620	1,210	1,250	987	948	987	1,310	1,830	2,150
13	1,060	987	1,250	1,740	1,140	1,250	966	924	934	1,240	1,780	2,190
14	1,060	1,040	1,290	1,970	1,170	1,250	952	914	952	1,210	1,740	2,100
15	1,060	1,060	1,330	2,300	1,170	1,220	952	900	945	1,170	1,650	1,990
16	1,060	1,060	1,300	2,460	1,250	1.190	952	907	931	1,140	1,540	1,770
17	1,060	1,060	1,230	2,410	1,540	1,230	934	907	931	1,260	1,530	1,570
18	1,020	1,040	1,190	2,210	1,770	1,270	931	897	917	1,310	1,500	1,480
19	1,020	1,020	1,210	2,020	1,890	1,190	934	890	907	1,280	1,480	1,440
20	1,060	1,020	1,230	1,890	1,910	1,120	931	910	886	1,240	1,420	1,340
21	1,060	1,000	1,350	1,800	1,890	1,100	917	890	910	1,190	1,370	1,300
22	1,060	987	1,460	1,740	2,170	1,070	910	900	897	1,210	1,340	1,260
23	1,060	1,000	1,590	1,690	2,470	1,060	903	893	890	1,310	1,300	1,270
24	1,060	1,020	1,450	1,640	2,520	1,060	945	880	883	1,360	1,280	1,270
25	1,060	1,030	1,420	1,570	2,510	1,060	980	873	886	1,360	1,270	1,260
26	1,020	1,060	1,400	1,480	2,240	1,120	984	870	903	1,330	1,220	1,240
27	1,020	1,040	1,480	1,430	1,960	1,140	980	863	897	1,280	1,230	1,220
28	1,060	1,020	1,570	1,390	1,730	1,100	970	866	893	1,220	1,240	1,170
29	1,060	.....	1,610	1,380	1,600	1,060	956	917	1,000	1,210	1,240	1,100
30	1,020	.....	1,590	1,380	1,460	1,060	934	907	1,020	1,170	1,240	1,130
31	1,000	.....	1,550	.....	1,550	.....	920	890	.....	1,130	.....	1,200

NOTE.—Daily discharge determined from a rating curve well defined below 1,700 second-feet. No correction for ice.

Monthly discharge of Manistee River near Sherman, Mich., for 1911.

[Drainage area, 900 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,060	952	1,040	1.16	1.34	C.
February	1,060	917	997	1.11	1.24	B.
March	1,610	952	1,250	1.39	1.60	B.
April	2,460	1,250	1,670	1.86	2.08	A.
May	2,520	1,140	1,660	1.84	2.12	A.
June	1,680	1,060	1,270	1.41	1.57	A.
July	1,030	903	966	1.07	1.23	A.
August	970	863	910	1.01	1.16	A.
September	1,020	870	921	1.02	1.14	A.
October	1,680	1,050	1,280	1.42	1.64	A.
November	1,830	1,080	1,330	1.48	1.65	A.
December	2,190	1,100	1,420	1.58	1.82	B.
The year	2,520	863	1,230	1.37	18.59	

STREAMS TRIBUTARY TO LAKE HURON.

AU SABLE RIVER AT BAMFIELD, MICH.

Location.—At remains of old wooden highway bridge at Bamfield, near Glennie post office, Mich., in the NW. ¼ sec. 14, T. 25 N., R. 5 E., about 600 feet above the mouth of Bamfields Creek.

Records available.—August 27, 1902, to December 31, 1911.

Drainage area.—1,420 square miles.

Gage.—Staff; fastened to wooden crib pier of the old bridge about 600 feet above the steel bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from the steel bridge about 600 feet below the wooden bridge at which measurements were formerly made. The steel bridge was begun in March and completed in July, 1907; part of the wooden bridge was removed when the steel bridge was finished. Bamfields Creek, which enters immediately above the steel bridge, carries only a few second-feet of water.

Winter flow.—The river is frozen over two or three months each year, but open places, probably caused by inflow from springs, are found throughout the winter.

Accuracy.—The relation between gage height and discharge is affected for short periods during the logging season by backwater from log jams and at times during the winter by backwater from anchor ice. Changes made in the channel below the gage when the new bridge was erected caused slight backwater at the gage. The station has not been inspected since March, 1909.

Cooperation.—Station maintained in cooperation with William G. Fargo.

Daily gage height, in feet, of Au Sable River at Bamfield, Mich., for 1911.

[Mrs. W. H. Bamfield, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.62	2.36	1.26	2.32	2.55	2.55	1.90	1.19	1.39	1.80	1.98	3.05
2	2.16	2.68	1.26	2.46	3.02	2.50	1.86	1.29	1.29	1.80	1.96	3.02
3	2.25	2.39	1.26	1.92	2.85	2.42	1.83	1.29	1.35	1.85	2.00	3.00
4	2.36	2.41	1.24	1.96	2.75	2.32	1.69	1.30	1.38	2.18	1.88	2.02
5	2.68	2.05	1.22	2.32	2.52	2.36	1.64	1.28	1.24	2.12	1.89	2.11
6	2.91	1.95	1.21	2.75	2.39	2.36	1.56	1.30	1.28	2.48	1.78	2.12
7	3.30	1.72	1.18	2.76	2.24	2.30	1.54	1.28	1.40	2.80	1.90	2.10
8	2.85	2.44	1.15	2.48	2.12	2.26	1.49	1.25	1.50	2.90	2.16	2.12
9	2.76	2.31	1.25	2.51	2.11	2.20	1.39	1.20	1.42	2.64	2.30	2.22
10	2.72	1.61	1.30	2.70	2.02	2.22	1.36	1.26	1.40	2.55	2.21	2.78
11	2.80	2.15	1.50	2.95	2.05	2.24	1.30	1.30	1.37	2.39	2.19	3.50
12	3.12	2.78	1.55	3.30	2.00	2.24	1.24	1.25	1.34	2.29	3.10	4.05
13	3.58	2.91	1.51	3.35	1.90	2.30	1.20	1.22	1.28	2.38	4.10	3.58
14	3.05	2.72	1.79	4.45	1.88	2.28	1.10	1.18	1.25	2.08	3.85	3.45
15	.....	2.80	1.86	4.45	1.92	1.95	1.05	1.24	1.38	1.92	3.70	3.24
16	.....	2.90	1.75	3.75	2.15	1.94	1.10	1.35	1.51	1.78	3.50	3.12
17	.....	3.30	1.60	3.62	2.51	1.95	1.11	1.47	1.40	2.08	3.38	3.02
18	.....	1.46	1.51	3.50	3.10	1.86	1.15	1.44	1.36	2.28	3.30	3.09
19	.....	1.39	1.48	3.51	3.08	1.70	1.21	1.28	1.28	2.38	3.19	3.05
20	.....	1.35	1.45	3.25	2.98	1.70	1.25	1.26	1.18	2.25	2.02	2.95
21	2.69	1.38	1.64	2.95	2.94	1.68	1.26	1.24	1.20	2.05	2.02	2.55
22	2.95	1.40	1.86	2.85	3.08	1.66	1.28	1.21	1.26	2.02	2.12	2.46
23	2.88	1.29	2.00	2.48	3.40	1.61	1.30	1.22	1.20	2.28	2.21	2.40
24	2.78	1.22	1.90	2.50	3.72	1.58	1.31	1.20	1.22	2.35	2.22	2.36
25	2.72	1.22	1.90	2.45	3.55	1.51	1.30	1.16	1.27	2.26	2.32	2.32
26	2.64	1.32	2.34	2.40	3.36	1.52	1.26	1.10	1.30	2.15	2.35	2.30
27	2.78	1.32	2.85	2.30	2.95	1.58	1.28	1.15	1.42	2.08	2.32	2.24
28	2.78	1.32	3.05	2.28	2.68	1.64	1.28	1.21	1.32	2.00	2.26	2.19
29	2.85	.....	3.44	2.26	2.49	1.60	1.24	1.28	1.48	2.02	2.18	2.12
30	2.46	.....	2.62	2.29	2.29	1.62	1.20	1.32	1.56	1.95	2.38	2.12
31	2.51	.....	2.40	.....	2.35	.....	1.18	1.38	.....	1.92	.....	2.12

NOTE.—Relation between gage height and discharge affected by ice Jan. 1 to Feb. 18, and during December; gage heights for these periods read to water surface.

STREAMS TRIBUTARY TO LAKE ERIE.

HURON RIVER AT DEXTER, MICH.

Location.—At the highway bridge at Dexter, Mich., a short distance below the mouth of Mill Creek.

Records available.—September 1, 1904, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Standard chain, attached to bridge; installed March 26, 1908, at the same datum as the staff gage which was in use until March 12, 1908, when it was carried out by ice; datum unchanged.

Channel.—The high water that carried out the gage produced permanent change in the bed of the river; a small head race runs to an abandoned mill on the left bank, but at ordinary stages little or no water flows into this canal; at high stages a small amount of water may pass around the gage through this race.

Discharge measurements.—Made from a boat several hundred feet below the gage or from the bridge to which the gage is attached.

Winter flow.—As the current is swift, little ice forms at this section.

Accuracy.—Relation between gage height and discharge that existed prior to March 12, 1908, was altered as the result of the change in the river bed produced at that time; gage heights are only slightly affected by ice. The station was last inspected October 17, 1908.

Cooperation.—Station maintained in cooperation with the Eastern Michigan Edison Co., Washtenaw division, Ann Arbor, Mich.

Daily gage height, in feet, of Huron River at Dexter, Mich., for 1911.

[D. M. Litchfield, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.00	0.62	0.78	0.20	0.45	−0.30	−0.30	−0.42	−0.40	0.05	0.18	0.52
2	.15	.58	.65	.22	.50	− .30	− .30	− .38	− .40	.20	.12	.48
3	.40	.52	.62	.20	.42	− .22	− .30	− .38	− .40	.28	.10	.52
4	.60	.50	.60	.20	.40	− .20	− .30	− .40	− .40	.30	.10	.50
5	.70	.50	.55	.50	.40	.15	− .35	− .40	− .45	.30	.10	.48
6	.70	.50	.52	.50	.42	.20	− .35	− .40	− .40	.32	.12	.48
7	.70	.48	.50	.50	.30	.10	− .40	− .40	− .35	.40	.20	.48
8	.30	.45	.45	.50	.25	.10	− .38	− .40	− .40	.40	.20	.48
9	.30	.40	.40	.50	.22	.10	− .40	− .40	− .35	.38	.22	.55
10	.60	.45	.40	.45	.20	.10	− .40	− .40	− .38	.38	.25	.58
11	.55	.42	.40	.40	.20	.10	− .35	− .38	− .35	.38	.28	.65
12	.55	.38	.40	.40	.15	− .02	− .38	− .40	− .30	.30	.32	.68
13	.60	.58	.55	.50	.10	− .02	− .40	− .40	− .30	.30	.42	.62
14	.75	1.30	.60	.50	.08	− .02	− .42	− .40	− .30	.25	.45	.62
15	.60	1.30	.60	.45	.00	− .08	− .45	− .35	− .20	.28	.42	.60
16	.75	1.60	.58	.40	.00	− .10	− .45	− .32	− .20	.20	.48	.58
17	.75	1.70	.50	.40	.00	− .10	− .48	− .30	− .20	.28	.52	.55
18	.60	1.70	.42	.38	.00	− .12	− .50	− .38	− .20	.30	.88	.52
19	.60	1.65	.38	.40	− .10	− .15	− .45	− .40	− .20	.25	.85	.50
20	.60	1.45	.35	.95	− .10	− .12	− .45	− .40	− .30	.20	.78	.48
21	.60	1.28	.35	.90	− .10	− .20	− .45	− .30	− .22	.22	.70	.48
22	.60	1.18	.38	.75	− .08	− .22	− .45	− .32	− .22	.22	.70	.55
23	.70	1.08	.45	.68	− .12	− .28	− .50	− .35	− .22	.20	.70	.60
24	.62	1.00	.42	.62	− .20	− .25	− .50	− .30	− .25	.20	.68	.58
25	.55	1.00	.35	.52	− .20	− .20	− .48	− .30	− .30	.20	.70	.58
26	.55	0.98	.30	.50	− .22	− .20	− .50	− .35	− .28	.18	.65	.50
27	.80	.88	.25	.48	− .30	− .20	− .48	− .40	− .20	.15	.60	.45
28	1.00	.80	.25	.40	− .30	− .20	− .48	− .40	− .15	.15	.65	.32
29	.85	.....	.20	.45	− .30	− .28	− .45	− .35	− .08	.12	.78	.55
30	.70	.....	.20	.48	− .30	− .30	− .48	− .35	− .08	.12	.50	.42
31	.70	.....	.20	.....	− .30	.....	− .48	− .38	.....	.15	.....	.42

NOTE.—Relation between gage height and discharge affected by backwater from ice ams during January and to some extent by ice during December.

HURON RIVER AT GEDDES, MICH.

Location.—At dam and power plant of the Eastern Michigan Edison Co. at Geddes, Mich., half a mile above mouth of Fleming Creek.

Records available.—February 1, 1904, to December 31, 1911.

Drainage area.—757 square miles.

Determination of discharge.—The flow of the river at this point is computed from records of the operation of the power plant and records of the depth of the flow over the dam.

Cooperation.—The estimates are made and furnished by G. S. Williams.

Daily discharge, in second-feet, of Huron River at Geddes, Mich., for 1911.

[Drainage area, 757 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	167	436	549	392	464	80	87	61	77	321	258	515
2	203	462	572	304	489	90	148	92	84	298	279	478
3	143	430	502	413	489	126	111	91	61	258	258	294
4	189	497	495	441	464	142	134	103	136	260	258	347
5	169	434	497	597	439	260	56	82	39	363	218	454
6	184	221	503	564	445	310	99	62	93	393	298	486
7	173	299	448	584	360	264	94	52	103	412	273	450
8	214	296	431	535	369	213	84	63	78	352	296	412
9	196	299	409	461	365	254	97	70	71	437	324	524
10	205	311	412	516	350	273	83	112	76	416	312	488
11	273	298	476	537	358	218	91	124	119	389	320	475
12	299	349	450	537	294	287	218	67	86	378	384	471
13	310	369	515	546	280	200	100	32	81	388	477	479
14	344	692	491	535	195	212	64	63	118	359	422	484
15	470	1,025	485	541	273	194	80	93	125	350	442	502
16	427	1,022	355	384	242	188	79	75	130	300	424	495
17	435	1,068	434	459	224	178	60	132	82	325	495	519
18	362	1,050	417	458	222	116	76	70	120	294	749	523
19	317	1,036	365	531	181	146	63	88	146	326	734	537
20	365	930	383	1,136	185	140	61	78	125	313	602	548
21	340	847	411	986	129	148	66	73	102	319	559	553
22	248	808	360	808	176	138	72	87	115	319	549	463
23	306	755	401	564	181	95	62	91	143	354	549	466
24	307	753	358	691	162	79	60	86	140	332	550	454
25	310	830	328	654	151	104	61	105	56	291	542	459
26	320	759	318	602	148	83	62	75	132	294	473	469
27	532	582	368	560	156	124	56	81	258	291	517	459
28	662	599	377	524	68	118	56	69	202	284	574	485
29	736	.....	389	505	126	105	55	140	257	225	620	406
30	532	.....	379	380	97	94	47	45	206	284	567	477
31	451	.....	381	.....	115	.....	64	78	.....	256	.....	515

NOTE.—Daily discharge July 1 to Sept. 30 and Oct. 15 to 17 estimated from records at the Superior dam, about 1½ miles below Geddes.

Monthly discharge of Huron River at Geddes, Mich., for 1911.

[Drainage area, 757 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area.)
	Maximum.	Minimum.	Mean.	Per square mile.	
January	736	143	329	0.435	0.50
February	1,070	221	623	.823	.86
March	572	318	428	.565	.65
April	1,140	304	558	.737	.82
May	489	68	264	.349	.40
June	310	79	166	.219	.24
July	218	47	82.1	.108	.12
August	140	32	81.9	.108	.12
September	258	39	119	.157	.18
October	437	225	328	.433	.50
November	749	218	444	.586	.65
December	553	294	474	.626	.72
The year	1,140	32	322	.425	5.76

HURON RIVER AT FLAT ROCK, MICH.

Location.—At the highway bridge at Flat Rock, Mich., half a mile below the crossing of the Detroit, Toledo & Ironton Railroad.

Records available.—August 6, 1904, to December 31, 1911.

Drainage area.—1,000 square miles.

Gage.—Staff; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Artificial control.—At ordinary stages the flow of the river is controlled by a dam and power plant immediately above the station, but the operation of this plant is assumed to have little effect on the diurnal fluctuations of stage.

Winter flow.—Ice jams form below the station and cause backwater at the gage; in general the section above the station is kept open by the power plant.

Accuracy.—Station was last inspected October 16, 1908. Records probably fair.

Cooperation.—Station maintained in cooperation with the Eastern Michigan Edison Co., Washtenaw division, Ann Arbor, Mich.

Daily gage height, in feet, of Huron River at Flat Rock, Mich., for 1911.

[C. L. Mettler, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	3.45	3.25	1.9	2.5	0.9	0.8	0.35	0.5	1.3	1.7	3.15
2	1.35	3.4	3.5	1.85	2.6	1.0	.8	.3	.45	1.3	1.75	3.15
3	1.75	3.5	2.9	1.85	2.6	.95	.75	.6	.4	2.3	1.8	2.6
4	1.7	3.05	2.55	2.2	2.6	.95	.8	.35	.6	2.0	1.6	2.45
5	1.6	3.05	2.55	2.45	2.5	1.15	.75	.4	.5	1.9	1.65	2.95
6	1.6	3.0	2.4	3.05	2.35	1.85	.75	.5	.5	1.85	1.6	2.9
7	1.9	3.0	2.5	3.35	2.1	1.95	.7	.75	.4	2.15	1.95	2.75
8	2.0	2.35	2.35	2.95	2.05	1.6	.75	.6	.45	2.2	2.05	2.6
9	2.0	2.65	2.3	2.85	2.2	1.55	.7	.45	.45	2.3	1.9	2.8
10	2.15	2.6	2.2	2.75	1.85	1.7	.65	.45	.5	2.45	1.9	2.5
11	1.9	2.65	2.1	2.75	1.95	1.55	.7	.4	.9	2.4	2.0	.....
12	2.85	2.4	2.05	2.7	1.9	1.55	.6	.....	.35	2.25	2.05	3.55
13	2.8	2.8	2.3	2.7	1.75	1.75	.65	.....	.35	2.05	2.2	3.45
14	2.8	4.7	2.65	2.85	1.45	1.4	.6	.7	.55	2.0	2.85	3.25
15	2.9	5.9	2.65	2.8	1.1	1.3	.6	.6	.6	2.0	2.6	3.0
16	2.85	6.0	2.55	.....	1.6	1.15	.65	.45	.8	2.1	2.75	3.0
17	3.1	5.9	2.0	2.6	1.5	1.25	.4	.55	.75	2.15	2.6	2.95
18	2.95	5.9	2.35	2.6	1.5	1.25	.4	.5	.8	1.95	3.45	2.85
19	3.0	6.3	.....	2.55	1.45	.9	.5	.5	.5	2.0	4.3	3.0
20	2.9	5.95	2.0	3.65	1.35	1.1	.7	.7	.6	1.9	3.75	2.8
21	2.7	5.25	1.9	4.6	.....	.95	.75	.65	.75	1.9	3.7	2.95
22	2.65	4.6	2.15	4.4	.95	1.0	.6	.45	.8	1.9	3.35	2.75
23	2.35	4.45	2.05	3.85	1.4	1.1	.55	.4	.75	1.9	3.35	2.75
24	2.7	4.2	2.25	3.45	1.2	.95	.55	.4	.6	1.95	3.25	2.75
25	2.55	3.65	1.9	3.35	1.25	1.0	.4	.45	.5	1.95	3.3	2.5
26	2.6	3.55	1.95	3.0	1.05	.9	.3	.4	.4	1.9	3.0	2.6
27	2.9	3.65	2.0	2.95	.95	.9	.45	.45	.6	1.9	2.4	3.05
28	3.5	3.5	1.65	2.8	.95	.95	.4	.7	1.0	1.8	3.25	2.5
29	4.15	.....	1.9	2.65	.85	.95	.4	.45	1.3	1.8	3.75	1.8
30	4.15	.....	2.15	2.55	.8	.9	.4	.4	1.25	1.65	3.65	2.2
31	4.0	.....	2.1	.....	.9	.....	.3	.55	.....	1.9	.....	2.6

NOTE.—Relation between gage height and discharge little, if at all, affected by ice during the winter.

Daily discharge, in second-feet, of Huron River at Flat Rock, Mich., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	312	864	802	427	583	211	192	116	140	291	379	772
2	302	849	880	415	611	230	192	109	132	291	391	772
3	391	880	697	415	611	220	183	157	124	529	403	611
4	379	742	597	503	611	220	192	116	157	452	356	570
5	356	742	597	570	583	260	183	124	140	427	368	712
6	356	727	556	742	542	415	183	140	140	415	356	697
7	427	727	583	834	477	440	174	183	124	490	440	654
8	452	542	542	712	464	356	183	157	132	503	464	611
9	452	625	529	682	503	345	174	132	132	529	427	668
10	490	611	503	654	415	379	166	132	140	570	427	583
11	427	625	477	654	440	345	174	124	211	556	452	740
12	682	556	464	639	427	345	157	141	116	526	464	896
13	668	668	529	639	391	391	166	157	116	464	503	864
14	668	1,280	625	682	323	312	157	174	148	452	682	802
15	697	1,700	625	668	250	291	157	157	157	452	611	727
16	682	1,730	597	640	356	260	166	132	192	477	654	727
17	757	1,700	452	611	334	280	124	148	183	490	611	712
18	712	1,700	542	611	334	280	124	140	192	440	864	682
19	727	1,840	497	597	323	211	140	140	140	452	1,140	727
20	697	1,710	452	927	302	250	174	174	157	427	959	668
21	639	1,470	427	1,240	261	220	183	166	183	427	943	712
22	625	1,240	490	1,170	220	230	157	132	192	427	834	654
23	542	1,190	464	991	312	250	148	124	183	427	834	654
24	639	1,110	516	864	270	220	148	124	157	440	802	654
25	597	927	427	834	280	230	124	132	140	440	818	583
26	611	896	440	727	240	211	109	124	124	427	727	611
27	697	927	452	712	220	211	132	132	157	427	556	742
28	880	880	368	668	220	220	124	174	230	403	802	583
29	1,090	.....	427	625	202	220	124	132	291	403	959	403
30	1,090	.....	490	597	192	211	124	124	280	368	927	503
31	1,040	.....	477	.....	211	.....	109	148	.....	427	.....	611

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge interpolated for days on which gage was not read. No correction for effect of ice.

Monthly discharge of Huron River at Flat Rock, Mich., for 1911.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,090	302	616	0.616	0.71	D.
February	1,840	542	1,050	1.05	1.09	D.
March	880	368	533	.533	.61	C.
April	1,240	415	702	.702	.78	B.
May	611	192	371	.371	.43	B.
June	440	211	275	.275	.31	B.
July	192	109	156	.156	.18	B.
August	183	109	141	.141	.16	B.
September	291	116	164	.164	.18	B.
October	570	291	447	.447	.52	B.
November	1,140	356	638	.638	.71	B.
December	896	403	674	.674	.78	C.
The year	1,840	109	476	.476	6.46	

CATTARAUGUS CREEK AT VERSAILLES, N. Y.

Location.—On a three-span highway bridge in the village of Versailles, about 6 miles below Gowanda, 2¼ miles above the mouth of Clear Creek (coming in from the right), and about 8 miles above the mouth of the stream.

Records available.—September 23, 1910, to December 31, 1911. Data published also in annual reports of the State Water Supply Commission of New York, New York State Conservation Commission, and New York State engineer and surveyor.

Drainage area.—467 square miles.

Gage.—Chain, fastened to the upstream side of the second span from the right-hand end of the bridge; read twice daily; datum unchanged.

Channel.—Rock and gravel; considered permanent.

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

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Discharge curve not sufficiently developed to warrant the publication of table of daily discharge.

Cooperation.—Station established by United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Cattaraugus Creek at Versailles, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 13[a]	F. J. Shuttleworth	5.55	542
Apr. 18	C. S. DeGolyer	5.90	928

[a] Ice along shore may have affected gage height.

Daily gage height, in feet, of Cattaraugus River at Versailles, N. Y., for 1911.

[James A. Palmer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.60	6.00	6.00	5.85	6.85	5.30	5.18	5.00	5.65	6.00	5.80	6.50
2	8.40	5.98	5.85	5.85	6.50	5.28	5.08	5.00	5.55	6.75	5.72	6.25
3	7.60	5.78	5.70	5.78	6.00	5.30	5.00	5.05	5.45	6.00	5.60	6.15
4	6.60	6.10	5.58	5.90	5.78	5.22	5.00	6.05	5.32	6.35	5.52	5.90
5	6.30	5.75	5.45	8.10	5.65	5.30	5.00	5.70	5.32	6.40	5.50	5.82
6	5.98	5.55	5.55	7.70	5.55	5.30	5.00	5.58	7.05	6.15	5.52	5.80
7	6.00	5.50	5.35	8.00	5.52	5.22	5.22	5.25	7.20	5.95	6.00	5.82
8	6.00	5.68	5.55	6.60	5.48	5.20	5.08	5.72	7.70	5.88	6.50	5.98
9	6.30	5.75	5.62	6.40	5.42	5.22	5.05	5.35	6.15	5.85	5.90	6.25
10	8.40	5.65	6.80	6.30	5.42	5.20	5.10	5.30	5.78	5.75	5.68	6.65
11	8.40	5.50	6.30	6.20	5.48	5.20	5.12	5.15	5.70	5.70	5.70	6.50
12	7.70	5.50	7.40	6.15	5.22	5.20	5.08	5.10	5.62	5.72	5.85	6.55
13	7.20	5.50	6.50	5.95	5.00	5.20	5.00	5.10	5.65	5.62	6.10	7.96
14	7.10	5.65	6.80	6.00	5.42	5.20	5.00	5.10	5.60	5.52	6.10	7.00
15	7.35	6.25	6.90	6.15	5.38	5.18	4.95	5.05	5.60	5.52	6.15	7.10
16	6.35	6.10	6.50	5.95	5.38	5.12	4.95	5.55	5.60	5.55	6.10	6.75
17	6.05	8.00	6.30	5.98	5.32	5.10	5.00	5.35	5.40	5.52	6.00	6.65
18	5.88	7.80	6.00	5.45	5.35	5.10	5.30	5.25	5.42	5.62	8.40	6.45
19	5.92	7.00	5.88	5.80	5.68	5.10	5.08	5.15	5.40	5.60	6.70	6.10
20	5.92	6.40	5.92	6.00	6.10	5.10	5.30	5.05	5.40	5.60	6.50	5.85
21	6.10	6.30	6.00	5.98	5.40	5.05	5.22	5.00	5.32	5.52	6.40	5.88
22	6.10	5.98	6.55	6.00	5.32	5.00	5.18	5.10	5.32	5.42	6.25	5.98
23	6.00	5.78	6.80	5.85	5.30	5.15	5.18	5.12	5.32	5.62	6.20	6.90
24	5.60	5.80	6.00	5.82	5.32	5.15	5.10	5.12	5.22	5.65	6.75	6.20
25	5.70	5.82	5.82	5.68	5.35	5.10	5.10	5.30	5.48	5.60	6.45	6.05
26	5.75	6.15	6.30	5.62	5.32	5.12	5.15	5.35	5.38	5.62	6.25	6.00
27	6.20	6.70	7.55	5.55	5.22	5.38	5.10	5.45	5.30	5.58	6.10	6.40
28	7.90	6.10	7.15	5.55	5.28	5.65	5.10	6.85	5.32	5.60	6.10	5.92
29	6.65	.....	6.40	5.50	5.25	5.45	5.12	7.50	5.30	5.48	7.05	6.45
30	6.25	.....	6.30	5.62	5.22	5.22	5.10	6.20	5.38	5.40	6.70	6.05
31	6.00	.....	6.10	.....	5.22	.....	5.00	5.75	.....	5.48	.....	6.00

NOTE.—Some uncertainty exists regarding the extent of backwater from ice at this station. Ice jams were frequent during January, and probably the relation of gage height to discharge was more or less affected by ice during the greater portion of February and March.

STREAMS TRIBUTARY TO LAKE ONTARIO.

GENESEE RIVER AND TRIBUTARIES.

GENESEE RIVER AT ST. HELENA, N. Y.

Location.—At the steel highway bridge about 6 miles above the mouth of Silver Lake outlet (coming in from the left), 9½ miles above Canaseraga Creek (coming in from the right), and 5½ miles below the village of Portageville and the site of the proposed storage dam of the State Water Supply Commission of New York.

Records available.—August 14, 1908, to December 31, 1911. Published also in annual reports of the State Water Supply Commission of New York, 1910, report of the New York State engineer and surveyor, and First Annual Report of the Conservation Commission of New York.

Drainage area.—1,030 square miles.

Gage.—Chain, fastened to the upstream side of the bridge, middle span; read twice daily; datum unchanged. Since August 24, 1911, a Gurley self-recording gage with intake pipe to the well a few feet downstream from the chain gage; datum same as chain gage, but slope of water surface makes readings different.

Channel.—Gravel and rocks; considered permanent.

Discharge measurements.—At high stages made from the bridge; at low and medium stages, either by wading or from the bridge.

Winter flow.—Relation between gage height and discharge, usually but slightly affected by ice; determination of winter discharge considered good.

Accuracy.—Discharge rating curve well defined and data as published considered excellent.

Cooperation.—Established and maintained by the United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Genesee River at St. Helena, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 27[a]	C. C. Covert	3.56	1,180
Aug. 16	C. S. De Golyer	2.60	552
19	W. G. Hoyt	2.06	216
22	C. S. De Golyer	1.46	53.7
23[b]	W. G. Hoyt	1.45	55.6
Sept. 20	.....do	[c]2.30	350

[a] Ice reduces discharge about 10 per cent.
[b] Measurement made by wading above bridge.
[c] Automatic gage height 2.26 feet.

Daily gage height, in feet, of Genesee River at St. Helena, N. Y., for 1911.

(Chain gage.)

[Herman Piper, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	4.50	3.50	3.80	3.75	3.30	2.80	2.11	1.71
2	5.20	3.45	3.70	3.15	4.40	2.46	1.95	1.74
3	7.20	3.30	3.40	3.50	3.80	2.55	1.98	1.72
4	5.20	3.30	3.10	3.60	3.50	2.28	1.96	1.86
5	4.30	3.10	2.78	5.40	3.25	2.39	1.76	2.60
6	3.65	2.80	3.05	6.40	3.10	2.34	1.88	2.06
7	3.70	2.48	3.10	7.40	3.00	3.10	1.84	2.70
8	3.70	2.70	2.80	5.60	3.40	2.65	1.85	2.06
9	3.70	3.05	2.90	4.90	2.75	2.49	1.58	1.96
10	3.35	3.00	4.00	5.20	2.70	2.39	1.61	1.80
11	3.50	2.80	5.10	4.70	2.75	2.28	1.76	1.70
12	6.00	2.70	6.00	4.40	2.70	2.36	1.51	1.75
13	5.20	2.80	6.10	4.00	2.70	5.60	1.80	1.58
14	5.40	2.70	5.70	4.00	2.50	4.20	1.80	1.82
15	6.60	2.70	5.60	4.60	2.44	3.35	1.68	1.50
16	4.80	3.05	4.20	4.10	2.45	3.05	1.60	2.42
17	4.20	3.00	4.00	4.10	2.50	2.80	1.82	2.18
18	3.80	6.80	3.90	3.90	2.55	2.60	1.94	2.05
19	3.80	5.60	3.30	3.75	2.80	2.55	1.96	2.06
20	3.60	4.50	3.50	4.70	2.80	2.41	2.02	1.72
21	3.50	4.00	3.35	4.70	2.70	2.31	2.01	1.95
22	3.65	3.70	4.50	4.60	2.60	2.21	1.91	1.72
23	3.20	4.90	5.70	4.40	2.49	2.29	1.86	1.70
24	2.88	4.80	4.40	4.20	3.30	2.26	1.89	1.68
25	2.95	3.80	3.75	3.80	2.95	2.18	2.06	.....
26	2.90	3.70	4.30	3.60	2.55	2.18	1.62	.....
27	3.35	4.90	7.00	3.40	2.42	2.26	1.70	.....
28	7.10	4.60	6.70	3.25	2.41	2.40	1.65	.....
29	5.20	.....	4.80	3.10	2.22	2.28	1.91	.....
30	5.10	.....	4.30	3.06	2.08	2.18	1.51	.....
31	4.00	.....	4.00	.....	2.26	.....	1.74	.....

NOTE.—Gage heights Jan. 1 to Aug. 24 referred to chain gage. Effect of backwater from ice somewhat uncertain from January to March, but the relation of gage height to discharge was probably little affected by ice except Jan. 7 to 11, 19 to 27, Feb. 23 to 26, and Mar. 6 to 7. Gage readings were to water surface. Probably no backwater from ice during December.

Daily gage heights, by automatic and chain gages, of Genesee River at St. Helena, N. Y., for Aug. 25 to Dec. 28, 1911.

Day.	August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1	.....	.....	2.75	2.80	2.68	2.79	2.97	3.10	3.44	3.65
2	.....	.....	2.59	2.60	4.14	4.50	2.94	3.02	3.28	3.35
3	.....	.....	2.46	2.55	3.69	3.65	2.75	2.81	3.17	3.28
4	.....	.....	2.35	2.30	3.40	3.49	2.64	2.68	2.96	2.96
5	.....	.....	2.21	2.25	4.03	4.02	2.57	2.61	3.00	3.09
6	.....	.....	3.87	4.70	3.34	3.26	2.53	2.59	2.96	2.89
7	.....	.....	3.71	3.70	5.14	5.66	2.88	2.91	2.88	2.94
8	.....	.....	4.07	4.60	4.31	4.25	3.98	4.10	2.92	3.01
9	.....	.....	3.36	3.45	3.62	3.69	3.48	3.46	3.80	3.54
10	.....	.....	3.24	3.35	3.29	3.31	3.11	3.18	4.02	4.14
11	.....	.....	3.03	3.10	3.21	3.29	3.00	3.08	3.68	3.82
12	.....	.....	2.90	3.00	3.31	3.36	2.93	2.98	4.18	3.72
13	.....	.....	2.94	3.00	3.10	3.11	3.26	3.54	6.27	6.60
14	.....	.....	2.64	2.70	2.90	2.94	3.22	3.28	4.98	5.26
15	.....	.....	2.50	2.55	2.75	2.76	3.14	3.21	4.88	4.88
16	.....	.....	2.55	2.40	2.67	2.66	3.22	3.21	4.85	4.61
17	.....	.....	2.54	2.55	2.59	2.64	3.12	3.20	4.81	5.05
18	.....	.....	2.41	2.36	2.66	2.74	5.46	5.24	4.12	4.30
19	.....	.....	2.30	2.36	2.92	3.00	4.36	4.64	3.73	3.82
20	.....	.....	2.26	2.29	2.76	2.76	3.82	4.18	3.40	3.34

Daily gage heights, by automatic and chain gages, of Genesee River at St. Helena, N. Y., for Aug. 25 to Dec. 28, 1911—Continued.

Day.	August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
21	.....	.....	2.23	2.26	2.64	2.68	3.63	3.66	3.31	3.38
22	.....	.....	2.18	2.20	2.57	2.60	3.43	3.52	3.28	3.38
23	.....	.....	2.15	2.19	2.56	2.62	3.31	3.36	4.11	4.22
24	.....	.....	2.08	2.16	2.60	2.62	3.88	3.79	3.71	3.85
25	1.81	1.75	2.11	2.11	2.54	2.55	3.79	3.94	3.38	3.46
26	1.96	1.96	2.11	2.16	2.45	2.49	3.49	3.59	3.32	3.29
27	1.97	1.86	2.13	2.14	2.42	2.48	3.35	3.38	3.83	3.88
28	3.72	3.60	2.09	2.08	2.41	2.49	4.27	3.76	3.39	3.52
29	5.78	5.70	2.16	2.20	2.37	2.36	4.84	5.46	.....	2.84
30	3.86	3.65	2.59	2.70	2.36	2.45	3.78	4.05	.....	3.01
31	3.08	3.15	.....	.....	2.38	2.45	.....	.....	.....	3.18

NOTE.—For the purpose of comparison gage heights for Aug. 25 to Dec. 28 are published for both the chain and automatic gages. It should be noted that, as the mouth of the intake pipe to the automatic gage is located a few feet downstream from the chain gage, the gage readings do not agree exactly, owing to slope, and that the slope varies with the stage. The daily gage heights for the automatic gage are the mean of 24 readings taken at hourly intervals, intermediate 15-minute readings being neglected. The daily chain-gage readings are the mean of two readings which are usually taken at 8 a. m. and 5 p. m.

Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	2,690	1,300	1,660	1,600	1,100	663	237	108
2	4,020	1,250	1,530	961	2,530	421	178	116
3	9,680	1,100	1,200	1,300	1,660	480	188	110
4	4,020	1,100	916	1,410	1,300	317	182	150
5	2,370	916	648	4,470	1,050	377	121	514
6	1,470	663	600	7,120	916	349	156	218
7	1,200	433	600	10,400	828	916	144	587
8	1,100	587	663	4,950	1,200	550	147	218
9	1,100	872	743	3,400	625	440	77	182
10	1,000	828	1,930	4,020	587	377	83	132
11	1,100	663	3,810	3,030	625	317	121	105
12	5,990	587	5,990	2,530	587	361	63	118
13	4,020	663	6,260	1,930	587	4,950	132	77
14	4,470	587	5,200	1,930	446	2,220	132	138
15	7,720	587	4,950	2,860	408	1,150	100	61
16	3,210	872	2,220	2,070	414	872	81	396
17	2,220	828	1,930	2,070	446	663	138	268
18	1,660	8,340	1,790	1,790	480	514	175	214
19	1,200	4,950	1,100	1,600	663	480	182	218
20	900	2,690	1,300	3,030	663	389	203	110
21	800	1,930	1,150	3,030	587	333	199	178
22	700	1,530	2,690	2,860	514	282	165	110
23	700	1,200	5,200	2,530	440	322	150	105
24	650	1,100	2,530	2,220	1,100	307	159	100
25	600	1,000	1,600	1,660	786	268	218	.....
26	650	1,000	2,370	1,410	480	268	86	.....
27	1,000	3,400	8,980	1,200	396	307	105	.....
28	9,330	2,860	8,030	1,050	389	383	93	.....
29	4,020	.....	3,210	916	287	317	165	.....
30	3,810	.....	2,370	881	225	268	63	.....
31	1,930	.....	1,930	.....	307	.....	116	.....

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge for the periods during which relation of gage height to discharge was affected by ice Jan. 7 to 11, 19 to 27, Feb. 23 to 26, and Mar. 6 to 7 estimated from climatologic records and the discharge at Rochester.

Daily discharge, in second-feet, from automatic and chain gages, of Genesee River at St. Helena, N. Y., for Aug. 25 to Dec. 28, 1911.

Day.	August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1			663	663	602	655	846	916	1,320	1,470
2			536	514	2,280	2,690	820	846	1,150	1,150
3			446	480	1,620	1,470	663	671	1,030	1,080
4			372	327	1,280	1,290	572	572	837	794
5			297	302	2,120	1,960	521	521	881	907
6			1,870	3,030	1,210	1,060	493	507	837	735
7			1,660	1,530	4,200	5,100	768	752	768	777
8			2,180	2,860	2,560	2,300	2,040	2,070	802	837
9			1,230	1,250	1,530	1,520	1,370	1,260	1,780	1,340
10			1,110	1,150	1,160	1,110	979	988	2,100	2,130
11			907	916	1,080	1,090	881	898	1,610	1,690
12			786	828	1,180	1,160	811	811	2,340	1,560
13			820	828	970	925	1,130	1,340	7,300	7,720
14			572	587	785	777	1,090	1,080	3,850	4,150
15			473	480	663	633	1,010	1,020	3,620	3,360
16			507	383	595	558	1,090	1,020	3,560	2,880
17			500	480	536	543	988	1,010	3,480	3,620
18			414	361	587	617	5,000	4,110	2,250	2,370
19			344	361	802	828	2,640	2,930	1,690	1,690
20			322	322	671	633	1,800	2,190	1,280	1,140
21			307	307	572	572	1,540	1,480	1,180	1,180
22			277	277	521	514	1,310	1,320	1,150	1,180
23			264	273	514	529	1,180	1,160	2,240	2,250
24			233	259	543	529	1,890	1,650	1,660	1,720
25	138	118	246	237	500	480	1,750	1,850	1,250	1,260
26	188	182	246	259	440	440	1,380	1,400	1,190	1,090
27	192	150	307	251	421	433	1,220	1,180	1,820	1,760
28	1,670	1,410	237	226	414	440	2,500	1,610	1,260	1,360
29	5,860	5,200	268	277	383	361	3,540	4,610	.....	695
30	1,860	1,470	536	587	379	414	1,750	2,000	.....	837
31	961	961	.....	.....	389	414	.....	.....	.....	988
Mean	1,550	1,360	631	687	1,020	1,030	1,450	1,460	1,830	1,800

NOTE.—Daily discharge Aug. 25 to Dec. 31 determined from a well-defined discharge rating curve based on measurements referred to the chain gage, the same rating curve being used for both sets of gage heights. The daily discharge was determined for the automatic gage record from the chain-gage rating by means of the following well-defined table of relation, which serves to reduce the automatic-gage readings to the corresponding chain-gage readings. Discharge Dec. 29 to 31 taken from chain-gage record; automatic-gage not running. Except for errors caused by diurnal fluctuations of stage and inaccuracies of observation, the determinations should be strictly comparable. The determinations referred to the automatic gage should, of course, be given preference.

Table for Genesee River at St. Helena, N. Y., changing automatic to chain gage heights for 1911.

Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
Feet.		*Feet.*		*Feet.*		*Feet.*	
1.80	1.81	3.80	3.89	5.80	5.97	7.80	8.05
1.90	1.92	3.90	4.00	5.90	6.08	7.90	8.16
2.00	2.02	4.00	4.10	6.00	6.18	8.00	8.26
2.10	2.12	4.10	4.20	6.10	6.28	.....	.....
2.20	2.23	4.20	4.31	6.20	6.39	.....	.....
2.30	2.33	4.30	4.41	6.30	6.49	.....	.....
2.40	2.44	4.40	4.52	6.40	6.60	.....	.....
2.50	2.54	4.50	4.62	6.50	6.70	.....	.....
2.60	2.64	4.60	4.72	6.60	6.80	.....	.....
2.70	2.75	4.70	4.83	6.70	6.91	.....	.....
2.80	2.85	4.80	4.93	6.80	7.01	.....	.....
2.90	2 95	4.90	5.04	6.90	7.12	.....	.....
3.00	3.06	5.00	5.14	7.00	7.22	.....	.....
3.10	3.16	5.10	5.24	7.10	7.32	.....	.....
3.20	3.27	5.20	5.34	7.20	7.43	.....	.....
3.30	3.37	5.30	5.45	7.30	7.53	.....	.....
3.40	3.48	5.40	5.56	7.40	7.64	.....	.....
3.50	3.58	5.50	5.66	7.50	7.74	.....	.....
3.60	3.68	5.60	5.76	7.60	7.84	.....	.....
3.70	3.79	5.70	5.87	7.70	7.95	.....	.....

Monthly discharge of Genesee River at St. Helena, N. Y., for 1911.

[Drainage area, 1,030 square miles.]

Month.	Discharge in second-feet.										Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.						Minimum.	Mean.		Per square mile.		
	Automatic gage.				Chain gage.			Automatic gage.	Chain gage.			
	Day.	Hour.	Crest gage heights.	Crest discharge.	Day.	24-hour discharge.						
Jan.	.....	.....	.....	.....	.....	9,680	600	.....	2,750	2.67	3.08	C.
Feb.	.....	.....	.....	.....	.....	8,340	433	.....	1,570	1.52	1.58	B.
Mar.	.....	.....	.....	.....	.....	8,980	600	.....	2,750	2.67	3.08	A.
Apr.	.....	.....	.....	.....	.....	10,400	881	.....	2,670	2.59	2.89	A.
May	.....	.....	.....	.....	.....	2,530	225	.....	730	.709	.82	A.
June	.....	.....	.....	.....	.....	4,950	268	.....	662	.643	.72	A.
July	.....	.....	.....	.....	.....	237	63	.....	141	.137	.16	B.
Aug.	28	9.15 p. m.	7.92	12,600	29	5,200	61	[a] 497	452	[b].482	.56	A.
Sept.	8	11.30 a. m.	5.30	4,240	6	3,030	[c] 233	631	687	[b].613	.68	A.
Oct.	7	11.30 a. m.	6.08	6,210	7	5,100	[c] 379	1,020	1,030	[b].991	1.14	A.
Nov.	18	10.30 a. m.	6.44	7,240	29	4,610	[c] 493	1,450	1,460	[b]1.41	1.57	A.
Dec.	13	6 a. m.	6.70	8,030	13	7,720	695	[a]1,830	1,800	[b]1.78	2.05	A.
The year.	Aug. 28	9.15 p. m.	7.92	12,600	.....	10,400	61	[a]1,390	1,390	[b]1.35	18.33	

[a] Missing records Jan. 1 to Aug. 24 and Dec. 29 to 31 completed from chain gage record.
[b] Computed from mean monthly discharge in automatic gage column.
[c] From automatic gage record.

NOTE.—In computing the monthly mean for August and December, and the annual mean, the automatic gage records have been used as far as available, as they are considered preferable. For comparison, the 24-hour maximum for the chain gage and the monthly means for the chain gage are presented in the table above for the period Aug. 25 to Dec. 31.

GENESEE RIVER AT JONES BRIDGE, NEAR MOUNT MORRIS, N. Y.

Location.—At the highway bridge known as Jones Bridge, about 5 miles below the village of Mount Morris, 6 miles by river above the village of Genesee, 1¾ miles below the inflow of Canesaraga Creek (coming in from the right) and about 1¾ miles above the mouth of Beads Creek (coming in from the left).

Records available.—May 22, 1903, to April 30, 1906; Aug. 12, 1908, to Dec. 31, 1911. Published also in reports of State engineer and surveyor of New York, State Water Supply Commission of New York, and Conservation Commission of New York.

Drainage area.—1,410 square miles.

Gage.—Chain, fastened to upstream side of highway bridge; read twice daily; datum unchanged since established.

Channel.—Clay; liable to shift, but measurements have shown it to be fairly permanent in recent years.

Discharge measurements.—Made at all stages from footbridge erected on the outriggers of the bridge.

Winter flow.—Relation between gage height and discharge for the winter months considerably affected by ice. Volume of flow during the winter months determined chiefly by comparison with the flow of the Genesee at Rochester and at St. Helena.

Accuracy.—Discharge curve well developed and data as published for open-water periods believed to be excellent.

Cooperation.—Established by United States Geological Survey in 1903 in cooperation with the State engineer of New York; reestablished in 1908 in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Genesee River at Jones Bridge, near Mount Morris, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 15	C. C. Covert	14.00	6,590
30	W. G. Hoyt	9.92	3,750
Aug. 28	Frank Weber	4.36	393
28	C. S. De Golyer	5.16	814

Daily gage height, in feet, of Genesee River at Jones Bridge, near Mount Morris, N. Y., for 1911.

[Elizabeth Trewer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.4	13.1	13.8	8.2	6.2	4.3	3.95	3.6	5.5	5.5	5.1	6.7
2	12.4	12.5	13.6	7.4	8.8	4.6	3.8	3.6	4.95	7.0	5.5	6.2
3	22.3	11.6	12.4	7.0	7.5	4.6	3.85	3.5	4.75	7.5	5.2	5.9
4	18.6	11.2	11.4	7.0	6.7	4.55	4.0	3.6	4.5	8.1	5.1	5.52
5	14.1	10.9	11.0	10.2	6.2	4.3	3.7	3.85	4.35	6.9	4.76	5.6
6	13.2	.....	10.0	16.7	6.0	4.55	3.7	4.3	6.5	6.6	4.8	5.6
7	13.1	10.4	9.2	19.1	5.7	4.5	3.7	3.9	7.8	8.0	4.95	5.5
8	13.2	.....	8.5	14.9	5.5	5.1	3.6	3.8	8.6	6.9	7.4	5.6
9	12.8	.....	9.1	11.2	5.4	4.65	3.55	3.85	6.7	6.4	6.5	5.8
10	12.4	.....	14.4	11.1	5.3	4.55	3.6	3.6	5.9	6.2	5.8	8.0
11	11.8	9.4	16.0	10.0	5.2	4.4	3.6	3.6	5.7	6.0	5.4	7.2
12	15.0	.....	18.4	9.1	5.2	4.45	3.45	3.45	5.4	6.2	5.4	6.7
13	20.1	.....	20.4	8.3	4.9	7.7	3.35	3.25	5.5	5.8	6.0	14.4
14	19.5	.....	17.7	7.8	4.85	7.9	3.55	3.45	5.1	5.4	6.0	13.2
15	22.3	.....	14.7	8.5	4.65	6.1	3.35	3.35	4.8	5.2	5.8	10.1
16	19.4	9.5	9.3	7.8	4.75	5.4	3.2	3.65	4.7	5.0	5.7	10.7
17	16.3	9.8	8.8	8.0	4.8	5.0	3.75	4.25	4.85	5.0	5.7	10.9
18	14.8	17.8	7.8	7.7	4.8	4.95	4.0	3.85	4.55	5.2	8.5	9.1
19	13.9	22.4	7.3	7.2	4.8	4.65	3.7	3.9	4.5	5.4	10.4	7.6
20	13.0	18.5	6.95	8.5	5.3	4.5	3.7	3.75	4.3	5.2	7.6	6.8
21	12.4	16.6	7.7	10.5	5.0	4.3	3.7	3.6	4.2	5.0	7.1	6.5
22	12.2	15.1	8.9	8.2	4.65	4.2	3.7	3.55	4.2	4.85	6.6	6.2
23	11.2	14.6	11.8	8.0	4.75	4.2	3.55	3.3	4.15	4.8	6.2	7.0
24	12.1	14.5	9.1	7.6	5.7	4.2	3.6	3.4	4.05	4.8	6.6	7.6
25	11.8	14.4	7.7	7.0	5.5	4.1	3.7	3.65	4.0	4.8	7.7	6.6
26	11.3	14.2	8.4	6.6	4.85	4.15	3.75	3.6	4.1	4.7	6.7	6.3
27	11.8	14.4	16.8	6.1	4.7	4.15	3.5	3.8	4.1	4.6	6.4	7.0
28	21.8	14.0	19.3	6.0	4.4	4.3	3.5	4.5	4.1	4.55	6.8	7.1
29	20.4	.....	11.5	5.75	4.3	4.45	3.45	15.4	4.15	4.51	11.0	5.6
30	15.4	.....	9.8	5.75	4.15	4.1	3.5	8.2	4.4	4.51	8.0	6.7
31	13.7	.....	8.8	.....	4.05	.....	3.5	6.7	.....	4.51	.....	7.1

NOTE.—Gage heights at this station during each winter period greatly affected by backwater from ice jams. It is probable that the relation of gage height to discharge was affected from this cause from about Jan. 1 to about Mar. 11. Gage readings were probably to water surface . Probably no backwater during December.

Daily discharge, in second-feet, of Genesee River at Jones Bridge, near Mount Morris, N. Y., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,000	2,530	1,340	410	282	175	960	960	760	1,620
2	2,400	2,030	2,920	530	235	175	688	1,790	960	1,340
3	1,900	1,790	2,090	530	250	150	598	2,090	810	1,180
4	1,500	1,790	1,620	510	300	175	490	2,460	760	970
5	1,200	3,890	1,340	410	205	250	430	1,730	602	1,010
6	1,000	8,920	1,230	510	205	410	1,500	1,560	620	1,010
7	900	10,800	1,060	490	205	265	2,270	2,400	688	960
8	950	7,480	960	760	175	235	2,790	1,730	2,030	1,010
9	1,000	4,590	910	552	162	250	1,620	1,450	1,500	1,120
10	2,500	4,520	860	510	175	175	1,180	1,340	1,120	2,400
11	5,000	3,750	810	450	175	175	1,060	1,230	910	1,910
12	10,300	3,120	810	470	138	138	910	1,340	910	1,620
13	11,900	2,600	665	2,210	112	90	960	1,120	1,230	7,080
14	9,720	2,270	642	2,340	162	138	760	910	1,230	6,120
15	7,320	2,720	552	1,280	112	112	620	810	1,120	3,820
16	3,260	2,270	598	910	80	190	575	710	1,060	4,240
17	2,920	2,400	620	710	220	390	642	710	1,060	4,380
18	2,270	2,210	620	688	300	250	510	810	2,720	3,120
19	1,970	1,910	620	552	205	265	490	910	4,030	2,150
20	1,760	2,720	860	490	205	220	410	810	2,150	1,670
21	2,210	4,100	710	410	205	175	370	710	1,850	1,500
22	2,980	2,530	552	370	205	162	370	642	1,560	1,340
23	5,020	2,400	598	370	162	100	352	620	1,340	1,790
24	3,120	2,150	1,060	370	175	125	318	620	1,500	2,150
25	2,210	1,790	960	335	205	190	300	620	2,210	1,560
26	2,660	1,560	642	352	220	175	335	575	1,620	1,400
27	9,000	1,280	575	352	150	235	335	530	1,450	1,790
28	11,000	1,230	450	410	150	490	335	510	1,670	1,850
29	4,800	1,090	410	470	138	7,880	352	494	4,450	1,010
30	3,610	1,090	352	335	150	2,530	450	494	2,400	1,620
31	2,920	.....	318	.....	150	1,620	.....	494	.....	1,950

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge Mar. 1 to 11 estimated from the determination of discharge at St. Helena and at Rochester.

Monthly discharge of Genesee River at Jones Bridge, near Mount Morris, N. Y., for 1911.

[Drainage area, 1,410 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	3,500	2.48	2.86	C.
February	.....	.....	2,200	1.56	1.62	C.
March	11,900	900	3,950	2.80	3.28	A.
April	10,800	1,090	3,120	2.21	2.47	A.
May	2,920	318	897	.636	.73	A.
June	2,340	335	637	.452	.50	A.
July	300	80	187	.133	.15	B.
August	7,880	90	577	.409	.47	A.
September	2,790	300	767	.544	.61	A.
October	2,460	494	1,070	.759	.88	A.
November	4,450	602	1,550	1.10	1.23	A.
December	7,080	960	2,150	1.52	1.75	A.
The year	11,900	80	1,710	1.21	16.50	

NOTE.—Monthly discharge for January and February computed from the discharge at St. Helena and Rochester, with due consideration of the relative drainage areas.

GENESEE RIVER AT ROCHESTER, N. Y.

Location.—At the highway bridge known locally as Elmwood Avenue Bridge, at the north end of South Park, 3½ miles above the center of the city of Rochester, 3¼ miles below the mouth of Black Creek (coming in from the left), and 7½ miles above the mouth of the river.

Records available.—February 9, 1904, to December 31, 1911; published also in annual reports of the State engineer and surveyor, the State Water Supply Commission, and the Conservation Commission of the State of New York. Elevation of water surface, measurements, and records of flow of Genesee River at Rochester during flood stages, and low water previous to 1904, published in annual reports of the State engineer and surveyor, 1902–3–4, and in Water-Supply Papers 24, 65, and 97.

Drainage area.—2,360 square miles.

Gage.—Prior to 1910 a staff gage bolted to the downstream end of the first pier from the right-hand abutment was read once daily. From December, 1910, to December, 1911, mean gage heights computed from a Gurley recording gage in the pump house immediately below the bridge on the right-hand bank. Elevation of zero of gage, 506.848 Barge Canal datum and 245.591 Rochester City datum. Gage datum unchanged since installation of the station.

Channel.—Gravel, smooth; considered permanent.

Discharge measurements.—Made from bridge at which the staff gage is located. Prior to 1904 measurements and elevations of water surface taken in conjunction with the water flowing over and around Johnson-Seymour dam in the city of Rochester.

Winter flow.—Affected by ice for short periods, although, as a rule, the channel is open.

Accuracy.—Discharge rating curve well developed for all stages; published data considered good for periods of open water.

Cooperation.—Maintained by the United States Geological Survey in cooperation with the New York State Barge Canal and the engineer department of the city of Rochester from 1904 to 1909; from December, 1909, maintained in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Genesee River at Rochester, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 29	W. G. Hoyt	6.79	13,800
29	do	6.36	13,100
Apr. 1	do	3.43	4,300
Aug. 14[a]	C. S. DeGolyer	1.03	219
14[a]	W. G. Hoyt	1.02	226
29	Frank Weber	1.18	470
Sept. 21	W. G. Hoyt	1.16	501

[a] Temporary earth dam below station caused backwater.

Daily gage height, in feet, of Genesee River at Rochester, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.55	3.84	4.42	3.26	2.28	1.49	1.3	1.3	1.89	1.18	1.34	2.87
2	3.62	3.31	3.83	3.02	2.48	1.52	1.3	1.3	1.88	1.42	1.56	2.44
3	4.08	2.76	3.30	2.87	2.57	1.56	1.3	1.3	1.45	2.38	1.75	2.18
4	4.99	2.46	2.94	2.80	2.58	1.57	1.3	1.3	1.32	2.31	1.64	2.01
5	5.15	2.30	2.75	3.69	2.43	1.53	1.2	1.3	1.27	2.04	1.56	1.85
6	3.82	2.41	2.40	6.37	2.24	1.58	1.2	1.3	1.29	2.46	1.47	1.84
7	2.88	2.60	2.20	6.67	2.08	1.77	1.2	1.2	2.11	2.19	1.48	1.83
8	2.65	2.62	2.04	6.60	1.93	1.70	1.4	1.2	2.33	3.65	1.57	1.79
9	2.75	2.43	2.09	4.80	1.87	1.85	1.7	1.2	2.69	3.14	2.49	1.77
10	2.97	1.99	2.89	4.40	1.84	1.73	1.7	1.1	2.22	2.64	2.29	2.14
11	2.63	2.22	4.29	4.29	1.68	1.56	1.7	1.1	1.93	2.07	2.01	2.77
12	2.98	1.94	5.34	4.06	1.29	1.49	1.6	1.1	1.83	1.99	1.84	2.55
13	4.14	1.72	6.43	3.66	1.4	2.03	1.6	1.1	1.67	2.04	1.78	3.11
14	4.81	1.68	6.83	3.36	1.79	3.05	1.5	1.1	1.68	1.89	2.00	5.43
15	4.77	2.31	6.65	3.26	1.75	2.41	1.5	1.1	1.52	1.73	2.04	4.71
16	5.48	2.20	5.56	3.54	1.74	2.05	1.5	1.1	1.40	1.59	1.94	4.13
17	4.60	1.68	3.84	3.29	1.72	1.84	1.5	1.1	1.33	1.53	1.93	4.10
18	3.56	3.02	3.37	3.18	1.73	1.65	1.5	1.1	1.31	1.48	1.94	4.00
19	3.09	5.50	3.13	3.04	1.74	1.55	1.5	1.0	1.32	1.46	3.56	3.32
20	2.65	6.07	2.95	3.02	1.73	1.55	1.5	1.0	1.19	1.62	3.63	2.79
21	2.57	4.66	3.09	3.67	1.86	1.54	1.5	1.0	1.16	1.59	2.82	2.36
22	2.74	3.71	3.32	3.70	1.82	1.43	1.5	1.06	1.15	1.51	2.55	2.28
23	2.80	3.21	4.55	3.33	1.74	1.37	1.5	1.02	1.13	1.43	2.35	2.36
24	2.46	2.89	4.76	3.27	1.76	1.35	1.4	.99	1.10	1.42	2.22	3.01
25	2.08	2.76	3.51	3.10	2.09	1.40	1.4	.99	1.05	1.43	2.53	2.86
26	1.96	3.04	3.17	2.81	2.06	1.2	1.4	1.01	1.08	1.42	2.74	2.46
27	2.17	4.40	3.84	2.61	1.81	1.2	1.3	1.01	1.08	1.45	2.44	2.40
28	3.60	4.94	6.46	2.47	1.66	1.2	1.3	1.03	1.07	1.36	2.27	2.68
29	5.65	.....	6.56	2.35	1.55	1.3	1.3	2.31	1.09	1.33	2.65	2.31
30	5.67	.....	5.24	2.27	1.52	1.4	1.3	4.11	1.10	1.27	3.75	1.64
31	4.50	.....	.....	.....	1.47	.....	1.3	2.62	.....	1.32	.....	1.79

NOTE.—Daily gage heights recorded on the automatic gage, except May 13 and June 26 to Aug. 21, which were observed at 4 p. m. on the staff gage. Relation of gage height to discharge probably not materially affected by ice during the winter months. The gage heights July 8 to Aug. 28 were affected by an earth dam put in below the gage. The daily automatic gage heights are the mean of 24 records taken at hourly intervals, intermediate 15-minute readings being neglected. There is probably no difference between the automatic and staff gage heights resulting from slope in water surface.

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,240	5,420	6,890	4,070	2,100	847	610	340	1,440	481	658	3,240
2	4,890	4,180	5,390	3,540	2,460	888	610	340	972	756	944	2,390
3	6,010	3,020	4,160	3,240	2,640	944	610	340	795	2,280	1,220	1,920
4	8,470	2,430	3,380	3,100	2,660	958	610	340	634	2,160	1,060	1,620
5	8,920	2,140	3,000	5,060	2,370	902	500	340	577	1,670	944	1,380
6	5,370	2,340	2,320	12,500	2,030	972	500	340	599	2,430	821	1,360
7	3,260	2,700	1,960	13,400	1,740	1,260	500	290	1,800	1,940	834	1,340
8	2,800	2,740	1,670	13,200	1,500	1,150	390	290	2,190	4,960	958	1,280
9	3,000	2,370	1,760	7,940	1,400	1,380	540	290	2,880	3,810	2,480	1,260
10	3,440	1,580	3,280	6,840	1,360	1,200	540	250	2,000	2,780	2,120	1,850
11	2,760	2,000	6,550	6,550	1,120	944	540	250	1,500	1,780	1,620	3,040
12	3,460	1,510	9,450	5,960	599	847	490	250	1,340	1,580	1,360	2,600
13	6,160	1,180	12,700	4,980	730	1,650	490	250	1,100	1,670	1,270	3,740
14	7,970	1,120	14,000	4,290	1,280	3,610	440	250	1,120	1,440	1,600	9,700
15	7,860	2,160	13,400	4,070	1,220	2,340	440	250	888	1,200	1,670	7,690
16	9,840	1,960	10,100	4,700	1,210	1,690	440	250	730	986	1,510	6,140
17	7,380	1,120	5,420	4,140	1,180	1,360	440	250	646	902	1,500	6,060
18	4,740	3,540	4,310	3,900	1,200	1,080	440	250	622	884	1,510	5,800
19	3,700	9,900	3,790	3,590	1,210	930	440	210	634	808	4,740	4,200
20	2,800	11,600	3,400	3,540	1,200	930	440	210	490	1,030	4,910	3,080

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2,640	7,550	3,700	5,010	1,390	916	440	210	462	986	3,140	2,250
22	2,980	5,100	4,200	5,080	1,330	769	440	234	452	874	2,600	2,100
23	3,100	3,960	7,240	4,230	1,210	694	440	218	434	769	2,230	2,250
24	2,430	3,280	7,830	4,090	1,240	670	390	206	405	756	2,000	3,520
25	1,740	3,020	4,620	3,720	1,760	730	390	206	362	769	2,560	3,220
26	1,540	3,590	3,870	3,120	1,710	500	390	214	388	756	2,980	2,430
27	1,910	6,840	5,420	2,720	1,320	500	340	214	388	795	2,390	2,320
28	4,840	8,330	12,800	2,450	1,090	500	340	222	380	682	2,090	2,860
29	10,400	.....	13,100	2,230	930	610	340	2,160	396	646	2,800	2,160
30	10,400	.....	9,170	2,090	888	730	340	6,090	405	577	5,200	1,060
31	7,100	.....	6,620	.....	821	.....	340	2,740	.....	634	.....	1,280

NOTE.—Daily discharge determined from a well-defined discharge rating curve, except from July 8 to Aug. 28. For this period an approximate auxiliary curve has been used, constructed by means of two discharge measurements made Aug. 14 and comparisons with discharge at St. Helena and at Jones Bridge.

Monthly discharge of Genesee River at Rochester, N. Y., for 1911.

[Drainage area, 2,360 square miles.]

Month.	Maximum.				Minimum.	Mean.	Per square mile.	Run-off (depth in inches).	Accuracy.
	Day.	Hour.	Crest.	Crest.					
			Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*		
January	29	11.30 a. m.	6.28	12,200	1,540	5,130	2.17	2.50	B.
February	20	6 a. m.	6.41	12,600	1,120	3,810	1.61	1.68	B.
March	29	2 a. m.	7.07	14,700	1,670	6,310	2.67	3.08	A.
April	6	12 p. m.	6.89	14,100	2,090	5,110	2.17	2.42	A.
May	3-4	All day.	2.58	2,660	599	1,450	.614	.71	A.
June	14	2.15 a. m.	3.44	4,470	500	1,080	.458	.51	A.
July	.....	.....	.....	[a] 610	340	458	.194	.22	C.
August	30	2.15 a. m.	4.63	7,460	206	590	.250	.29	C.
September	9	4.30 p. m.	3.02	3,540	362	901	.382	.43	A.
October	8	1 p. m.	3.89	5,540	481	1,410	.598	.69	A.
November	19	7 p. m.	4.37	6,760	658	2,060	.873	.97	A.
December	14	3 p. m.	5.66	10,400	1,060	3,070	1.30	1.50	A.
The year	Mar. 29	2 a. m.	7.07	14,700	206	2,610	1.11	15.00	

[a] 24-hour maximum.

CANASERAGA CREEK AT DANSVILLE, N. Y.

Location.—At the highway bridge 1 mile due west from the village of Dansville, about 2,200 feet below the mouth of Mill Brook (coming in from the right) and about 22 miles above the mouth of the creek.

Records available.—July 21, 1910, to December 31, 1911. Data published also in annual reports of State Water Supply Commission, State Conservation Commission, and State engineer and surveyor, State of New York.

Drainage area.—Not measured.

Gage.—Staff, bolted to the downstream side of the left-hand abutment; read twice daily; datum unchanged.

Channel.—Sand and gravel, liable to shift during high water.

Discharge measurements.—At high stages made from the bridge; low-water measurements made by wading below the bridge.

Winter flow.—The relation of gage height to discharge is affected by ice.

Accuracy.—Discharge rating curve not sufficiently developed to warrant the publication of table of daily discharge.

Cooperation.—Established by United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Canaseraga Creek at Dansville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 31	W. G. Hoyt	2.50	242
Aug. 28[a]	Frank Weber	1.77	26.9

[a] Measurement made by wading above bridge.

Daily gage height, in feet, of Canaseraga Creek at Dansville, N. Y., for 1911.

[Floyd Harter, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			3.20	2.18	2.32	2.18	1.80	1.60	2.22	2.06	2.09	2.24
2			3.20	2.05	2.55	2.18	1.78	1.60	1.96	2.20	2.06	2.19
3			2.95	2.10	2.42	2.05	1.75	1.62	1.94	1.99	2.03	2.22
4			2.78	2.12	2.32	1.98	1.70	1.82	1.81	2.06	1.92	2.24
5			2.88	3.08	2.28	2.10	1.62	1.73	1.98	2.03	1.99	2.12
6			2.80	3.05	2.20	2.08	1.68	1.70	1.98	1.92	2.01	2.16
7			2.55	3.85	2.12	1.98	1.70	1.68	1.84	2.89	2.18	2.19
8			2.58	3.40	2.15	2.02	1.68	1.72	2.24	2.74	2.02	2.24
9			2.78	2.92	2.12	1.92	1.72	1.68	2.06	2.74	2.29	2.18
10			3.15	2.82	2.02	1.90	1.70	1.60	1.89	2.51	2.16	2.32
11			3.40	2.72	2.02	2.05	1.72	1.68	1.81	2.24	2.08	2.24
12			3.65	2.52	1.98	2.20	1.70	1.60	1.88	2.26	2.19	2.36
13			3.90	2.45	1.92	2.28	1.72	1.62	1.94	2.12	2.20	3.20
14			4.20	2.60	1.92	2.18	1.70	1.60	1.84	2.04	2.18	2.95
15			4.20	2.48	1.90	2.05	1.65	1.80	1.81	2.04	2.26	2.69
16			3.45	2.32	1.82	1.95	1.70	2.10	1.82	1.96	2.18	2.95
17		2.33	3.15	2.45	2.02	1.88	2.05	1.88	1.82	1.92	2.29	2.91
18		3.40	3.30	2.40	2.05		1.95	1.98	1.80	2.04	2.91	2.69
19		3.60	3.30	2.30	1.92	1.82	1.82	1.88	1.88	1.94	2.59	2.64
20		3.40	3.05	2.48	1.92	1.80	1.98	1.72	1.86	1.88	2.50	2.29
21		3.05	2.78	2.40	1.95	1.82	1.80	1.70	1.79	1.89	2.31	2.11
22		2.82	2.78	2.45	1.92	1.88	1.78	1.72	1.78	1.96	2.24	2.20
23		2.35	2.75	2.62	1.95	1.82	1.75	1.72	1.81	2.01	2.18	2.59
24		2.08	2.48	2.48	2.05	1.80	1.72	1.80	1.85	1.92	2.25	2.62
25		2.45	2.88	2.32	2.18	1.82	1.70	2.02	1.84	1.94	2.21	2.49
26		2.94	2.95	2.22	2.08	1.80	1.68	1.88	1.91	1.88	2.19	2.39
27		3.40	4.15	2.12	1.98	1.88	1.65	1.72	1.82	1.99	2.18	2.81
28		3.35	3.80	2.02	1.95	2.02	1.62	2.45	1.84	1.96	2.14	2.58
29			2.82	1.90	1.82	1.92	1.62	2.50	1.92	1.92	2.39	2.41
30			2.58	1.88	1.80	1.80	1.62	2.22	1.96	1.95	2.26	2.44
31			2.35		1.95		1.60	2.20		2.14		2.75

NOTE.—No information regarding backwater from ice at this station.

KESHEQUA CREEK AT SONYEA, N. Y.

Location.—On the second highway bridge in the village of Sonyea, 4¼ miles above the junction of Canaseraga Creek and about 4 miles downstream from Tuscarora.

Records available.—July 22, 1910, to December 31, 1911. Data also in annual reports of State Water Supply Commission, New York State Conservation Commission, and State engineer and surveyor, State of New York.

Drainage area.—Not yet determined.

Gage.—Staff, fastened to a pile on the right bank directly back of and across from the Craig Colony power house; used for low-water readings. Chain gage installed October 25, 1910, on upstream side of second bridge; used for high-water readings. Gage read twice daily. The zeros of these gages are not set at the same datum.

Channel.—Sand and gravel; liable to shift at high stages.

Discharge measurements.—At high stages made from either bridge; at low stages made by wading.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Discharge rating curve not sufficiently developed to warrant publication of table of daily discharge.

Cooperation.—Established by United States Geological Survey in cooperation with State Water Supply Commission of New York.

Discharge measurements of Keshequa Creek at Sonyea, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
Mar. 15	C. C. Covert	[b] 4.18	207
31	W. G. Hoyt	[c] 3.70	70
Aug. 26	Frank Weber	[d] 3.00	5.9

[a] Chain gage.
[b] Gage height at staff gage, 1.86.
[c] Gage height at staff gage, 1.39.
[d] Gage height at staff gage, 0.73.

Daily gage height, in feet, of Keshequa Creek at Sonyea, N. Y., for 1911.

[Elmer E. Reynolds, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.70	3.72	3.58	3.18	2.95	2.90	3.05	3.15	3.20	3.40
2	.....	3.60	3.65	3.68	3.20	2.90	2.88	2.98	3.45	3.18	3.42
3	.....	3.60	3.75	3.68	3.20	2.95	2.92	2.95	3.20	3.15	3.32
4	.....	3.60	3.70	3.58	3.12	2.98	3.12	2.98	3.18	3.15	3.25
5	.....	3.60	4.70	3.48	3.10	2.88	3.00	3.00	3.15	3.15	3.20
6	.....	3.50	4.40	3.40	3.10	2.92	2.95	3.25	3.15	3.20	3.35
7	.....	3.45	4.30	3.48	3.10	3.00	3.00	3.12	4.18	3.42	3.35
8	.....	3.50	3.98	3.45	3.10	3.02	2.98	4.55	3.50	3.50	3.45
9	.....	3.65	3.95	3.40	3.05	2.98	2.95	4.50	3.42	3.52	3.52
10	.....	4.55	3.92	3.35	3.05	2.92	2.92	3.90	3.30	.45	3.55
11	.....	4.85	3.85	3.35	3.05	2.95	2.95	3.38	3.40	3.35	3.55
12	.....	5.10	3.70	3.35	3.10	2.95	2.92	3.45	3.42	3.35	3.88
13	.....	4.65	3.62	3.28	3.32	2.92	2.88	3.38	3.40	3.38	4.75
14	.....	4.50	3.60	3.25	3.20	2.85	2.88	3.20	3.32	3.35	3.95
15	.....	4.20	3.58	3.25	3.15	2.90	2.92	3.20	3.20	3.35	4.10
16	.....	3.95	3.55	3.25	3.10	2.88	2.95	3.05	3.20	3.40	3.95
17	5.40	3.70	3.58	3.28	3.05	3.28	2.98	3.00	3.15	3.42	4.02
18	5.35	3.65	3.60	3.25	3.05	3.20	2.95	3.00	3.20	4.15	3.75
19	4.75	3.68	3.60	3.25	3.00	2.98	2.95	3.02	3.20	4.35	3.55
20	3.90	3.70	3.60	3.20	2.98	2.95	2.92	2.98	3.20	3.50	3.35
21	3.80	3.70	3.60	3.15	3.00	2.98	2.90	2.98	3.20	3.50	3.35
22	3.80	3.98	3.60	3.12	3.00	3.00	2.90	2.98	3.25	3.50	3.38
23	3.82	3.88	3.60	3.18	3.00	3.00	2.85	3.00	3.22	3.50	4.08
24	3.78	3.82	3.58	3.50	3.00	2.98	2.80	2.98	3.20	4.52	3.58
25	3.68	3.70	3.55	3.35	2.98	2.95	3.02	2.92	3.20	4.05	3.45
26	4.25	3.72	3.55	3.30	2.92	3.00	3.08	3.00	3.18	3.50	3.45
27	4.50	4.80	3.55	3.18	2.90	3.00	3.00	3.02	3.15	3.45	3.90
28	3.85	4.18	3.50	3.10	3.05	3.00	3.35	3.05	3.15	3.52	3.60
29	.....	3.82	3.40	3.02	2.95	2.88	3.25	3.08	3.15	3.70	3.45
30	.....	3.85	3.35	3.00	2.95	2.85	3.30	3.20	3.15	3.45	3.45
31	.....	3.75	.....	3.02	.....	2.88	3.08	.....	3.22	.....	3.45

NOTE.—No information available regarding backwater from ice at this station. All gage readings for 1911 made with the chain gage except those from Mar. 4 to 16, which were made with the staff gage and reduced to the corresponding chain gage readings by means of a curve of relation between the two gages.

CANADICE LAKE OUTLET NEAR HEMLOCK, N. Y.

Location.—In outlet at foot of lake. Canadice Lake is tributary to Genesee River through Hemlock Lake outlet and Honeoye Creek.

Records available.—April, 1903, to December 31, 1911. Data also found in annual reports of the New York State engineer and surveyor and the reports of the city engineer of Rochester, N. Y.

Drainage area.—12.6 square miles, of which 0.7 square mile is lake surface.

Gage.—Hook gage; in channel above gate.

Discharge measurements.—Outlet is measured over a standard, thin-edged weir with a 5-foot crest and two-end contractions, so arranged with needle timbers at the ends that the length may be increased to 14.96 with no end contractions during high water. The weir crest stands 3 feet above the stream channel and is never submerged by backwater. Two additional rectangular gates, each 1 foot square, with three complete contractions and a forth partial contraction at the bottom, afford by-passes during high water. The depth of water on the weir is read each morning to hundredths of a foot by means of the hook gage. Each change of the gates is also noted. Corrections are made for velocity of approach for the higher stages. All computations are made by the Francis formula.

Diversions.—No water is diverted from Canadice Lake above the station.

Artificial control.—The outflow of the lake at the dam above the weir is controlled by the gates.

Winter flow.—The pool above the weir is free from ice throughout the winter.

Accuracy.—The observations and computations are made by engineers of the city engineer's office of Rochester, N. Y., under the direction of E. A. Fisher, city engineer, and John F. Skinner, principal assistant city engineer. They are considered excellent.

Monthly discharge of Canadice Lake outlet near Hemlock, N. Y., for 1911.

[Drainage area, 12.6 square miles.]

Month.	Discharge in second-feet.		Run-off (depth in inches on drainage area).	Mean elevation of lake above low water.
	Mean.	Per square mile.		
January	4.966	.394	0.45	1.529
February	5.566	.442	.46	1.828
March	9.859	.782	.90	2.210
April	10.540	.836	.93	2.489
May	3.987	.316	.36	2.411
June	4.183	.332	.37	2.402
July	3.859	.306	.35	1.905
August	3.662	.291	.34	1.211
September	3.643	.289	.32	0.959
October	3.781	.300	.35	0.816
November	4.153	.330	.37	0.701
December	4.281	.340	.39	1.152
The year	5.2066	.413	5.59	1.6344

TRIBUTARY TO OSWEGO RIVER.

ONEIDA RIVER AT CAUGHDENOY, N. Y.

Location.—At Caughdenoy, about 6 miles above the old Euclid station at Oak Orchard State dam, half a mile below the mouth of Caughdenoy Creek (which enters from the north) and 5 miles below Lake Oneida.

Records available.—August 30, 1902, to December 31, 1909 (at Euclid); January 1, 1910, to December 31, 1911 (at Caughdenoy, which replaces the Euclid station). Data published also in annual reports of New York State Engineer and Surveyor.

Drainage area.—1,377 square miles.

Gage.—Staff, about 150 feet upstream from the dam, on the right-hand side of the stream.

Discharge measurements.—Discharge measured over a masonry dam 415 feet long, completed at Caughdenoy during the summer of 1909. This dam has a practically level crest at elevation 369.4 feet, and an ogee cross section with a slope or batter on the upstream portion of the crest of 1 foot rise in 2 feet horizontal width. The downstream part of the crest is rounded, with a radius of 3.24 feet. The dis-

charge over the dam has been computed from formulas derived from United States Geological Survey experiments on a dam of ogee cross section similar in form, and a correction has been made for velocity of approach.

Diversions.—During the summer, and also to some extent during the winter, water is diverted past the left-hand end of the dam through the Caughdenoy lock. An estimate of the amount of water so diverted has been made and included in the calculated discharge of the river.

Cooperation.—Station maintained and records furnished by New York State engineer and surveyor.

Daily discharge, in second-feet, of Oneida River at Caughdenoy, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,776	2,384	1,566	4,815	5,468	1,324	1,219	659	711	480	1,219	2,737
2	1,824	2,330	1,621	4,779	5,432	1,219	1,219	659	659	412	746	2,682
3	2,072	2,278	1,703	4,887	5,322	1,282	1,219	711	570	659	1,119	2,737
4	2,278	2,384	1,703	5,322	5,322	1,324	1,119	832	570	480	1,324	2,737
5	2,278	2,278	1,621	5,395	5,248	2,922	926	711	659	659	1,324	2,600
6	2,463	2,224	1,703	6,004	4,887	2,774	659	711	412	832	1,430	2,600
7	2,410	2,330	1,566	6,237	4,740	2,545	926	746	570	888	1,324	2,490
8	2,278	2,198	1,621	6,408	4,389	2,490	1,019	659	832	832	1,119	2,545
9	2,198	2,072	1,776	6,839	4,188	2,384	926	412	832	888	1,945	2,436
10	2,463	2,021	1,824	7,126	4,154	1,566	926	344	746	1,019	1,566	2,737
11	2,410	1,945	1,872	7,253	3,728	1,512	832	480	711	926	1,703	2,878
12	2,278	1,824	1,945	7,337	3,633	1,457	659	412	746	746	1,566	2,922
13	2,330	1,872	2,021	7,337	3,506	1,324	746	412	832	832	1,324	3,106
14	2,463	1,945	2,122	7,253	3,411	1,282	832	412	926	926	2,072	3,106
15	2,410	1,824	2,330	7,126	3,258	1,324	832	385	926	1,019	1,824	3,728
16	2,463	1,776	2,463	7,126	3,106	1,512	746	344	832	1,119	1,703	3,728
17	2,463	1,703	2,384	7,003	3,069	1,566	711	283	926	1,019	1,824	3,891
18	2,463	1,566	2,330	7,003	2,737	1,566	832	307	832	1,019	2,122	4,054
19	2,463	1,566	2,278	6,962	2,710	1,430	1,019	283	746	926	1,824	4,054
20	2,410	1,703	2,330	7,085	2,737	1,409	746	344	1,019	1,119	2,198	4,054
21	2,072	1,621	2,384	6,921	2,490	1,119	746	344	746	1,324	2,463	4,054
22	2,072	1,621	2,490	6,839	2,072	1,199	832	259	746	1,282	2,600	3,956
23	2,122	1,703	2,490	6,798	1,921	1,324	832	283	746	1,324	2,737	4,222
24	2,198	1,703	2,545	6,584	1,703	1,199	926	283	746	1,324	2,737	4,088
25	2,198	1,776	2,545	6,082	1,621	1,282	926	307	746	1,367	2,655	4,288
26	2,072	1,824	2,490	5,927	1,512	1,219	832	307	746	1,324	2,811	4,356
27	2,021	1,824	2,490	5,850	1,485	1,219	746	344	711	1,324	2,737	3,411
28	2,021	1,872	2,922	5,696	1,430	1,240	832	440	570	1,282	2,811	3,258
29	2,122	.....	3,570	5,620	1,457	1,199	832	480	480	1,282	2,436	3,411
30	1,566	.....	4,584	5,468	1,566	1,240	711	466	412	1,219	2,774	3,633
31	2,384	.....	4,506	.....	1,282	.....	659	746	.....	1,219	.....	3,924

Monthly discharge of Oneida River at Caughdenoy, N. Y., for 1911.

[Drainage area, 1,377 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,463	1,566	2,227	1.62	1.87
February	2,384	1,566	1,935	1.41	1.47
March	4,584	1,566	2,316	1.68	1.94
April	7,337	4,779	6,369	4.63	5.17
May	5,468	746	3,212	2.33	2.69
June	2,922	1,119	1,548	1.12	1.25
July	1,219	659	871	0.633	0.730
August	832	259	465	0.338	0.390
September	1,019	412	723	0.525	0.586
October	1,367	412	1,002	0.728	0.839
November	2,811	746	1,935	1.41	1.57
December	4,356	2,436	3,368	2.45	2.82
The year	7,337	259	2,164	1.573	21.325

SALMON RIVER AND TRIBUTARIES.

SALMON RIVER AT STILLWATER BRIDGE, NEAR REDFIELD, N. Y.

Location.—On Stillwater highway bridge 6¼ miles by road east of Altmar, one-fourth mile above the proposed dam of the Ontario Power Co., seven-eighths mile below Pennock Brook (coming in from the right), and 7 miles below the mouth of North Branch (coming in from the right).

Records available.—June 24 to Dec. 31, 1911.

Drainage area.—191 square miles.[1]

Gage.—Chain, attached to upstream side of bridge; datum unchanged since established.

Channel.—Small stone and gravel.

Discharge measurements.—Made from the bridge or by wading.

Accuracy.—Conditions for making measurements are good and records should be excellent.

Cooperation.—Station established by United States Geological Survey in cooperation with David R. Cooper, of Niagara Falls, N. Y., and State of New York Conservation Commission.

Discharge measurements of Salmon River at Stillwater Bridge, near Redfield, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	C. S. De Golyer	2.92	386
June 24[a]	do	1.92	138
Sept. 16[a]	G. H. Canfield	2.44	259
Oct. 8[b]	O. M. Moulton	4.07	752
19	do	4.50	977
Nov. 8	do	4.98	1,300
13[c]	do	6.07	2,150
15	C. S. De Golyer	[d] 4.38	977
21	do	[e] 4.34	933
Dec. 12[f]	O. M. Moulton	[g] 7.66	3,860

[a] Made by wading about 200 feet downstream from bridge.
[b] Bottom of weight held at 0.2 and 0.8 depth; discharge corrected by coefficient of 0.94 obtained from vertical velocity curves.
[c] Measurement made only to station 80 on bridge; remainder of discharge computed on basis of percentage of total discharge at station 80 obtained from other measurements.
[d] Staff gage below dam =1.74.
[e] Staff gage below dam =1.70.
[f] Measurement made by 0.2 and 0.8 depth method, but was not computed on this basis because the high velocities with insufficient weight made meter swing downstream. Discharge computed using velocity at 0.2 depth with coefficient of 0.85 obtained from vertical velocity curves.
[g] Staff gage below dam =3.77.

NOTE.—Angle of normal to bridge to current =20°. A coefficient of 0.94 applied to discharge of all measurements made at bridge.

Daily gage height, in feet, of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911.

[C. A. Hall, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.45	1.62	2.0	2.2	4.0	4.4
2	.....	2.2	1.6	1.92	2.8	3.6	4.0
3	.....	2.0	1.58	1.89	2.65	3.2	3.8
4	.....	1.9	1.6	1.76	3.5	3.0	3.7
5	.....	1.84	1.62	1.68	4.7	2.9	3.4
6	.....	1.8	1.62	3.6	4.2	2.8	3.4
7	.....	1.74	1.6	4.1	4.6	4.0	3.2
8	.....	1.7	1.61	2.95	4.1	4.8	3.1
9	.....	1.62	2.3	2.65	3.6	4.4	3.9
10	.....	1.65	1.92	2.65	3.2	4.3	5.4

[1] Measured by engineers of Ontario Power Co. from topographic maps.

Daily gage height, in feet, of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	1.74	1.8	2.3	2.9	4.0	6.0
12	.....	1.86	1.78	2.45	2.7	3.8	7.7
13	.....	1.82	1.7	2.6	2.5	5.6	9.0
14	.....	1.69	1.68	2.35	2.4	4.9	6.6
15	.....	1.65	1.62	2.2	2.3	4.4	5.2
16	.....	1.65	1.78	2.5	2.25	4.0	4.9
17	.....	2.6	1.71	2.35	2.16	3.8	5.7
18	.....	3.8	1.65	2.2	3.6	4.4	5.0
19	.....	2.6	1.76	1.92	4.5	5.1	4.2
20	.....	2.15	1.79	1.85	3.9	4.7	3.8
21	.....	2.0	1.7	1.82	3.5	4.4	3.9
22	.....	1.86	1.6	2.2	3.2	4.0	3.6
23	.....	1.76	1.58	2.4	4.1	4.0	5.2
24	1.92	1.95	1.59	2.2	4.0	3.8	4.9
25	1.85	2.1	1.59	1.99	3.6	3.6	4.2
26	1.82	1.88	1.68	1.92	3.2	3.5	3.9
27	3.8	1.79	1.65	1.89	3.0	3.9	4.4
28	6.0	1.74	1.91	2.25	3.1	3.4	4.3
29	4.2	1.69	2.8	2.25	2.9	5.0	4.1
30	2.85	1.66	2.3	2.35	2.75	4.8	3.9
31	.....	1.64	2.0	.....	2.8	.....	3.5

Daily discharge, in second-feet, of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	262	79	155	200	770	960
2	.....	200	75	139	352	605	770
3	.....	155	71	133	312	470	685
4	.....	135	75	107	570	410	645
5	.....	123	79	91	1,120	380	535
6	.....	115	79	605	860	352	535
7	.....	103	75	815	1,070	770	470
8	.....	95	77	395	815	1,180	440
9	.....	79	225	312	605	960	725
10	.....	85	139	312	470	910	1,580
11	.....	103	115	225	380	770	2,080
12	.....	127	111	262	325	685	3,870
13	.....	119	95	300	275	1,740	5,550
14	.....	93	91	238	250	1,240	2,650
15	.....	85	79	200	225	960	1,440
16	.....	85	111	275	212	770	1,240
17	.....	300	97	238	191	685	1,820
18	.....	685	85	200	605	960	1,310
19	.....	300	107	139	1,020	1,380	860
20	.....	188	113	125	725	1,120	685
21	.....	155	95	119	570	960	725
22	.....	127	75	200	470	770	605
23	.....	107	71	250	815	770	1,440
24	139	145	73	200	770	685	1,240
25	125	177	73	153	605	605	860
26	119	131	91	139	470	570	725
27	685	113	85	133	410	725	960
28	2,080	103	137	212	440	535	910
29	860	93	352	212	380	1,310	815
30	366	87	225	238	338	1,180	725
31	.....	83	155	.....	352	.....	570

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

Monthly discharge of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911.

[Drainage area, 191 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 24-30	2,080	119	625	3.27	0.85	A.
July	685	79	153	.801	.92	A.
August	352	71	110	.576	.66	A.
September	815	91	237	1.24	1.38	A.
October	1,120	191	523	2.74	3.16	A.
November	1,740	352	841	4.40	4.91	A.
December	5,550	440	1,240	6.49	7.48	A.

SALMON RIVER AT PULASKI, N. Y.

Location.—At a highway bridge known locally as Fox's bridge, about 2½ miles above the village of Pulaski, 2¼ miles above Trout Brook (coming in from the left) and 6½ miles above the mouth of the river.

Records available.—Sept. 5, 1900, to June 30, 1907; Aug. 16, 1908, to Dec. 6, 1908; July 14, 1910, to Dec. 31, 1911. Published in reports of the New York State engineer and surveyor, New York State Water Supply Commission, and Conservation Commission of the State of New York.

Drainage area.—264 square miles.

Gage.—A vertical staff attached to the upstream end of the center pier of the bridge was read from Sept. 5, 1900, to the winter of 1901–2, when it was destroyed by ice. On July 23, 1902, a chain gage was installed the zero of which is 1.20 feet below the original staff gage zero. Datum of chain gage unchanged since established.

Channel.—Gravel; fairly permanent.

Discharge measurements.—Made either by wading or from the bridge.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Open-water curve well developed. Published data considered good.

Cooperation.—Maintained in cooperation with the State engineer and surveyor of New York prior to 1910, in cooperation with the State Water Supply Commission of New York beginning July 14, 1910.

Discharge measurements of Salmon River at Pulaski, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 11	C. S. De Golyer	5.56	3,450
21	C. C. Covert	5.99	4,690
May 15	C. S. De Golyer	3.11	416
22	do	3.00	343
June 23[a]	do	2.78	226
Sept. 17[a]	G. H. Canfield	2.88	274
17[a]	do	2.91	285
Nov. 21	C. S. De Golyer	4.00	1,170
Dec. 12	do	5.87	4,190
14	do	5.77	4,040

[a] Measurement made by wading at bridge.

Daily gage height, in feet, of Salmon River at Pulaski, N. Y., for 1911.

[Seymour Fox, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.60	3.06	3.15	2.45	2.70	2.84	3.65	4.05
2	.....	6.30	3.29	2.95	2.45	2.65	2.94	3.49	3.85
3	4.05	5.20	3.02	2.80	2.40	2.60	3.04	3.26	3.55
4	3.79	4.35	2.86	2.72	2.45	2.60	3.19	3.16	3.32
5	4.05	4.05	3.65	2.62	2.40	2.50	4.10	3.12	3.40
6	4.85	3.85	4.70	2.60	2.40	4.20	3.85	3.04	3.40
7	6.20	3.85	3.90	2.60	2.40	4.05	4.10	3.90	3.30
8	6.20	3.75	3.75	2.55	2.48	3.40	3.95	4.40	3.30
9	5.80	3.70	3.24	2.50	.....	3.22	3.44	3.95	3.60
10	5.60	3.60	3.09	2.50	2.75	3.18	3.29	3.60	4.70
11	5.50	3.46	2.94	2.50	2.60	2.95	3.14	3.65	5.00
12	5.70	3.36	3.65	2.65	2.58	2.90	3.04	3.52	6.00
13	5.90	3.24	3.85	2.60	2.50	2.90	2.96	4.90	7.00
14	6.50	3.14	3.50	2.52	2.45	2.85	2.86	4.35	5.70
15	7.10	3.09	3.19	2.48	2.45	2.80	2.82	4.05	4.65
16	6.30	3.04	3.06	2.50	2.50	2.95	2.74	3.80	4.45
17	5.40	3.02	2.96	3.05	2.48	2.90	2.76	3.34	4.95
18	5.20	2.96	2.84	4.00	2.45	2.79	3.32	4.05	4.50
19	5.30	2.96	2.79	3.32	2.52	2.66	4.05	4.40	4.05
20	5.60	3.19	2.74	2.90	2.45	2.62	3.65	4.15	3.50
21	5.80	3.09	2.64	2.80	2.42	2.59	3.42	4.00	3.48
22	5.30	2.96	2.69	2.70	2.40	2.79	3.39	3.75	3.60
23	4.95	2.92	2.74	2.60	2.40	2.94	3.60	3.55	4.35
24	4.75	3.16	2.68	2.62	2.40	2.82	3.75	3.55	4.45
25	5.50	3.22	2.65	2.78	2.40	2.72	3.44	3.50	4.05
26	5.60	3.09	2.65	2.68	2.42	2.64	3.29	3.50	3.80
27	5.50	2.92	3.95	2.62	2.42	2.64	3.14	3.45	3.90
28	5.40	2.84	5.40	2.55	2.58	2.76	3.14	3.48	4.00
29	5.50	2.79	4.00	2.55	3.10	2.86	3.14	4.55	3.48
30	5.40	2.72	3.65	2.50	2.95	2.84	3.04	4.35	3.40
31	.....	2.69	.....	2.50	2.78	.....	3.09	.....	3.42

NOTE.—Probably ice at this station from Jan. 1 to about Apr. 2.

Daily discharge, in second-feet, of Salmon River at Pulaski, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,800	3,710	376	432	103	191	255	820	1,230
2	1,500	5,050	528	312	103	172	307	682	1,010
3	1,230	2,970	352	235	88	152	364	507	732
4	950	1,610	265	200	103	152	458	439	550
5	1,230	1,230	820	160	88	118	1,290	413	610
6	2,370	1,010	2,130	152	88	1,410	1,010	364	610
7	4,850	1,010	1,060	152	88	1,230	1,290	1,060	535
8	4,850	912	912	135	112	610	1,120	1,680	535
9	4,090	865	493	118	162	479	642	1,120	775
10	3,710	775	394	118	213	452	528	775	2,130
11	3,520	658	307	118	152	312	426	820	2,620
12	3,900	580	820	172	145	285	364	707	4,470
13	4,280	493	1,010	152	118	285	318	2,450	6,450
14	5,450	426	690	125	103	260	265	1,610	3,900
15	6,660	394	458	112	103	235	245	1,230	2,060
16	5,050	364	376	118	118	312	209	960	1,760
17	3,330	352	318	370	112	285	217	565	2,540
18	2,970	318	255	1,170	103	231	550	1,230	1,830
19	3,150	318	231	550	125	175	1,230	1,680	1,230
20	3,710	458	209	285	103	160	820	1,350	690
21	4,090	394	168	235	94	149	626	1,170	674
22	3,150	318	187	191	88	231	602	912	775
23	2,540	296	209	152	88	307	775	732	1,610
24	2,210	439	183	160	88	245	912	732	1,760
25	3,520	479	172	226	88	200	642	690	1,230
26	3,710	394	172	183	94	168	528	690	960
27	3,520	296	1,120	160	94	168	426	650	1,060
28	3,330	255	3,330	135	145	217	426	674	1,170
29	3,520	231	1,170	135	400	265	426	1,900	674
30	3,330	200	820	118	312	255	364	1,610	610
31	.....	187	.....	118	226	.....	394	.....	626

NOTE.—Daily discharge is based on a well-defined discharge rating curve. Discharge Apr. 1 to 2 estimated.

Monthly discharge of Salmon River at Pulaski, N. Y., for 1911.

[Drainage area, 264 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
April	6,660	950	3,380	12.8	14.28	A.
May	5,050	187	871	3.30	3.80	A.
June	3,330	168	651	2.47	2.76	A.
July	1,170	112	226	.856	.99	A.
August	400	88	131	.496	.57	A.
September	1,410	118	324	1.23	1.37	A.
October	1,290	209	582	2.20	2.54	B.
November	2,450	364	1,010	3.83	4.27	A.
December	6,450	535	1,530	5.80	6.69	A.

ORWELL BROOK NEAR ALTMAR, N. Y.

Location.—At highway bridge 1½ miles by road northwest of Altmar and ⅛ mile above confluence of Orwell Brook with Salmon River.

Records available.—June 23 to December 31, 1911.

Drainage area.—22.1 square miles.

Gage.—Standard chain, attached to downstream side of bridge.

Channel.—Curved above the bridge and current rather swift. Bed composed of small stone and gravel; 2 channels above bridge, but one at gage.

Discharge measurements.—Made by wading at low stages, from bridge at high stages.

Winter flow.—No information; relation of gage height to discharge probably affected by ice.

Accuracy.—The discharge rating curve has been fairly well developed for low stages.

Cooperation.—Established by United States Geological Survey in cooperation with David R. Cooper, of Niagara Falls, N. Y., and State of New York Conservation Commission.

Discharge measurements of Orwell Brook near Altmar, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 22	C. S. De Golyer	[b] 1.98	19.9
June 23[a]	do	1.92	13.8
Sept. 14[a]	G. H. Canfield	2.00	17.6
14[a]	do	2.01	18.2
17[a]	do	1.97	15.2
Nov. 14[c]	C. S. De Golyer	2.83	98.6
Dec. 12	do	3.64	227

[a] Measurement made by wading a short distance below bridge.
[b] Measurement made before gage was established; gage height uncertain.
[c] Made by wading 200 feet below bridge.

Daily gage height, in feet, of Orwell Brook near Altmar, N. Y., for 1911.

[Mrs. A. G. White, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.22	1.70	1.85	1.98	2.28	2.78
2	.....	2.12	1.70	1.80	2.08	2.22	2.49
3	.....	2.08	1.70	1.78	2.00	2.20	2.48
4	.....	2.00	1.70	1.72	2.30	2.15	2.42
5	.....	1.95	1.70	1.65	2.30	2.10	2.45
6	.....	1.90	1.65	2.80	2.28	2.05	2.34
7	.....	1.88	1.65	2.32	2.55	2.45	2.28
8	.....	1.85	1.88	2.15	2.35	2.48	2.26
9	.....	1.85	2.02	2.18	2.22	2.38	2.90
10	.....	1.80	1.85	2.05	2.12	2.35	3.10
11	.....	1.80	1.80	1.98	2.08	2.30	3.40
12	.....	1.82	1.75	2.00	2.02	2.48	3.65
13	.....	1.80	1.70	1.98	2.02	2.98	4.20
14	.....	1.75	1.65	1.92	2.00	2.86	3.20
15	.....	1.80	1.68	1.95	1.95	2.60	2.88
16	.....	1.75	1.75	1.92	1.95	2.49	2.80
17	.....	2.45	1.75	1.92	1.95	3.55	2.98
18	.....	2.62	1.75	1.95	2.40	2.88	2.75
19	.....	2.28	1.80	1.90	2.38	2.82	2.52
20	.....	2.08	1.75	1.92	2.22	2.72	2.60
21	.....	1.95	1.70	1.85	2.18	2.61	2.52
22	.....	1.90	1.65	2.12	2.10	2.50	2.35
23	1.95	1.82	1.65	2.02	2.32	2.50	2.85
24	1.78	1.98	1.65	1.95	2.28	2.45	2.62
25	1.75	1.82	1.70	1.90	2.20	2.38	2.50
26	1.75	1.82	1.75	1.90	2.12	2.40	2.45
27	3.50	1.80	1.70	1.88	2.15	2.40	2.62
28	4.60	1.78	1.85	2.02	2.18	2.48	2.28
29	2.90	1.75	2.02	1.98	2.10	3.20	2.48
30	2.40	1.75	1.82	2.00	2.05	2.80	2.52
31	.....	1.75	1.75	.....	2.15	.....	2.45

Daily discharge, in second-feet, of Orwell Brook near Altmar, N. Y., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	32	6	11	16	36	92
2	.....	24	6	9	22	32	57
3	.....	22	6	8	17	30	56
4	.....	17	6	7	38	26	50
5	.....	15	6	5	38	23	53
6	.....	13	5	95	36	20	42
7	.....	12	5	40	64	53	36
8	.....	11	12	26	48	56	35
9	.....	11	18	28	32	46	109
10	.....	9	11	20	24	43	139
11	.....	9	9	16	22	38	186
12	.....	10	8	17	18	56	239
13	.....	9	6	16	18	121	330
14	.....	8	5	14	17	103	154
15	.....	9	6	15	15	70	106
16	.....	8	8	14	15	57	95
17	.....	53	8	14	15	212	121
18	.....	72	8	15	48	106	88
19	.....	36	9	13	46	98	60
20	.....	22	8	14	32	85	70
21	.....	15	6	11	29	71	60
22	.....	13	5	24	23	58	43
23	15	10	5	18	40	58	102
24	8	16	5	15	36	53	72
25	8	10	6	13	30	46	58
26	8	10	8	13	24	48	53
27	203	9	6	12	26	48	72
28	410	8	11	18	29	56	36
29	109	8	18	16	23	154	56
30	48	8	10	17	20	95	60
31	.....	8	8	.....	26	.....	53

NOTE.—Daily discharge determined from a discharge rating curve well defined between 10 and 300 second-feet.

Monthly discharge of Orwell Brook near Altmar, N. Y., for 1911.

[Drainage area, 22.1 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 23-30	410	8	101.	4.57	1.36	B.
July	72	8	16.7	.756	.87	B.
August	18	5	7.87	.356	.41	C.
September	95	5	18.5	.837	.93	B.
October	64	15	28.5	1.29	1.49	A.
November	154	20	66.6	3.01	3.36	A.
December	330	35	89.5	4.05	4.67	A.

BLACK RIVER AND TRIBUTARIES.

BLACK RIVER NEAR BOONVILLE, N. Y.

Location.—At highway bridge about 2 or 3 miles northeast of Boonville, an equal distance by river downstream from Hawkinsville, and about 1 mile above the mouth of Sugar River, a small tributary from the left.

Records available.—February 16 to December 31, 1911; data also published in first annual report of Conservation Commission, State of New York.

Drainage area.—316 square miles.

Gage.—Standard chain, fastened to the downstream side of the bridge. A staff gage, reading from 6 to 13 feet, is fastened to the downstream right-hand abutment and is used for high-water readings.

Channel.—Rough and bowldery; permanent.

Discharge measurements.—At high stages from a cable stretched across the stream about one-half mile above the gage; at low stages, by wading near the cable section.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—A well-defined discharge rating curve has been developed. The records do not give the total discharge of the drainage area. See "Diversions."

Diversions.—A portion of the flow of Black River is diverted past the gaging station through a feeder having its intake at the State dam at Forestport and delivering its flow to the summit level of the Black River canal at Boonville. A portion of the flow passes northward, supplying the Black River canal from Boonville to the head of slack-water navigation at the foot of Lyon Falls. The remainder is diverted from the drainage basin and flows into the Erie Canal at Rome. To determine the amount diverted past the station and out of the drainage basin measurements are made in the Forestport feeder at a farm bridge near Speny Hill, 1 mile northeast of Boonville. Measurements of northward flow in the Black River canal are made at a farm bridge half a mile north of Boonville; measurements of the southward flow at a farm bridge about three-fourths of a mile southeast from Boonville. The Forestport feeder is open for service about May 1 for the purpose of feeding the Erie Canal, which opens about May 15, although the Black River canal does not open until later. When navigation is closed on the Erie Canal the feeder gates are closed also and the surplus water runs over the dam into Black River. Some water leaks through feeder gates and flows through the feeder into Lansing Kill and Mohawk River. Feeder gates were closed November 20, 1911. Results of measurements made at this place in the past are published in reports of the State engineer and surveyor of New York.

Storage.—A reservoir built by the State at Forest Brook, about 8 miles upstream, stores about 2,000,000,000 cubic feet. About a mile above the station is a site at which a dam 110 feet high would impound 3,300,000,000 cubic feet of water.

Cooperation.—Established and maintained in cooperation with the State Conservation Commission of New York.

Discharge measurements of Black River near Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 16[a]	Hoyt and Shuttleworth	4.99	307
Apr. 22[b]	C. C. Covert	7.60	2,410
June 30[c]	C. S. De Golyer	3.75	107
Aug 20[c]	C. C. Covert	3.40	59.1
Sept. 13[d]	G. H. Canfield	4.55	268
13[c]	do	4.50	244
Nov. 23	C. S. De Golyer	5.97	949
23	do	6.00	924
Dec. 13	do	8.43	3,850

[a] Measurement made under complete ice cover about one-half mile above bridge and gage; average thickness of ice, 1.56 feet.
[b] Measurement made from bridge on which gage is fastened; poor section in high water.
[c] Measurement made by wading about 200 feet above bridge.
[d] Wading at cable section.

Discharge measurements of Forestport feeder at Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
June 30	C. S. De Golyer	1.35	[b] 296
Aug. 20	C. C. Covert	1.13	[b] 236
Sept. 13	G. H. Canfield	1.19	[b] 253
Nov. 23	C. S. De Golyer	3.53	[b] 80

[a] Distance reference point to water surface. Reference point is top of mudsill at left, upstream side of bridge.
[b] Amount of water from Black River into Forestport feeder.

NOTE.—Measurements made at highway bridge about 1 mile northeast of Boonville, N. Y.

Discharge measurements of Black River canal (north) at Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
July 1	G. E. Carman	1.82	[b] 69.4
Sept. 14	G. H. Canfield	1.42	[b] 63.0

[a] Distance reference point to water surface. Reference point is top of mudsill at right upstream side of bridge.
[b] Amount of water diverted permanently to Erie Canal.

NOTE.—Measurements made at second bridge south of feeder, about three-fourths mile south of Boonville, N. Y.

Discharge measurements of Black River canal (south) at Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
June 30	C. S. De Golyer	1.36	6,232
Aug. 19	C. C. Covert	1.35	6,162
Sept. 13	G. H. Canfield	1.21	6,159

[a] Distance reference point to water surface. Reference point is top of mudsill at left upstream side of bridge.
[b] Amount of water returning to Black River below gaging station.

NOTE.—Measurements made at bridge No. 2, about one-half mile north of Boonville, N. Y.

Daily gage height, in feet, of Black River near Boonville, N. Y., for 1911.

[W. D. Charboneau, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.2	6.5	8.2	5.4	3.4	3.22	3.58	3.48	5.0	6.5
2	.....	5.1	6.0	8.8	6.1	3.36	3.19	3.52	3.5	5.1	5.9
3	.....	5.1	5.85	9.0	5.2	3.36	3.19	3.76	3.45	4.95	5.8
4	.....	5.2	5.69	7.8	4.7	3.5	3.21	4.6	3.75	4.7	5.5
5	.....	5.05	5.8	7.2	5.05	3.38	3.22	4.6	4.8	4.38	5.4
6	.....	5.0	6.4	7.0	6.6	3.22	3.5	4.65	4.95	4.35	5.4
7	.....	4.55	7.6	6.6	6.2	3.31	3.78	5.2	5.9	4.9	5.3
8	.....	4.08	7.6	6.4	5.45	3.25	3.84	4.9	5.85	5.9	5.25
9	.....	4.55	7.6	6.1	5.1	3.24	3.82	4.9	5.4	6.1	5.4
10	.....	4.55	7.3	5.85	4.8	3.26	3.55	5.0	4.65	5.6	5.9
11	.....	5.15	7.1	5.65	4.6	3.28	3.31	5.0	3.95	5.4	6.3
12	.....	5.05	7.2	5.45	6.0	3.24	3.36	4.48	3.88	5.7	6.9
13	.....	5.0	7.4	5.4	7.0	3.28	3.32	4.5	3.82	6.0	8.5
14	.....	4.95	7.9	5.0	7.0	3.29	3.32	4.2	3.77	6.1	8.3
15	.....	5.0	8.8	4.8	6.4	3.31	3.3	3.68	3.68	5.7	7.3
16	4.99	4.65	8.9	4.8	5.9	3.71	3.38	3.45	3.58	5.5	6.8
17	5.0	5.05	8.0	4.7	5.8	4.1	3.45	3.85	3.5	5.15	7.0
18	5.3	5.0	7.2	4.6	5.45	4.38	3.35	3.68	3.98	5.8	7.0
19	5.45	4.8	7.2	4.9	5.0	3.78	3.38	3.7	5.3	6.7	6.6
20	5.3	4.9	7.2	5.0	4.6	3.35	3.35	3.42	5.3	6.8	5.9
21	5.2	4.9	7.3	5.0	4.38	3.31	3.36	3.35	4.95	6.5	5.7
22	5.15	5.05	7.5	4.8	4.2	3.27	3.26	3.48	5.0	6.1	5.8
23	5.05	5.25	7.3	4.85	4.18	3.32	3.34	3.58	5.7	5.75	6.1
24	5.0	5.3	6.9	5.2	3.88	3.48	3.25	3.52	5.5	5.9	7.6
25	5.0	5.25	7.5	5.9	3.72	3.45	3.19	3.58	5.6	5.75	6.6
26	5.0	5.1	7.9	5.75	3.62	3.35	3.12	3.42	5.25	5.6	6.4
27	5.3	6.4	7.6	5.45	3.68	3.3	3.18	3.32	5.05	5.6	6.3
28	5.2	8.3	7.6	5.5	3.93	3.32	3.65	3.38	5.15	5.5	6.4
29	.....	7.4	8.0	4.75	3.75	3.24	5.2	3.32	5.15	6.4	6.2
30	.....	7.3	8.2	4.55	3.7	3.24	4.1	3.38	4.9	6.8	5.95
31	.....	6.9	.....	4.35	.....	3.22	3.8	.....	4.7	.....	5.9

NOTE.—Relation of gage height to discharge affected by backwater from ice from about Jan. 1 to about Mar. 27. Probably no backwater from ice during December. Gage heights were probably taken to the water surface. Canal feeder closed Nov. 20.

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,320	3,480	590	61	44	82	70	410	1,320
2	.....	950	4,560	1,020	57	41	74	72	450	880
3	.....	848	4,960	495	57	41	106	66	390	815
4	.....	749	2,850	305	72	43	275	104	305	640
5	.....	815	2,040	430	59	44	275	335	224	590
6	.....	1,240	1,810	1,410	44	72	290	390	218	590
7	.....	2,560	1,410	1,090	52	109	495	880	370	540
8	.....	2,560	1,240	615	46	119	370	848	880	518
9	.....	2,560	1,020	450	46	115	370	590	1,020	590
10	.....	2,160	848	335	47	78	410	390	695	880
11	.....	1,920	725	275	49	52	410	138	590	1,160
12	.....	2,040	615	950	46	57	246	126	755	1,700
13	.....	2,290	590	1,810	49	53	250	115	950	4,000
14	.....	3,000	410	1,810	50	53	186	108	1,020	3,650
15	.....	4,560	335	1,240	52	51	94	94	755	2,160
16	.....	4,760	335	880	98	59	66	82	640	1,600
17	.....	3,160	305	815	166	66	120	72	472	1,810
18	.....	2,040	275	615	224	56	94	143	815	1,810
19	.....	2,040	370	410	109	59	97	540	1,500	1,410
20	.....	2,040	410	275	56	56	63	540	1,600	880
21	.....	2,160	410	224	52	57	56	390	1,320	755
22	.....	2,420	335	186	48	47	70	410	1,020	815
23	.....	2,160	352	182	53	55	82	755	785	1,020
24	.....	1,700	495	126	70	46	74	640	880	2,560
25	.....	2,420	880	100	66	41	82	695	785	1,410
26	.....	3,000	785	87	56	36	63	518	695	1,240
27	1,240	2,560	615	94	51	40	53	430	695	1,160
28	3,650	2,560	640	134	53	90	59	472	640	1,240
29	2,290	3,160	320	104	46	495	53	472	1,240	1,090
30	2,160	3,480	262	97	46	166	59	370	1,600	915
31	1,700	.....	218	.....	44	112	.....	305	.....	880

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

Monthly discharge of Black River near Boonville, N. Y., for 1911.

[Drainage area, 316 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	375	1.19	1.37	C.
February	.....	.....	275	.870	.91	C.
March	3,650	.....	608	1.92	2.21	B.
April	4,760	749	2,310	7.31	8.16	A.
May	4,960	218	1,090	3.45	3.98	A.
June	1,810	87	572	1.81	2.02	A.
July	224	44	65.3	.207	.24	A.
August	495	36	79.1	.250	.29	A.
September	495	53	167	.528	.59	A.
October	880	66	360	1.14	1.31	A.
November	1,600	218	791	2.50	2.79	A.
December	4,000	518	1,310	4.15	4.78	A.
The year	4,960	36	667	2.11	28.65	

NOTE.—Discharge Jan. 1 to Mar. 26 estimated from that of Black River at Felts Mills, the rate of run-off at Boonville being considered slightly less than at Felts Mills during this period.
Mean discharge Mar. 1 to 26, estimated, 300 second-feet.

BLACK RIVER NEAR FELTS MILLS, N. Y.

Location.—At the dam of the Lefevre Paper Co., formerly owned by the Black River Traction Co., about 1½ miles above the village of Felts Mills. The dam is 9 miles upstream from Watertown and 7 miles upstream from the old Huntingtonville gaging station.

Records available.—February, 1897 to December, 1901, at Huntingtonville dam, August 29, 1902, to December 31, 1911, at Felts Mills. Data also in annual reports of the State engineer and surveyor, State of New York.

Drainage area.—1,851 square miles.

Gage.—Vertical staff attached to a crib at the left-hand side of the stream above the mill; correction is made to gage readings for velocity of approach during the high water.

Discharge.—Previous to August 16, 1910, records were kept of the flow over a dam about 100 feet upstream from the paper mill. This dam was of sawed timber resting on a limestone foundation and its main crest was 380.6 feet long. During the summer of 1910 a new concrete dam was constructed about 100 feet downstream. This dam has a main crest for low and medium stages 300.45 feet long and 3.75 feet wide. Upstream face vertical; downstream semiogee section. Main crest of dam about 6 feet high. On the right-hand side is an additional section, of greater elevation, 48.2 feet long; on the left-hand side, angling upstream, is a section 139.7 feet long, making the total length of the dam for high-water discharge approximately 488.4 feet. A wood-pulp mill constructed at the left-hand end of the dam has been in operation since 1907. The mill contains one 45-inch and four 72-inch Smith-McCormick turbines. The discharge over the spillways has been calculated by means of the weir formula, using coefficients derived from experiments by the United States Geological Survey on a dam of similar cross-section. Record is kept of the hours run and of the gate opening of each wheel as well as the head under which the turbines operate.

Winter flow.—Affected by ice. No correction attempted.

Artificial control.—Power plants and storage above the station.

Accuracy.—Results believed to be good for a station of this type.

Cooperation.—Records obtained and computations made by engineers of the New York State engineer's department, which furnishes the data to the Survey.

Daily discharge, in second-feet, of Black River near Felts Mills, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,929	2,842	2,151	6,808	12,766	1,655	873	793	1,600	1,435	2,186	6,232
2	2,158	2,693	2,019	6,472	14,676	2,693	873	793	1,290	816	2,447	6,099
3	3,941	2,282	1,888	5,654	17,181	3,287	873	634	240	1,190	2,447	5,079
4	5,208	2,151	1,888	4,747	19,123	2,414	714	793	801	1,948	2,314	3,318
5	4,990	1,888	1,655	4,530	15,799	2,019	634	714	1,215	2,728	2,011	3,772
6	4,344	1,888	1,536	7,319	12,241	5,340	475	714	1,290	3,066	1,550	3,531
7	3,468	1,830	1,597	12,241	9,633	5,497	714	634	2,657	3,066	2,186	3,611
8	4,125	1,772	1,655	14,258	7,575	5,183	714	634	2,381	3,061	4,180	3,531
9	2,839	1,713	1,536	16,351	6,136	3,771	873	714	2,024	3,386	4,991	3,611
10	2,606	1,655	1,536	17,181	5,654	3,139	793	793	1,849	2,728	4,991	7,995
11	2,606	1,536	1,536	14,957	4,965	2,414	634	873	1,550	2,314	4,518	8,011
12	2,364	1,536	1,536	13,302	4,094	2,019	634	952	1,908	2,186	4,515	8,668
13	2,839	1,536	1,536	13,029	3,448	3,448	634	873	2,186	1,908	3,864	10,554
14	2,578	1,536	1,830	13,575	2,151	4,530	634	1,038	2,006	1,799	4,991	13,547
15	2,414	1,597	3,139	16,075	2,282	5,183	714	1,038	1,853	1,568	4,991	16,335
16	2,414	1,888	2,842	18,013	2,282	5,183	793	1,529	1,511	1,292	4,518	13,868
17	2,414	1,888	2,282	18,845	1,772	5,183	873	1,668	1,502	1,237	3,779	11,624
18	2,282	1,536	2,019	16,075	2,151	4,094	1,123	1,719	665	1,361	3,066	10,258
19	1,888	1,536	1,888	13,849	2,151	3,448	1,655	1,771	1,190	1,618	5,876	9,024
20	1,597	1,655	1,772	11,715	2,282	2,842	1,207	1,043	910	1,600	5,313	7,802

Daily discharge, in second-feet, of Black River near Felts Mills, N. Y., for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1,655	1,713	1,655	10,959	2,545	2,282	1,040	1,005	839	2,024	6,499	3,919
22	1,655	1,713	1,655	10,456	2,842	1,888	873	887	839	2,163	6,499	3,741
23	1,655	2,019	2,151	9,633	2,545	1,655	957	1,062	1,039	1,550	4,788	5,804
24	1,655	1,888	2,545	9,442	3,610	1,536	957	1,290	1,502	1,696	4,140	8,913
25	1,772	1,772	2,414	9,252	4,530	1,291	555	1,202	600	3,552	4,140	8,136
26	1,655	1,655	2,545	9,019	4,747	1,123	793	1,238	839	3,028	3,244	7,267
27	1,207	1,536	3,771	9,442	4,312	1,040	714	677	939	2,447	2,732	6,845
28	2,151	2,085	9,442	10,456	3,287	1,772	793	1,052	1,034	2,186	3,779	5,804
29	3,139	.....	8,319	11,463	2,693	1,655	873	1,261	839	1,849	6,499	3,868
30	2,990	.....	7,830	12,241	2,693	1,413	957	1,799	1,053	1,183	6,499	3,552
31	3,287	.....	7,319	.....	2,151	.....	793	1,908	.....	2,024	.....	4,193

Monthly discharge of Black River near Felts Mills, N. Y., for 1911.

[Drainage area, 1,851 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	5,208	1,207	2,672	1.44	1.66
February	2,842	1,536	1,834	0.991	1.03
March	9,442	1,536	2,822	1.52	1.75
April	18,845	4,530	11,579	6.26	6.98
May	19,123	1,772	5,946	3.21	3.70
June	5,497	1,040	2,967	1.60	1.78
July	1,655	475	830	0.448	0.516
August	1,908	634	1,068	0.577	0.665
September	2,657	240	1,338	0.723	0.807
October	3,552	816	2,065	1.12	1.29
November	6,499	1,550	4,118	2.22	2.48
December	16,335	3,318	7,049	3.81	4.39
Year	19,123	240	3,690	1.99	27.098

MOOSE RIVER AT MOOSE RIVER, N. Y.

Location.—In the village of Moose River, about 3 miles downstream from McKeever station on the Adirondack division of the New York Central & Hudson River Railroad, 5 miles below the mouth of South Branch of Moose River (coming in from the left), and nearly 20 miles above the junction of Black and Moose rivers at Lyons Falls.

Records available.—June 5, 1900, to December 31, 1911. Data also in annual reports of the New York State engineer and surveyor and State Water Supply Commission of New York.

Drainage area.—346 square miles.

Gage.—Staff, in two sections, fastened to the left bank a short distance above cable; read twice daily. The elevation of the gage zero was changed February 28, 1903, from 15.36 to 15.53.

Channel.—Composed of cobble and bowlders; fairly permanent; current smooth; depth comparatively uniform. Just above the station is a small island on which ice and log jams occasionally form. Velocity from dam at McKeever to the station relatively slow; below the station velocity very high.

Discharge measurements.—Made from a cable erected July, 1903. Cable has a clear span of 269 feet.

Artificial control.—A timber dam at McKeever is used for power and for the regulation of flow for log driving. During portions of the year, therefore, two gage readings a day may not give a representative mean.

Winter flow.—The stream freezes over in winter and is covered with alternate layers of ice and snow which render the determination of discharge difficult.

Accuracy.—Discharge rating curve for open channel fairly accurate. Published discharge data for periods of open water considered good.

Cooperation.—The station was established and is maintained in cooperation with the New York State engineer and surveybr.

Discharge measurements of Moose River at Moose River, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 29[a]	W. G. Hoyt	6.54	4,700
July 15	C. S. De Golyer	1.04	307

[a] Measurement partly estimated by timing floating logs to obtain velocity. Area determined by separate soundings. Coefficient of 0.84, from vertical velocity curves taken in 1904, used to reduce surface velocities.

Daily gage height, in feet, of Moose River at Moose River, N. Y., for 1911.

[Chris Hannan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	.....	.....	4.0	6.6	2.0	1.6	0.8	0.5	1.0	3.0	2.2
2	2.2	.....	.....	.....	8.6	2.2	1.5	.8	.5	1.1	2.9	2.1
3	2.9	.....	.....	.....	6.6	2.3	1.5	.75	.6	1.2	3.0	2.2
4	3.2	2.9	2.4	.....	5.2	2.2	1.35	.7	.6	1.15	3.1	2.3
5	3.4	.....	.....	.....	5.2	2.5	1.2	.6	.75	1.5	3.0	2.4
6	3.5	.....	.....	.....	5.0	2.9	1.05	.5	.9	1.9	3.2	2.5
7	3.9	.....	.....	.....	4.7	2.8	.9	.6	.9	2.0	3.6	2.6
8	4.2	.....	.....	4.5	4.2	2.6	.85	.6	.8	2.0	3.95	2.7
9	4.2	.....	.....	.....	4.1	2.2	.7	.5	.8	2.1	3.9	3.1
10	2.2	.....	.....	.....	4.0	2.0	1.05	.5	.8	2.2	3.8	3.6
11	1.8	2.9	2.6	.....	3.4	1.9	1.1	.6	.9	1.9	3.7	4.4
12	.....	.....	.....	.....	3.0	2.0	1.1	.6	.9	1.8	3.6	5.2
13	.....	.....	.....	.....	2.7	2.0	1.1	.75	.9	1.8	3.3	7.0
14	2.3	.....	.....	.....	2.6	1.8	1.1	.7	.8	1.9	3.0	5.5
15	.....	.....	.....	6.4	2.6	1.8	1.2	.65	.9	1.9	2.6	4.3
16	.....	.....	.....	5.9	2.4	1.7	.95	.6	1.0	1.8	2.1	4.0
17	.....	.....	.....	4.6	2.3	1.6	1.2	.7	.9	2.0	1.8	3.8
18	.....	2.6	2.6	3.7	2.2	1.6	1.55	.6	.8	2.2	1.6	3.8
19	.....	.....	.....	3.2	2.0	1.6	1.65	.6	.7	2.4	1.6	3.6
20	.....	.....	.....	3.1	2.0	1.7	1.3	.7	.7	2.8	1.6	3.4
21	2.3	.....	.....	3.5	2.2	1.6	1.15	.7	.8	3.0	1.5	3.3
22	.....	.....	.....	3.9	2.2	1.5	1.0	.6	.9	3.0	1.5	3.4
23	.....	.....	.....	3.6	2.6	1.6	1.1	.6	.9	3.1	1.4	3.6
24	.....	.....	.....	3.8	2.2	1.6	1.0	.5	.8	3.0	1.5	3.8
25	.....	2.6	2.4	4.0	2.2	1.5	1.1	.5	.7	3.0	1.6	4.4
26	.....	.....	.....	5.0	2.3	1.6	1.0	.5	.8	3.1	1.5	4.0
27	.....	.....	.....	5.8	2.4	1.6	.9	.6	.9	3.0	1.6	3.4
28	2.5	.....	.....	6.0	2.3	1.5	.85	.6	1.0	3.0	1.7	3.5
29	.....	.....	.....	6.6	2.3	1.6	.7	.7	1.0	3.1	2.0	3.8
30	.....	.....	.....	6.3	2.1	1.6	.7	.8	.9	3.0	2.2	3.5
31	.....	.....	.....	.....	2.2	.....	.7	.6	.....	3.1	.....	3.1

NOTE.—Relation of gage height to discharge affected by ice Jan. 1 to Apr. 14. Probably not much back water from ice during December. The gage readings were probably to water surface.

Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4,780	610	465	240	175	290	1,150	700
2	.....	7,200	700	435	240	175	315	1,080	650
3	.....	4,780	750	435	228	195	345	1,150	700
4	.....	3,140	700	390	215	195	330	1,220	750
5	.....	3,140	855	345	195	228	435	1,150	800
6	.....	2,920	1,080	312	175	265	570	1,290	855
7	.....	2,600	1,020	265	195	265	610	1,590	910
8	.....	2,120	910	252	195	240	610	1,900	965
9	.....	2,030	700	215	175	240	650	1,850	1,220
10	.....	1,940	610	302	175	240	700	1,760	1,590
11	.....	1,430	570	315	195	265	570	1,670	2,300
12	.....	1,150	610	315	195	265	535	1,590	3,140
13	.....	965	610	315	228	265	535	1,360	5,260
14	.....	910	535	315	215	240	570	1,150	3,470
15	4,540	910	535	345	205	265	970	910	2,210
16	3,940	800	500	278	195	290	535	650	1,940
17	2,500	750	465	345	215	265	610	535	1,760
18	1,670	700	465	450	195	240	700	465	1,760
19	1,290	610	465	482	195	215	800	465	1,590
20	1,220	610	500	375	215	215	1,020	465	1,430
21	1,510	700	465	330	215	240	1,150	435	1,360
22	1,850	700	435	290	195	265	1,150	435	1,430
23	1,590	910	465	315	195	265	1,220	405	1,590
24	1,760	700	465	290	175	240	1,150	435	1,760
25	1,940	700	435	315	175	215	1,150	465	2,300
26	2,920	750	465	290	175	240	1,220	435	1,940
27	3,820	800	465	265	195	265	1,150	465	1,430
28	4,060	750	435	252	195	290	1,150	500	1,510
29	4,780	750	465	215	215	290	1,220	610	1,760
30	4,420	650	465	215	240	265	1,150	700	1,510
31	.....	700	.....	215	195	.....	1,220	.....	1,220

NOTE.—Daily discharge determined from a discharge rating curve well defined between 240 and 3,650 second-feet.

Monthly discharge of Moose River at Moose River, N. Y., for 1911.

[Drainage area, 346 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	600	1.73	1.99	C.
February	.....	.....	400	1.16	1.21	C.
March	.....	.....	700	2.02	2.33	C.
April	.....	.....	2,630	7.60	8.48	B.
May	4,780	610	1,660	4.80	5.53	B.
June	1,080	435	592	1.71	1.91	B.
July	482	215	321	.928	1.07	B.
August	240	175	202	.584	.67	B.
September	290	175	244	.705	.79	B.
October	1,220	290	782	2.26	2.61	B.
November	1,900	405	943	2.73	3.05	B.
December	5,260	650	1,670	4.83	5.57	B.
The year	.....	175	897	2.59	35.21	

NOTE.—Discharge Jan. 1 to Apr. 14 estimated at approximately 25 per cent of the discharge of Black River at Felts Mills.
Mean discharge Apr. 1 to 14 estimated 2,500 second-feet.

MIDDLE BRANCH OF MOOSE RIVER AT OLD FORGE, N. Y.

Location.—About 300 feet below the highway bridge in Old Forge and about 400 feet below the dam.

Records available.—November 9, 1911, to December 31, 1911; published also in annual report of New York State Conservation Commission.

Drainage area.—51.5 square miles.

Gage.—Vertical staff, graded to feet and tenths, reading from 1 foot to 7 feet, spiked to birch tree on left bank of stream 300 feet below highway bridge.

Channel.—Fairly straight from dam to a point about 200 feet below the gage where the river turns abruptly to the right and flows over a rock reef which is the control point for the gage. Channel fairly uniform from dam to point of control. Right bank high and wooded; left bank from the highway bridge to within about 50 feet of the gage, defined by a stone wall about 3 feet above ordinary low water.

Accuracy.—Station rated from ordinary low water to ordinary high water, the rating table covering a gage ranging from 1.60 feet to 3 feet, inclusive. Conditions at the station considered good.

Discharge measurements of Middle Branch of Moose River at Old Forge, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Aug. 21 *a*	C. C. Covert	1.96	79.3
Nov. 8 *a*	C. S. De Golyer	1.73	53.4
8 *a*	do	2.16	112
8 *a*	do	2.44	150
6 *a*	do	2.90	241

a Measurements made by wading in front of State hatchery 150 feet above the gage.

Daily gage height, in feet, and discharge, in second-feet, of Middle Branch of Moose River at Old Forge, N. Y., for 1911.

[Vernon S. Ervin, observer.]

Day.	November.		December.		Day.	November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
1			2.55	172	16	2.70	201	3.00	262
2			2.55	172	17	2.70	201	3.00	262
3			2.50	163	18	2.65	192	3.00	262
4			2.50	163	19	2.65	192	3.00	262
5			2.50	163	20	2.65	192	3.00	262
6			2.45	154	21	2.65	192	2.95	252
7			2.45	154	22	2.60	182	2.90	241
8			2.45	154	23	2.60	182	2.90	241
9	2.30	128	2.45	154	24	2.60	182	2.95	252
10	2.35	136	2.45	154	25	2.60	182	2.95	252
11	2.35	136	2.45	154	26	2.60	182	2.95	252
12	2.35	136	2.42	149	27	2.55	172	2.90	241
13	2.40	145	2.60	182	28	2.55	172	2.85	231
14	2.70	201	2.80	221	29	2.50	163	2.80	221
15	2.79	219	2.95	252	30	2.55	172	2.80	221
					31			2.75	211

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

Monthly discharge of Middle Branch of Moose River at Old Forge, N. Y., for 1911.

[Drainage area, 51.5 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
November (9–30)	219	128	175	3.40	2.78	A.
December	262	149	209	4.06	4.68	A.

STREAMS FLOWING TO ST. LAWRENCE RIVER.

OSWEGATCHIE RIVER NEAR OGDENSBURG, N. Y.

Location.—At the steel highway bridge known locally as Eel Weir bridge, about 1 mile below the mouth of the outlet of Black Lake and 5½ miles above the city of Ogdensburg and the mouth of the river.

Records available.—April 22, 1903, to December 31, 1911. Data published also in annual reports of the State Water-Supply Commission, State Conservation Commission, and State engineer and surveyor, State of New York.

Drainage area.—1,580 square miles.

Gage.—Chain, fastened to the upstream side of the bridge; read once daily; datum unchanged.

Channel.—Rocky and partly artificial, the rock having been removed underneath the bridge by blasting to increase the bridge opening.

Discharge measurements.—Usually made from the bridge.

Artificial control.—Three dams in the vicinity of the gage: One at Heuvelton, about 5 miles above; one at Rensselaer Falls, 10 miles above, and one at Ogdensburg.

Winter flow.—Not affected by ice, as velocity of the current at the station is swift.

Accuracy.—Rating curve fairly well developed; open-water curve used throughout the year.

Cooperation.—Established by the United States Geological Survey in cooperation with the State engineer and surveyor of New York.

Discharge measurements of Oswegatchie River near Ogdensburg, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 18	F. J. Shuttleworth	5.05	1,290
July 1[a]	G. H. Canfield	5.22	1,050

[a] Measurement made from upstream side of bridge where measuring conditions are poor.

Daily gage height, in feet, of Oswegatchie River near Ogdensburg, N. Y., for 1911.

[Joseph H. La Rue, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.2	5.7	5.2	8.6	6.3	6.1	5.1	4.5	4.4	4.7	4.9	6.5
2	5.2	5.7	5.2	8.3	6.4	6.0	5.1	4.5	4.4	4.6	4.9	6.5
3	5.3	5.7	5.4	8.1	6.3	5.8	5.1	4.5	4.4	4.6	5.0	6.5
4	5.9	5.7	5.5	8.0	6.4	5.7	5.1	4.5	4.4	4.6	5.0	6.5
5	6.1	5.7	5.4	7.7	6.4	5.7	5.0	4.5	4.4	4.6	5.1	6.4
6	6.5	5.6	5.4	7.8	6.4	5.7	5.0	4.5	4.5	4.7	5.0	6.3
7	6.6	5.6	5.4	8.1	6.4	5.5	4.9	4.5	4.5	4.9	5.1	6.2
8	6.2	5.5	5.3	8.5	6.3	5.6	4.9	4.5	4.6	5.0	5.3	6.2
9	6.4	5.5	5.2	9.1	6.3	5.6	4.9	4.5	4.8	5.0	5.3	6.1
10	6.2	5.5	5.2	9.4	6.1	5.6	4.9	4.4	4.9	5.0	5.5	6.0
11	6.2	5.4	5.1	9.5	5.9	5.7	4.9	4.5	4.9	5.1	5.5	6.0
12	6.1	5.3	5.1	9.4	5.9	5.7	4.8	4.5	4.9	5.1	5.9	6.2
13	6.1	5.2	5.1	9.1	5.8	5.6	4.8	4.5	4.9	5.1	5.7	6.2
14	6.1	5.2	5.1	9.1	5.7	5.5	4.7	4.4	4.9	5.1	5.7	6.6
15	6.1	5.2	5.5	9.1	5.5	5.5	4.7	4.4	5.0	5.1	5.7	7.0
16	6.1	5.1	6.2	9.0	5.4	5.4	4.7	4.4	5.0	5.1	5.7	7.4
17	6.1	5.1	6.6	8.9	5.4	5.3	4.7	4.4	4.9	5.1	5.7	7.4
18	6.0	5.0	6.1	8.5	5.4	5.3	4.7	4.4	4.9	5.1	5.7	7.5
19	6.0	5.0	6.1	8.4	5.4	5.4	4.7	4.4	4.9	5.1	6.0	7.4
20	5.9	5.1	6.0	8.1	5.4	5.3	4.7	4.4	4.9	5.1	6.0	7.2
21	5.8	5.1	6.0	8.1	5.5	5.3	4.7	4.4	4.9	5.0	6.1	7.2
22	5.7	5.1	6.0	8.0	5.6	5.3	4.7	4.4	4.9	5.0	6.1	7.2
23	5.7	5.1	6.1	7.7	5.8	5.3	4.7	4.4	4.9	5.0	6.1	7.0
24	5.7	5.1	6.3	7.5	6.0	5.2	4.7	4.4	4.8	5.0	6.1	6.9
25	5.6	5.1	6.1	7.3	6.0	5.2	5.0	4.4	4.8	5.0	6.2	6.9
26	5.5	5.1	6.0	7.0	6.2	5.2	4.6	4.4	4.8	5.0	6.0	6.7
27	5.5	5.1	6.3	6.7	6.3	5.2	4.6	4.4	4.8	5.0	6.0	6.6
28	5.5	5.1	7.3	6.6	6.3	5.2	4.5	4.4	4.7	5.0	6.1	6.4
29	5.3	.....	7.8	6.5	6.4	5.1	4.5	4.4	4.7	5.0	6.2	6.4
30	5.3	.....	8.5	6.3	6.3	5.1	4.5	4.4	4.7	4.9	6.3	6.7
31	5.7	.....	8.6	.....	6.2	.....	4.5	4.4	.....	4.9	.....	6.5

NOTE.—Relation of gage height to discharge at this station not affected by ice.

Daily discharge, in second-feet, of Oswegatchie River near Ogdensburg, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,570	2,640	1,570	11,200	4,310	3,730	1,380	450	330	720	1,030	4,890
2	1,570	2,640	1,570	10,300	4,600	3,440	1,380	450	330	580	1,030	4,890
3	1,770	2,640	1,970	9,660	4,310	2,890	1,380	450	330	580	1,200	4,890
4	3,160	2,640	2,180	9,350	4,600	2,640	1,380	450	330	580	1,200	4,890
5	3,730	2,640	1,970	8,450	4,600	2,640	1,200	450	330	580	1,380	4,600
6	4,890	2,400	1,970	8,750	4,600	2,640	1,200	450	450	720	1,200	4,310
7	5,180	2,400	1,970	9,660	4,600	2,180	1,030	450	450	1,030	1,380	4,020
8	4,020	2,180	1,770	10,900	4,310	2,400	1,030	450	580	1,200	1,770	4,020
9	4,600	2,180	1,570	12,700	4,310	2,400	1,030	450	870	1,200	1,770	3,730
10	4,020	2,180	1,570	13,600	3,730	2,400	1,030	330	1,030	1,200	2,180	3,440
11	4,020	1,970	1,380	14,000	3,160	2,640	1,030	450	1,030	1,380	2,180	3,440
12	3,730	1,770	1,380	13,600	3,160	2,640	870	450	1,030	1,380	3,160	4,020
13	3,730	1,570	1,380	12,700	2,890	2,400	870	450	1,030	1,380	2,640	4,020
14	3,730	1,570	1,380	12,700	2,640	2,180	720	330	1,030	1,380	2,640	5,180
15	3,730	1,570	2,180	12,700	2,180	2,180	720	330	1,200	1,380	2,640	6,360
16	3,730	1,380	4,020	12,400	1,970	1,970	720	330	1,200	1,380	2,640	7,550
17	3,730	1,380	5,180	12,100	1,970	1,770	720	330	1,030	1,380	2,640	7,550
18	3,440	1,200	3,730	10,900	1,970	1,770	720	330	1,030	1,380	2,640	7,850
19	3,440	1,200	3,730	10,600	1,970	1,970	720	330	1,030	1,380	3,440	7,550
20	3,160	1,380	3,440	9,660	1,970	1,770	720	330	1,030	1,380	3,440	6,960
21	2,890	1,380	3,440	9,660	2,180	1,770	720	330	1,030	1,200	3,730	6,960
22	2,640	1,380	3,440	9,350	2,400	1,770	720	330	1,030	1,200	3,730	6,960
23	2,640	1,380	3,730	8,450	2,890	1,770	720	330	1,030	1,200	3,730	6,360
24	2,640	1,380	4,310	7,850	3,440	1,570	720	330	870	1,200	3,730	6,070
25	2,400	1,380	3,730	7,250	3,440	1,570	1,200	330	870	1,200	4,020	6,070
26	2,180	1,380	3,440	6,360	4,020	1,570	580	330	870	1,200	3,440	5,480
27	2,180	1,380	4,310	5,480	4,310	1,570	580	330	870	1,200	3,440	5,180
28	2,180	1,380	7,250	5,180	4,310	1,570	450	330	720	1,200	3,730	4,600
29	1,770	.....	8,750	4,890	4,600	1,380	450	330	720	1,200	4,020	4,600
30	1,770	.....	10,900	4,310	4,310	1,380	450	330	720	1,030	4,310	5,480
31	2,640	.....	11,200	.....	4,020	.....	450	330	.....	1,030	.....	4,890

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

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for 1911.

[Drainage area, 1,580 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	5,180	1,570	3,120	2.97	3.42	B.
February	2,640	1,200	1,810	1.15	1.20	B.
March	11,200	1,380	3,560	2.25	2.59	A.
April	14,000	4,310	9,820	6.22	6.94	A.
May	4,600	1,970	3,480	2.20	2.54	A.
June	3,730	1,380	2,150	1.36	1.52	A.
July	1,380	450	867	.549	.63	B.
August	450	330	376	.238	.27	B.
September	1,200	330	813	.515	.57	B.
October	1,380	580	1,130	.715	.82	B.
November	4,310	1,030	2,670	1.69	1.89	A.
December	7,850	3,440	5,380	3.41	3.93	A.
The year	14,000	330	2,930	1.85	26.32	

RAQUETTE RIVER AND TRIBUTARIES.

RAQUETTE RIVER AT RAQUETTE FALLS, NEAR COREYS, N. Y.

Location.—6 miles above Axton, 5 miles below the outlet of Long Lake and 2 miles below the mouth of Moose Creek.

Records available.—August 27, 1908, to December 31, 1911. Published also in annual reports of New York State Water-Supply Commission and New York State engineer and surveyor.

Drainage area.—418 square miles.

Gage.—A staff fastened to the right bank in a comparatively smooth section between two small falls; read once daily during the open-water period and weekly during the ice period; datum unchanged since station was established.

Channel.—Rough, composed of large bowlders; permanent; one channel at all stages.

Discharge measurements.—Made from a car and cable about 10 feet above the gage.

Winter flow.—Relation of gage height to discharge somewhat affected by ice.

Accuracy.—Low-water section of discharge curve well defined; but few measurements have been made at high water, and determinations of flow for stages above gage height 5 feet may be somewhat in error.

Cooperation.—Established and maintained in cooperation with the State Water Supply Commission of New York.

The discharge at this station added to that of Bog River near Tupper Lake shows in a general way the amount of water flowing into Tupper Lake, a study of which is being made to determine the amount of storage feasible in the lake. The combined drainage areas equal about 75 per cent of the drainage at Piercefield.

The following measurement was made by W. G. Hoyt:

February 22, 1911: Gage height, 2.11 feet; discharge, 336 second-feet.

There was ice along the shore but the relation of gage height to discharge was not affected thereby.

Daily gage height, in feet, of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911.

[C. A. De Lancett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	2.9	6.1	4.4	2.8	1.2	1.4	1.6	2.5	3.1
2	.....	.....	.....	2.8	6.3	4.4	2.7	1.2	1.4	1.8	2.5	3.1
3	.....	.....	.....	2.7	6.6	4.3	2.7	1.1	1.3	1.9	2.5	3.0
4	.....	2.5	2.0	2.7	6.4	4.2	2.6	1.1	1.2	2.0	2.5	3.0
5	.....	.....	.....	2.8	6.2	4.2	2.5	1.1	1.2	2.5	2.5	3.0
6	.....	.....	.....	2.8	6.0	4.2	2.4	1.1	1.2	2.5	2.6	3.0
7	3.4	.....	.....	3.1	5.9	4.1	2.3	1.1	2.2	2.5	2.6	3.0
8	.....	.....	.....	3.2	5.7	4.1	2.2	1.1	2.2	2.5	2.7	2.9
9	.....	.....	.....	3.4	5.4	4.0	2.2	1.0	1.9	2.5	2.7	2.9
10	.....	.....	.....	3.4	5.4	3.9	2.1	1.0	1.9	2.5	2.8	2.9
11	.....	2.2	1.9	3.5	5.3	3.4	2.1	1.1	1.8	2.5	2.8	3.2
12	.....	.....	.....	3.5	5.2	3.4	1.9	1.1	1.8	2.5	2.8	3.5
13	.....	.....	.....	3.6	5.1	3.4	1.8	1.0	2.0	2.4	2.9	4.0
14	3.4	.....	.....	3.8	5.0	3.7	1.7	1.0	2.0	2.4	2.9	4.4
15	.....	.....	.....	4.1	4.9	3.7	1.7	1.0	1.9	2.4	3.9	4.4
16	.....	.....	.....	4.4	4.8	3.9	1.6	1.0	1.9	2.4	2.9	4.4
17	.....	.....	.....	4.5	4.8	4.0	1.6	1.0	1.8	2.4	2.9	4.5
18	.....	2.2	1.8	4.7	4.7	4.0	1.7	1.0	1.8	2.5	3.0	4.4
19	.....	.....	.....	4.7	4.7	3.7	1.8	1.3	1.8	2.6	3.0	4.3
20	.....	.....	.....	4.6	5.0	3.6	1.7	1.3	1.7	2.6	3.0	4.2
21	2.4	.....	.....	4.6	4.9	3.5	1.6	1.2	1.7	2.6	3.0	4.2
22	.....	2.1	.....	4.6	4.7	3.5	1.5	1.2	1.7	2.7	3.0	4.1
23	.....	.....	.....	4.7	4.7	3.4	1.4	1.2	1.7	2.7	3.1	4.1
24	.....	.....	.....	4.7	5.5	3.4	1.4	1.1	1.7	2.7	3.1	4.1
25	.....	2.1	2.2	4.8	5.5	3.3	1.4	1.1	1.6	2.7	3.1	4.2
26	.....	.....	.....	4.9	5.1	3.3	1.4	1.1	1.6	2.6	3.0	4.2
27	.....	.....	.....	5.2	4.7	3.3	1.4	1.0	1.6	2.6	3.0	4.3
28	2.2	.....	.....	5.4	4.7	3.2	1.4	1.0	1.6	2.6	3.0	4.1
29	.....	.....	.....	5.4	4.6	3.0	1.3	1.8	1.6	2.5	3.1	4.0
30	.....	.....	.....	5.9	4.4	2.9	1.3	1.7	1.5	2.5	3.1	3.9
31	.....	.....	.....	.....	4.3	.....	1.3	1.5	.....	2.5	.....	3.7

NOTE.—Extent to which the gage heights were affected by ice somewhat uncertain. Probably, however, more or less backwater from ice from about Jan. 1 to about Feb. 10. The measurement made Feb. 22 indicated no backwater due to ice. Gage readings probably to water surface. Probably backwater from a log jam during the later part of May and the first part of June. When the log jam was removed June 10 to 11, there was a sudden drop in stage, indicating approximately 0.5 foot of backwater from this cause during the first part of June.

Daily discharge, in second-feet, of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	300	655	4,220	1,860	600	110	150	190	460	770
2	.....	290	600	4,540	1,860	550	110	150	240	460	770
3	.....	290	550	5,030	1,750	550	90	130	265	460	710
4	.....	290	550	4,700	1,640	505	90	110	290	460	710
5	.....	280	600	4,380	1,640	460	90	110	460	460	710
6	.....	280	600	4,060	1,640	420	90	110	460	505	710
7	.....	270	770	3,900	1,540	385	90	350	460	505	710
8	.....	270	830	3,580	1,540	350	90	350	460	550	655
9	.....	265	970	3,130	1,450	350	70	265	460	550	655
10	.....	265	970	3,130	1,360	320	70	265	460	600	655
11	350	265	1,040	2,980	970	320	90	240	460	600	830
12	350	250	1,040	2,840	970	265	90	240	460	600	1,040
13	350	250	1,120	2,700	970	240	70	290	420	655	1,450
14	350	250	1,280	2,570	1,200	215	70	290	420	655	1,860
15	350	250	1,540	2,440	1,200	215	70	265	420	1,360	1,860
16	350	240	1,860	2,320	1,360	190	70	265	420	655	1,860
17	350	240	1,970	2,320	1,450	190	70	240	420	655	1,970
18	350	240	2,200	2,200	1,450	215	70	240	460	710	1,860
19	340	240	2,200	2,200	1,200	240	130	240	505	710	1,750
20	330	250	2,080	2,570	1,120	215	130	215	505	710	1,640

Daily discharge, in second-feet, of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	320	260	2,080	2,440	1,040	190	110	215	505	710	1,640
22	320	270	2,080	2,200	1,040	170	110	215	550	710	1,540
23	320	280	2,200	2,200	970	150	110	215	550	770	1,540
24	320	300	2,200	3,280	970	150	90	215	550	770	1,540
25	320	350	2,320	3,280	900	150	90	190	550	770	1,640
26	320	380	2,440	2,700	900	150	90	190	505	710	1,640
27	320	400	2,840	2,200	900	150	70	190	505	710	1,750
28	320	450	3,130	2,200	830	150	70	190	505	710	1,540
29	.....	500	3,130	2,080	710	130	240	190	460	770	1,450
30	.....	550	3,900	1,860	655	130	215	170	460	770	1,360
31	.....	600	.....	1,750	.....	130	170	.....	460	.....	1,200

NOTE.—Daily discharge determined from a fairly well defined discharge rating curve. The open-channel rating curve has been applied throughout the period Feb. 11 to Dec. 31, with no corrections for possible backwater from ice or from log jams. Discharge interpolated for periods when the gage was not read.

Monthly discharge of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911.

[Drainage area, 418 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	373	0.892	1.03	C.
February	.....	.....	341	.816	.85	C.
March	600	240	311	.744	.86	B.
April	3,900	550	1,660	3.97	4.43	A.
May	5,030	1,750	2,970	7.11	8.20	A.
June	1,860	655	1,240	2.97	3.31	A.
July	600	130	272	.651	.75	A.
August	240	70	101	.242	.28	B.
September	350	110	216	.517	.58	A.
October	550	190	446	1.07	1.23	A.
November	1,360	460	657	1.57	1.75	A.
December	1,970	655	1,290	3.09	3.56	A.
The year	5,030	70	825	1.97	26.83	

NOTE.—Discharge for Jan. 1 to Feb. 10 was estimated from climatologic records and the discharge at other stations in the Raquette River basin. Mean discharge Feb. 1 to 10 estimated 350 second-feet.

RAQUETTE RIVER AT PIERCEFIELD, N. Y.

Location.—About three-fourths of a mile above the head of Black Rapids and half a mile below the dam of International Paper Co. at Piercefield.

Records available.—August 20, 1908, to December 31, 1911. Published also in annual reports of State Water Supply Commission, New York State Conservation Commission, and New York State engineer and surveyor.

Drainage area.—723 square miles.

Gage.—From August 20, 1908, to September 3, 1910, a vertical staff fastened to a large pine stump in a pond like stretch of the stream controlled by Black Rapids; after September 3, 1910, chain gage fastened to same stump. Both gages installed at same datum, which has remained unchanged.

Channel.—Permanent.

Discharge measurements.—Made at low and medium stages from a boat just above Black Rapids; at high stages made from the highway bridge about three-fourths mile above the station and one-fourth mile above the dam of the International Paper Co.

Winter flow.—The rapids controlling the stream at the gage rarely freeze and measurements made with ice present indicate that the relation between gage height and discharge is little if any affected by ice. Open-water discharge rating curve usually applicable throughout the year.

Artificial control.—The dam of the International Paper Co. controls the flow of the stream at the station during low-water periods, but the mill is usually run for 24 hours each day except Sundays. The numerous lakes in the upper part of the drainage basin afford considerable storage, most of which is controlled.

Accuracy.—Although the discharge at this station is somewhat affected by artificial control, the records are believed to be good.

Discharge measurements of Raquette River at Piercefield, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 23[a]	F. J. Shuttleworth	5.10	888
June 30	G. H. Canfield	5.40	1,060
Sept. 10[b]	do	1.54	51.6

[a] Measurement made under complete ice cover about 4 miles below gage. Average thickness of ice 0.93 foot. Ice at gage section, complete cover. Average thickness of ice about 2.5 feet. Control point free from ice cover; some ice on rocks and side.

[b] Measurement made by wading about 300 yards below boat section.

Daily gage height, in feet, of Raquette River at Piercefield, N. Y., for 1911.

[W. B. Graves, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	4.7	5.2	4.9	10.4	7.6	5.6	5.5	3.3	1.10	3.8	5.6
2	3.5	4.9	5.2	2.0	10.4	7.6	2.7	5.1	3.4	2.9	4.0	5.6
3	4.0	5.1	5.2	5.0	10.3	7.5	4.3	3.7	3.5	3.9	4.0	5.7
4	4.1	5.2	5.2	5.6	10.4	4.3	5.0	2.6	3.6	3.7	3.9	5.9
5	4.1	2.0	2.0	5.7	10.4	6.3	5.4	2.4	3.8	3.6	1.45	5.9
6	4.1	4.0	3.5	5.5	10.4	6.4	5.4	2.05	4.0	3.6	2.4	6.0
7	4.1	5.2	4.0	5.6	10.1	6.4	5.4	2.10	3.9	3.5	3.2	6.0
8	2.0	5.4	4.2	5.8	9.7	6.4	5.4	3.45	3.8	.95	4.0	6.0
9	3.5	5.4	4.2	5.6	9.8	6.4	2.4	3.7	3.7	2.3	4.2	6.0
10	5.0	5.4	4.1	6.2	9.6	6.4	4.2	4.0	1.7	2.6	4.1	3.8
11	5.0	5.4	4.2	6.4	9.5	5.2	4.5	4.0	1.55	2.7	4.0	5.9
12	5.0	2.0	2.0	6.4	9.4	6.5	4.4	4.0	2.35	2.8	1.9	6.0
13	5.0	3.1	3.5	6.4	9.4	6.5	4.3	1.85	4.2	2.8	5.8	6.1
14	5.0	4.3	4.2	6.4	9.0	6.5	4.4	2.2	4.3	2.95	5.4	6.1
15	2.0	4.7	4.1	6.3	9.1	6.5	4.4	2.15	4.4	1.05	5.2	6.2
16	3.5	4.7	4.2	6.1	9.0	6.4	2.5	3.9	4.4	3.6	5.0	6.3
17	5.0	4.7	4.1	6.5	8.9	6.4	3.25	4.0	2.5	4.0	4.9	7.8
18	5.0	4.7	4.2	6.6	8.8	5.2	3.9	2.15	3.4	4.1	5.0	7.8
19	5.0	2.0	2.0	6.6	8.6	6.2	4.2	1.95	3.9	4.0	2.65	7.5
20	5.0	3.7	3.5	6.7	8.6	6.3	4.2	1.75	4.0	4.0	5.5	7.5
21	5.0	5.2	4.2	6.8	7.2	6.3	4.2	1.9	4.0	4.1	5.9	7.4
22	2.0	5.2	4.2	6.5	7.6	6.3	4.5	4.0	3.4	2.3	5.8	7.5
23	4.9	5.2	4.1	7.8	7.6	6.4	2.7	4.0	3.3	3.2	5.9	7.4
24	4.8	5.2	4.2	8.3	7.8	6.3	4.0	2.2	1.35	3.8	5.9	6.7
25	4.9	5.2	4.2	8.5	7.7	4.2	4.2	2.1	3.0	4.0	5.9	6.5
26	5.0	2.0	2.0	8.7	7.6	5.3	3.8	2.0	3.8	4.0	5.3	7.6
27	5.0	5.2	3.6	8.8	7.6	6.0	3.6	1.9	3.7	4.0	5.3	7.6
28	4.8	5.2	5.0	8.8	7.3	6.1	2.7	3.45	3.6	3.8	5.6	7.1
29	2.0	.....	4.9	8.5	7.4	6.1	2.55	3.3	3.6	2.35	5.6	7.1
30	3.5	.....	5.0	8.7	7.6	5.6	2.35	3.2	3.5	2.85	5.6	7.1
31	4.0	.....	4.9	.....	7.6	.....	4.5	3.25	.....	3.7	.....	7.1

NOTE.—Relation of gage height to discharge not usually affected by ice at this station. The gage readings are taken in a pond above a swift control point which usually remains open throughout the winter. Gage readings probably to water surface. The fluctuation of the gage heights is under the control of the paper mill above the station.

Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	88	730	940	810	5,880	2,750	1,160	1,100	290	28	425	1,160
2	342	810	940	88	5,880	2,750	161	895	316	196	485	1,160
3	485	895	940	850	5,750	2,650	580	397	342	455	485	1,220
4	515	940	940	1,160	5,880	580	850	147	369	397	455	1,350
5	515	88	88	1,220	5,880	1,630	1,040	124	425	369	47	1,350
6	515	485	342	1,100	5,880	1,700	1,040	92	485	369	124	1,420
7	515	940	485	1,160	5,500	1,700	1,040	96	455	342	265	1,420
8	88	1,040	545	1,280	5,020	1,700	1,040	329	425	22	485	1,420
9	342	1,040	545	1,160	5,140	1,700	124	397	397	114	545	1,420
10	850	1,040	515	1,560	4,900	1,700	545	485	64	147	515	425
11	850	1,040	545	1,700	4,780	940	650	485	54	161	485	1,350
12	850	88	88	1,700	4,660	1,780	615	485	118	177	80	1,420
13	850	241	342	1,700	4,660	1,780	580	76	545	177	1,280	1,490
14	850	580	545	1,700	4,200	1,780	615	105	580	207	1,040	1,490
15	88	730	515	1,630	4,320	1,780	615	100	615	26	940	1,560
16	342	730	545	1,490	4,200	1,700	135	455	615	369	850	1,630
17	850	730	515	1,780	4,090	1,700	278	485	135	485	810	2,950
18	850	730	545	1,860	3,980	940	455	100	316	515	850	2,950
19	850	88	88	1,860	3,760	1,560	545	84	455	485	154	2,650
20	850	397	342	1,940	3,760	1,630	545	68	485	485	1,100	2,650
21	850	940	545	2,020	2,380	1,630	545	80	485	515	1,350	2,560
22	88	940	545	1,780	2,750	1,630	650	485	316	114	1,280	2,650
23	810	940	515	2,950	2,750	1,700	161	485	290	265	1,350	2,560
24	770	940	545	3,450	2,950	1,630	485	105	41	425	1,350	1,940
25	810	940	545	3,660	2,850	545	545	96	218	485	1,350	1,780
26	850	88	88	3,870	2,750	990	425	88	425	485	990	2,750
27	850	940	369	3,980	2,750	1,420	369	80	397	485	990	2,750
28	770	940	850	3,980	2,470	1,490	161	329	369	425	1,160	2,290
29	88	.....	810	3,660	2,560	1,490	141	290	369	119	1,160	2,290
30	342	.....	850	3,870	2,750	1,160	119	265	342	186	1,160	2,290
31	485	.....	810	.....	2,750	.....	650	278	.....	397	.....	2,290

NOTE.—Daily discharge determined from a well-defined discharge rating curve. The accuracy of the daily discharge is not greatly affected by the operation of the mill above the station, as the plant runs continuously except occasionally on Sundays or other times when it is closed for repairs.

Monthly discharge of Raquette River at Piercefield, N. Y., for 1911.

[Drainage area, 723 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	850	88	587	0.812	0.94	B.
February	1,040	88	715	.989	1.03	B.
March	945	88	543	.751	.87	B.
April	3,980	88	2,030	2.81	3.14	A.
May	5,880	2,380	4,120	5.71	6.58	A.
June	2,750	580	1,600	2.22	2.48	A.
July	1,160	119	544	.752	.87	B.
August	1,100	76	293	.405	.47	B.
September	615	41	358	.495	.55	B.
October	515	22	304	.420	.48	B.
November	1,350	47	785	1.09	1.22	B.
December	2,950	425	1,890	2.61	3.01	A.
The year	5,880	22	1,150	1.59	21.64	

RAQUETTE RIVER AT MASSENA SPRINGS, N. Y.

Location.—At highway bridge at Massena Springs, N. Y., 1,000 feet above the New York Central & Hudson River Railroad bridge used for freight transfer from the railroad station to the Massena power plant, one-fourth mile from the New York Central & Hudson River Railroad station on the highway bridge leading to Massena, 8 miles below Raymondville, and 10 miles above the mouth of the stream.

Records available.—September 21, 1903, to October 17, 1903; April 9, 1904, to December 31, 1911; data also in annual reports of New York State engineer and surveyor, New York State Water Supply Commission, and New York State Conservation Commission.

Drainage area.—1,170 square miles.

Gage.—Original gage a vertical staff fastened to a stone wall on the left bank 25 feet upstream from the bridge. Staff gage was replaced August 16, 1906, by a standard chain gage fastened to upstream side of highway bridge. The datum of the chain gage was made 1 foot lower than the staff gage in order to avoid negative readings. During the summer and fall of 1911 a new concrete bridge was constructed just below the old bridge. During the period of construction gage readings were obtained from a temporary staff gage fastened to the railroad bridge. Readings were also made at the regular gage, and special discharge measurements were made to develop the proper discharge rating curves for this period.

Channel.—Bed of river of coarse gravel and small bowlders; permanent; current good at all points; formerly one channel, now two; slight correction necessary for angle.

Discharge measurements.—Previous to construction of new bridge, made from upstream side of highway bridge; no measurements have yet been made from new bridge. The new bridge has two spans and will undoubtedly cause some change in the discharge rating curve.

Artificial control.—The operation of a number of power plants above the station has marked effect on the low-water discharge of the stream. These plants are usually run for 24-hour power but are closed on Sundays. The effect of the Sunday closing is shown in the stream for several days.

Winter flow.—Ice forms at this station to a thickness of 3 feet and considerably affect the relation of gage height to discharge for December, January, February, and March.

Accuracy.—Determinations of monthly discharge considered good, but those of daily discharge may be considerably in error for low-water periods due to artificial control. Monthly estimates for periods during which ice is present also subject to large errors.

Cooperation.—Maintained in cooperation with New York State Conservation Commission.

Discharge measurements of Raquette River at Massena Springs, N. Y., in 1911.

Date.	Hydrographer.	Mean gage height.[a]	Discharge.
1911.		*Feet.*	*Sec.-ft.*
Feb. 20[b]	W. G. Hoyt	4.48	969
Apr. 12[c]	C. S. De Golyer	9.51	4,790
July 3	G. H. Canfield	2.79	1,050
Sept. 8	do	1.80	387
11	do	[d] 1.84	406
12	do	[e] 2.66	868
12	do	[f] 2.30	612
Nov. 21	C. S. De Golyer	[g] 4.30	1,850

[a] Chain gage.
[b] Measurement made under complete ice cover.
[c] Gage height, top of ice, 4.58 feet. Average thickness of ice, 2.24 feet. Open water at bridge. Ice jammed below and above, causing backwater.
[d] Gage height, staff gage, 2.84 feet.
[e] Gage height, staff gage, 3.30 feet.
[f] Gage height, staff gage, 3.64 feet.
[g] Gage height, staff gage, 4.99 feet.

Daily gage height, in feet, of Raquette River at Massena Springs, N. Y., for 1911.

[Fred L. Babcock, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.6	.....	.....	5.9	8.4	5.6	3.6	1.8	1.75	2.8	3.7	5.4
2	.....	.....	.....	.....	9.2	5.5	3.3	2.05	2.05	3.8	3.35	5.2
3	.....	.....	.....	.....	9.4	5.6	3.0	1.85	1.7	3.5	3.9	4.8
4	.....	.....	4.6	.....	9.4	5.2	3.0	1.75	1.8	3.2	3.9	6.2
5	.....	4.7	.....	.....	9.2	5.2	3.0	1.5	1.75	3.2	3.7	6.5
6	.....	.....	.....	.....	9.0	4.8	3.4	1.65	2.0	3.1	3.25	5.8
7	4.5	.....	.....	.....	8.8	4.8	3.2	1.8	1.85	3.6	3.9	6.1
8	.....	.....	.....	10.5	9.0	4.6	2.8	1.85	1.75	3.4	4.0	5.2
9	.....	.....	.....	.....	8.7	4.4	2.25	2.0	1.8	3.7	3.7	5.0
10	.....	.....	.....	.....	8.4	4.6	2.2	1.85	2.8	4.3	4.3	5.0
11	.....	.....	4.8	.....	8.0	4.0	3.0	1.75	1.8	3.6	4.4	5.4
12	.....	4.7	.....	9.4	7.8	4.4	3.1	1.55	3.35	3.6	4.4	5.6
13	.....	.....	.....	9.2	7.4	4.4	2.8	1.75	3.3	3.0	3.6	5.7
14	.....	.....	.....	8.6	7.2	4.6	1.85	1.75	3.1	3.6	4.2	7.1
15	4.5	.....	.....	8.2	6.9	4.4	1.75	1.85	3.25	2.95	4.4	7.0
16	.....	.....	.....	8.0	6.7	4.4	1.75	1.85	3.85	2.8	4.0	7.1
17	.....	.....	.....	8.0	6.6	4.3	2.0	2.05	3.85	3.3	4.2	6.8
18	.....	.....	5.1	7.6	6.4	4.2	3.1	1.82	2.9	3.4	4.7	6.8
19	.....	4.6	.....	7.4	6.3	4.4	2.7	1.75	3.15	3.6	5.1	5.8
20	.....	.....	.....	7.4	6.2	4.0	2.6	1.75	3.3	3.3	5.5	5.7
21	.....	.....	.....	7.4	5.8	4.1	2.5	1.45	3.15	3.3	5.2	5.6
22	4.4	.....	.....	7.4	5.6	4.1	2.8	1.55	2.9	3.35	4.8	5.4
23	.....	.....	.....	7.2	5.35	4.1	1.9	1.85	2.85	3.25	4.8	5.8
24	.....	.....	.....	7.2	5.4	4.0	1.55	1.9	2.9	3.6	4.6	6.0
25	.....	4.7	5.3	7.1	7.6	3.6	1.7	1.95	3.1	3.8	5.2	6.0
26	.....	.....	.....	7.2	7.6	3.8	2.45	1.9	3.5	3.6	5.0	6.0
27	.....	.....	.....	7.6	7.0	3.8	2.35	1.7	3.1	3.4	4.6	5.6
28	.....	.....	.....	7.8	6.4	3.8	2.0	1.6	2.9	3.8	4.8	5.6
29	4.4	.....	.....	8.0	6.3	3.7	1.85	1.75	3.0	3.6	4.8	7.7
30	.....	.....	.....	8.1	6.0	3.65	1.65	1.75	2.85	3.9	4.9	8.8
31	.....	.....	.....	.....	5.8	.....	1.65	1.85	.....	3.8	.....	8.6

NOTE.—Relation of gage height to discharge affected by ice from Jan. 1 to about Apr. 16 and from about Dec. 29 to 31. Gage heights to water surface, except those for Jan. 1 and 7, which are to the top of the ice. From about July 1 to Dec. 13 the gage heights read from the chain gage were affected by construction work at the new bridge. Some uncertainty also exists regarding the gage heights from Dec. 19 to 31, owing to the possibility of a permanent change in the relation of gage height to discharge, caused by the construction work at the bridge, which was completed on Dec. 13. All gage readings were taken on the chain gage, except for the periods Sept. 12 to Dec. 3 and Dec. 7 to 18, when they were read from a temporary staff gage established on the railroad bridge below the bridge to which the chain gage is attached.

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	7,160	3,680	1,660	465	365	385	875	2,200
2	.....	8,350	3,580	1,420	592	505	945	662	2,020
3	.....	8,650	3,680	1,200	490	345	750	1,020	1,690
4	.....	8,650	3,280	1,200	442	385	580	1,020	3,650
5	.....	8,350	3,280	1,200	335	365	580	875	4,000
6	.....	8,050	2,880	1,500	398	480	530	608	3,250
7	.....	7,750	2,880	1,350	465	408	810	1,020	2,900
8	.....	8,050	2,700	1,060	490	365	690	1,080	2,020
9	.....	7,600	2,500	705	565	385	875	875	1,850
10	.....	7,160	2,700	675	490	945	1,300	1,300	1,850
11	.....	6,590	2,140	1,200	442	385	810	1,380	2,200
12	4,800	6,310	2,500	1,280	355	662	810	1,380	2,400
13	5,000	5,780	2,500	1,060	442	635	480	810	2,500
14	5,500	5,520	2,700	490	442	530	810	1,230	4,040
15	6,000	5,150	2,500	442	490	608	455	1,380	3,920
16	6,200	4,910	2,500	442	490	980	385	1,080	4,040
17	6,590	4,790	2,420	565	592	980	635	1,230	3,680
18	6,040	4,560	2,320	1,280	475	430	690	1,610	3,680
19	5,780	4,440	2,500	990	442	555	810	1,940	3,680
20	5,780	4,330	2,140	925	442	635	635	2,300	3,560

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for 1911— Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	5,780	3,890	2,240	860	315	555	635	2,020	3,450
22	5,780	3,680	2,240	1,060	355	430	662	1,690	3,230
23	5,520	3,420	2,240	515	408	408	608	1,690	3,680
24	5,520	3,480	2,140	355	430	430	810	1,530	3,920
25	5,400	6,040	1,800	420	455	530	945	2,020	3,920
26	5,520	6,040	1,960	828	430	750	810	1,850	3,920
27	6,040	5,270	1,960	765	345	530	690	1,530	3,450
28	6,310	4,560	1,960	565	305	430	945	1,690	3,450
29	6,590	4,440	1,880	490	365	480	810	1,690	3,300
30	6,730	4,110	1,840	398	365	408	1,020	1,770	3,200
31	.....	3,890	.....	398	408	.....	945	.....	3,000

NOTE.—Daily discharge determined by means of four discharge rating curves: (1) A well-defined curve, used during 1910, applicable for the open-water period until June 30; (2) a rating curve based on a measurement made July 3, applicable July 1 to Aug. 22, curve only fairly well defined and period of application uncertain; (3) a well-defined curve constructed from four measurements made during September, and applicable, though with some uncertainty regarding the period, from Aug. 23 to Sept. 11, and (4) a well-defined curve constructed from measurements made during September and November, and applicable to the staff gage readings Sept. 12 to Dec. 3 and Dec. 7 to 18; also applicable to chain gage readings Dec. 4 to 6 and Dec. 19 to 31, with a correction of +0.6 foot for Dec. 4 to 6 and +1.0 foot for Dec. 19–31. Daily discharge May 13 to 16 and Dec. 29 to 31 estimated.

Monthly discharge of Raquette River at Massena Springs, N. Y., for 1911.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	1,400	1.20	1.38	D.
February	.....	.....	1,200	1.03	1.07	C.
March	.....	.....	1,350	1.15	1.33	C.
April	6,730	.....	4,800	4.10	4.57	B.
May	8,650	3,420	5,840	4.99	5.75	A.
June	3,680	1,800	2,520	2.15	2.40	A.
July	1,660	355	881	.753	.87	B.
August	592	305	436	.373	.43	B.
September	980	345	530	.453	.51	A.
October	1,300	385	737	.630	.73	A.
November	2,300	608	1,370	1.17	1.30	A.
December	4,040	1,690	3,150	2.69	3.10	B.
The year	8,650	305	2,020	1.73	23.44	

NOTE.—Discharge Jan. 1 to Apr. 11 determined from the discharge at Piercefield plus an inflow between Piercefield and Massena Springs estimated from consideration of general conditions affecting run-off in northern New York. Mean discharge Apr. 1 to 11 estimated 3,000 second-feet.

BOG RIVER NEAR TUPPER LAKE, N. Y.

Location.—Mouth of Bog River, head of Tupper Lake, 1½ miles below the junction of Bog River and the outlet from Round Pond.

Records available.—August 24, 1908, to December 31, 1911. Published also in annual reports of the New York State Water-Supply Commission and the New York State engineer and surveyor.

Drainage area.—132 square miles.

Gage.—Staff, fastened to the left wing wall of an unused dam; read once daily; datum unchanged since established.

Channel.—Possibly shifting, as the bed is composed of rock on one side and gravel on the other. The crest of the dam with the brink of the adjacent falls forms a control point considered permanent.

Discharge measurements.—Made from a car and cable about 1½ miles above the gage and immediately below the mouth of the outlet from Round Pond.

Artificial control.—The flow is more or less regulated during the spring for log driving. The operation of a small power plant on the main stream causes some variation in the daily gage heights during the low-water periods in the summer.

Winter flow.—The gage heights are usually not observed during December to March on account of ice.

Accuracy.—Low-water portion of the discharge curve well developed. As few higher measurements have been made, determinations of discharge for stages above gage height 4 feet may be somewhat in error.

Cooperation.—Established and maintained in cooperation with the Water Supply Commission of the State of New York.

Bog River and its tributary drain a number of small lakes and ponds, among which are Higgens First, Second, and Third ponds on Bog River, and Round Pond and Little Tupper Lake on the tributary, all of which lie south and southwest of Big Tupper Lake. The station is important, in connection with stations on the Raquette at Raquette Falls and Piercefield, to the study of storage feasible in Tupper Lake.

Daily gage height, in feet, of Bog River near Tupper Lake, N. Y., for 1911.

[B. O. Lott, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.5	3.0	2.0	1.1	1.0	1.3	1.4
2	2.1	4.9	3.0	2.0	1.1	1.0	1.3	1.4
3	2.1	4.9	2.8	1.9	1.0	1.0	1.3	1.4
4	2.2	4.8	2.8	1.8	1.0	1.0	1.3	1.4
5	2.4	4.8	2.8	1.7	1.0	1.0	1.4	1.4
6	2.6	4.7	2.6	1.6	1.0	1.0	1.4	1.5
7	2.7	4.5	2.8	1.6	1.0	1.0	1.5	1.5
8	2.7	4.2	2.8	1.6	1.0	1.0	1.4	1.5
9	2.6	4.0	2.6	1.6	1.0	1.0	1.4	1.5
10	2.9	3.8	2.4	1.5	.9	1.1	1.4	1.6
11	3.2	3.5	2.4	1.5	.9	1.2	1.4	1.9
12	3.7	3.2	2.4	1.4	.9	1.2	2.4	2.4
13	4.0	3.1	2.4	1.4	.9	1.2	1.4	2.5
14	4.2	3.0	2.5	1.4	.8	1.2	1.4	2.5
15	4.1	3.0	2.6	1.4	.8	1.3	1.4	2.5
16	4.1	2.8	2.5	1.4	.8	1.3	1.4	2.6
17	4.2	2.7	2.4	1.4	.9	1.3	1.4	2.6
18	4.3	2.6	2.4	1.4	.9	1.3	1.4	2.7
19	4.3	2.5	2.4	1.4	1.0	1.3	1.5	2.7
20	4.3	2.5	2.5	1.5	1.0	1.3	1.5	2.8
21	4.3	2.4	2.4	1.5	.9	1.3	1.4	2.8
22	4.2	2.5	2.4	1.4	.9	1.3	1.4	2.7
23	4.2	2.6	2.6	1.2	.9	1.3	1.5	2.6
24	4.2	3.0	2.5	1.2	.9	1.3	1.5	2.6
25	4.3	3.4	2.3	1.2	.9	1.3	1.5	2.6
26	4.3	3.5	2.2	1.2	.9	1.3	1.5	2.6
27	4.3	3.4	2.1	1.1	.9	1.4	1.5	2.7
28	4.3	3.4	2.1	1.1	1.0	1.4	1.4	2.9
29	4.2	3.4	2.1	1.0	1.0	1.4	1.4	3.1
30	4.3	3.2	2.0	1.1	1.0	1.4	1.4	3.1
31	.....	3.0	.....	1.1	1.0	.....	1.4	.....

NOTE.—No information available regarding the extent to which ice existed at this station during 1911.

Daily discharge, in second-feet, of Bog River near Tupper Lake, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	180	1,260	455	166	37	28	60	72
2	186	1,540	455	166	37	28	60	72
3	186	1,540	375	148	28	28	60	72
4	208	1,470	375	131	28	28	60	72
5	254	1,470	375	115	28	28	72	72
6	310	1,400	310	100	28	28	72	85
7	340	1,260	375	100	28	28	85	85
8	340	1,060	375	100	28	28	72	85
9	310	940	310	100	28	28	72	85
10	415	825	254	85	20	37	72	100
11	535	670	254	85	20	48	72	148
12	770	535	254	72	20	48	72	254
13	940	495	254	72	20	48	72	280
14	1,060	455	280	72	14	48	72	280
15	1,000	455	310	72	14	60	72	280
16	1,000	375	280	72	14	60	72	310
17	1,060	340	254	72	20	60	72	310
18	1,130	310	254	72	20	60	72	340
19	1,130	280	254	72	28	60	85	340
20	1,130	280	280	85	28	60	85	375
21	1,130	254	254	85	20	60	72	375
22	1,060	280	254	72	20	60	72	340
23	1,060	310	310	48	20	60	85	310
24	1,060	455	280	48	20	60	85	310
25	1,130	625	230	48	20	60	85	310
26	1,130	670	208	48	20	60	85	310
27	1,130	625	186	37	20	72	85	340
28	1,130	625	186	37	28	72	72	415
29	1,060	625	186	28	28	72	72	495
30	1,130	535	166	37	28	72	72	495
31	.....	455	.....	37	28	.....	72	.....

NOTE.—Daily discharge determined from a discharge rating curve fairly well defined below about 80 second-feet. Discharge Apr. 1 estimated.

Monthly discharge of Bog River near Tupper Lake, N. Y., for 1911.

[Drainage area, 132 square miles.]

Month.	Discharge in second-feet.				Run-off d(epth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	120	0.909	1.05	D.
February	.....	.....	100	.758	.79	D.
March	.....	.....	120	.909	1.05	D.
April	1,130	180	783	5.93	6.62	A.
May	1,540	254	723	5.48	6.32	A.
June	455	166	286	2.17	2.42	A.
July	166	28	80.1	.607	.70	A.
August	37	14	23.9	.181	.21	C.
September	72	28	49.6	.376	.42	A.
October	85	60	73.8	.559	.64	A.
November	495	72	247	1.87	2.09	A.
December	.....	.....	450	3.41	3.93	D.
The year	1,540	14	255	1.93	26.24	

NOTE.—Discharge January, February, March, and December estimated from climatologic records and general conditions of run-off in northern New York.

ST. REGIS RIVER AT BRASHER CENTER, N. Y.

Location.—At the steel highway bridge in the village of Brasher Center, 5 miles downstream from Brasher Falls, 6½ miles below the junction of East and West branches of St. Regis River, and about 12 miles above the mouth.

Records available.—August 22, 1910, to December 31, 1911. Data published also in annual reports of State Water Supply Commission and State Conservation Commission of New York.

47883°—WSP 304—12——6

Drainage area.—621 square miles (measured on post-route map).

Gage.—Chain, fastened to downstream side of bridge; read twice daily; datum unchanged.

Channel.—Very rough; composed of gravel and large bowlders; considered permanent. Velocity of current at high stages very swift and water rough.

Discharge measurements.—At low stages made by wading about 500 feet below the bridge; at high stages made from the bridge.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Discharge rating curve not yet developed.

Cooperation.—Established by United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of St. Regis River at Brasher Center, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 20[a]	Shuttleworth and Hoyt	7.15	526
Apr. 13	C. S. De Golyer	6.30	3,750
13	....do	6.26	3,650
July 2	G. H. Canfield	4.57	709

[a] Measurement made under complete ice cover about 400 feet above gage. Gage height to top of ice 7.20 feet; average thickness of ice 0.85 foot.

Daily gage height, in feet, of St. Regis River at Brasher Center, N. Y., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.70	6.20	4.75	4.55	4.28	4.15	4.42	4.48	5.32
2	.....	5.55	6.68	4.72	4.52	4.25	4.05	4.45	4.72	5.32
3	.....	5.60	6.32	4.82	4.55	4.10	4.02	4.42	4.75	5.08
4	.....	5.40	6.20	4.80	4.62	4.08	4.05	4.60	4.59	4.95
5	.....	5.15	5.90	4.74	4.56	4.15	4.10	5.00	4.52	4.85
6	.....	8.25	5.80	4.80	4.48	4.22	4.15	5.20	4.51	4.71
7	.....	8.70	5.55	4.85	4.62	4.29	4.75	5.12	4.60	4.78
8	.....	8.80	5.50	4.65	4.45	4.28	4.78	4.95	4.90	4.72
9	.....	7.25	5.42	4.68	4.48	4.20	4.68	4.78	5.08	4.95
10	.....	6.60	5.35	4.90	4.41	4.32	4.45	4.68	5.06	5.10
11	.....	6.35	5.30	4.65	4.42	4.15	4.30	4.45	5.04	5.35
12	.....	6.20	5.30	4.80	4.45	4.05	4.38	4.40	5.04	5.52
13	.....	6.40	5.12	4.92	4.18	4.19	4.35	4.55	4.85	6.10
14	.....	6.70	5.05	5.12	4.15	4.12	4.38	4.48	4.84	6.08
15	.....	6.85	5.15	5.15	4.08	4.08	4.45	4.38	4.82	5.82
16	.....	6.80	4.55	5.25	4.15	4.15	4.38	4.36	4.76	5.72
17	.....	6.75	4.85	5.12	4.08	4.12	4.32	4.38	4.80	5.35
18	.....	6.65	4.68	4.95	4.32	4.09	4.28	4.45	4.90	5.28
19	.....	6.10	4.75	4.72	4.25	4.12	4.40	4.55	5.15	5.40
20	.....	6.25	4.55	4.60	4.35	4.25	4.40	4.06	5.09	5.32
21	.....	5.95	4.58	4.72	4.22	4.30	4.38	4.52	5.06	5.25
22	.....	6.15	4.65	4.82	4.19	4.25	4.25	4.52	5.04	5.18
23	.....	6.18	4.78	4.65	4.10	4.22	4.22	4.45	4.92	5.55
24	.....	6.02	4.70	4.52	4.08	4.22	4.25	4.48	4.49	5.60
25	.....	6.00	5.95	4.38	4.15	4.30	4.22	4.35	4.78	5.42
26	.....	6.18	5.55	4.38	4.05	4.21	4.35	4.45	4.72	5.38
27	.....	6.28	5.25	4.58	4.18	4.32	4.72	4.44	4.70	5.30
28	7.95	6.25	5.05	4.60	3.98	4.15	5.02	4.42	4.75	5.30
29	6.88	6.28	5.05	4.55	4.09	4.35	4.42	4.41	5.20	5.60
30	6.15	6.25	4.85	4.59	3.95	4.32	4.35	4.38	5.35	5.78
31	5.80	.....	4.75	.....	3.98	4.38	.....	4.48	.....	5.95

NOTE.—Relation of gage height to discharge probably affected by backwater from ice during the latter part of March, the first part of April, and the last few days of December. It is not known when the ice passed out of the river.

RICHELIEU RIVER AND LAKE CHAMPLAIN.

LAKE CHAMPLAIN AT BURLINGTON, VT.

Location.—On the south side of the roadway leading to the dock of the Champlain Transportation Co. at Burlington, Vt., at a point about 80 feet from the road at the foot of King Street.

Records available.—May, 1907, to December 31, 1911.

Gage.—Staff; read once daily. Comparison of gage readings, made under the direction of Prof. A. D. Butterfield on calm days during 1907–8, indicate that the zero of the gage at Burlington is at practically the same elevation as that of the gage at Fort Montgomery, namely, 92.50 feet above mean sea level.

Cooperation.—Gage heights at Burlington and tables showing dates when the ice went out and transportation began, furnished through the courtesy of Mr. D. A. Loomis, general manager of the Champlain Transportation Co.

Daily gage height, in feet, of Lake Champlain at Burlington, Vt., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	6.00	3.75	2.15	.....	0.60	.....	1.10	1.50
2	.....	.....	.....	.....	6.05	3.65	.....	1.10	.60	.....	1.10	1.50
3	1.50	.....	.....	2.94	6.25	3.55	2.10	1.10	.....	.....	1.10	.....
4	.....	.....	.....	2.97	6.23	.....	.....	1.10	.60	.....	1.00	1.50
5	.....	.....	.....	.....	6.15	3.48	.....	1.10	.60	.....	1.05	1.50
6	.....	.....	.....	3.05	6.10	3.40	2.00	.....	.60	.....	1.10	1.50
7	.....	.....	.....	3.38	5.95	3.30	1.95	1.05	.60	0.65	1.10	1.55
8	.....	.....	.....	3.82	.....	3.25	.....	.....	.....	.....	1.10	1.55
9	2.00	.....	.....	.....	5.85	3.15	1.80	.85	.....	.65	1.10	1.50
10	.....	.....	.....	4.48	5.80	3.12	.....	.85	.....	.65	1.10	.....
11	.....	.....	.....	4.64	5.70	.....	1.80	.85	.....	.68	1.05	1.55
12	.....	.....	a 2.10	4.75	5.55	3.05	1.70	.85	.65	.68	.....	1.60
13	.....	.....	a 2.20	4.90	5.40	3.00	1.65	.....	.....	.70	1.10	1.70
14	.....	.....	a 2.10	5.05	5.25	2.95	1.60	.80	.55	.70	1.10	1.90
15	.....	.....	a 2.10	5.33	.....	2.90	1.58	.80	.....	.....	1.10	2.10
16	.....	.....	1.70	.....	5.12	.....	.....	.80	.52	.65	1.10	2.20
17	2.20	.....	1.70	5.82	5.05	.....	1.55	.78	.....	.65	1.15	.....
18	.....	.....	.....	5.90	4.95	.....	1.51	.78	.56	.65	1.20	2.30
19	.....	.....	.....	5.92	4.85	.....	1.45	.78	.60	.75	.....	2.30
20	.....	.....	.....	5.93	4.80	2.75	.....	.....	.60	.85	1.22	2.30
21	.....	.....	1.80	5.94	.....	2.68	1.40	.70	.58	.90	1.28	2.30
22	.....	.....	.....	5.95	4.55	2.60	1.40	.70	.....	.....	1.30	2.30
23	.....	.....	.....	.....	.....	2.55	.....	.70	.....	1.00	1.30	2.45
24	.....	2.10	.....	5.90	4.40	2.50	1.30	.65	.....	1.05	1.30	.....
25	.....	.....	.....	5.90	4.30	.....	1.25	.64	.....	1.05	1.30	2.50
26	.....	.....	.....	5.89	4.20	2.40	1.20	.....	.60	1.10	.....	2.70
27	.....	.....	1.90	5.90	4.10	2.35	1.20	.60	.....	1.10	1.30	2.90
28	.....	.....	2.15	5.95	.....	2.30	1.20	.52	.57	1.10	1.35	2.90
29	.....	.....	2.40	5.95	4.00	2.25	1.15	.60	.....	.....	1.40	2.90
30	.....	.....	.....	.....	3.90	2.20	.....	.60	.52	1.10	1.40	2.80
31	.....	.....	2.80	.....	3.80	.....	1.15	.60	.....	1.15	.....	.....

a To top of ice.

NOTE.—The lake was frozen at the gage during January, February, March, and April. The thickest ice recorded was 18½ inches Mar. 13 and 20. No ice notes for the latter part of the year.

RICHELIEU RIVER AT FORT MONTGOMERY, ROUSES POINT, N. Y.

Location.—About half a mile from the head of Richelieu River at the outlet of Lake Champlain, about 1 mile northeast of the village of Rouses Point and three-eighths of a mile south of the Canadian boundary; in the fort.

Records available.—1875 to 1911; data published in the reports of the Deep Waterways Survey, the annual reports of the State engineer and surveyor of the State of New York, and in the water-supply papers of the United States Geological Survey. Gage heights for 1911 will be published in the 1912 report.

Drainage area.—8,180 square miles at Chambly.

Gage.—Staff, read once daily. Elevation of gage zero at Fort Montgomery is 92.50 feet above mean sea level; high-water level is at elevation 101.6 feet; probably lowest elevation recorded at Fort Montgomery is 91.9 feet November 13, 1908.

Determination of flow.—The daily discharge of the lake has been determined from observations of depth and discharge over the Chambly dam, 35 miles below the head of Richelieu River, made in 1898 by the United States Board of Deep Waterways. A discharge rating curve has been constructed from the observations at Chambly dam and the gage readings at Rouses Point. The area tributary to the river between Rouses Point and Chambly is 310 square miles.

Winter flow.—Relation of gage height to discharge probably affected by ice, as the entire surface of Lake Champlain freezes over nearly every winter.

Cooperation.—Observations of gage heights are made under the direction of the Corps of Engineers of the United States Army. Gage readings reported weekly to the Survey through the courtesy of Maj. Edward Burr.

Accuracy.—Gage heights and estimates of daily discharge since 1907 are withheld pending verification of the rating curve.

AUSABLE RIVER AT AUSABLE FORKS, N. Y.

Location.—In the village of Ausable Forks, immediately below the junction of the East and West branches and about 15 miles above the mouth of the river.

Records available.—August 17, 1910, to December 31, 1911. Data also in annual reports of the New York State Water Supply Commission and New York State Conservation Commission.

Drainage area.—439 square miles (measured on post-route map).

Gage.—Chain, on the left bank, about 100 feet below the junction of East and West branches of Ausable River; read twice daily; datum unchanged.

Channel.—Sand and gravel; liable to shift. Divided by an island.

Discharge measurements.—Made from a car hung on a cable about 1½ miles below the gage. At this place the river flows in one channel.

Winter flow.—Ice may form on the riffles below the gage and either divert or cause backwater.

Accuracy.—Conditions at the measuring section good. Discharge rating curve not yet developed.

Cooperation.—Established by the United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Ausable River at Ausable Forks, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 25[a]	F. J. Shuttleworth	3.63	188
Apr. 14	C. S. De Golyer	4.96	2,130
14	do	4.97	2,160
June 28[b]	G. H. Canfield	3.73	308
Aug. 10[b]	do	3.54	152

[a] Measurement made by wading about 300 feet above gage. Section at cable frozen over. Average thickness, 1.2 feet. Section at gage nearly clear of ice.
[b] Measurements by wading at cable section.

Daily gage height, in feet, of Ausable River at Ausable Forks, N. Y., for 1911.

[H. Edward Minor, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.82	3.90	5.7	3.87	3.69	3.52	3.61	3.64	3.70	3.98
2	.....	3.65	3.97	7.1	4.01	3.59	3.53	3.57	3.72	3.77	3.89
3	.....	3.92	3.99	5.15	3.87	3.67	3.53	3.57	3.68	3.78	3.76
4	.....	3.63	4.03	4.70	3.79	3.60	3.54	3.57	3.70	3.76	3.84
5	.....	3.65	3.84	4.35	3.81	3.58	3.50	3.58	4.35	3.63	3.78
6	.....	3.76	5.05	4.25	3.71	3.58	3.49	4.00	4.16	3.67	3.76
7	.....	3.88	5.9	4.30	3.77	3.60	3.56	4.18	3.94	3.77	3.70
8	.....	3.66	5.00	4.65	3.67	3.57	3.58	3.84	3.75	4.13	3.71
9	.....	3.65	4.27	4.80	3.88	3.53	3.60	3.63	3.78	4.00	3.75
10	.....	3.62	4.33	4.80	3.94	3.57	3.55	3.64	3.76	3.88	3.65
11	.....	3.63	4.29	4.65	3.91	3.56	3.56	3.62	3.76	3.88	3.99
12	.....	3.66	4.30	4.75	3.99	3.52	3.51	3.64	3.69	3.95	4.70
13	.....	3.92	4.48	4.55	4.52	3.56	3.52	3.66	3.64	4.43	5.7
14	.....	3.86	5.10	4.14	4.31	3.48	3.53	3.62	3.63	4.07	4.85
15	.....	3.90	5.6	4.09	4.17	3.48	3.52	3.62	3.64	3.91	4.44
16	.....	4.02	5.00	3.93	4.23	3.54	3.56	3.67	3.63	3.82	4.18
17	.....	3.98	4.60	4.47	4.15	3.56	3.52	3.61	3.58	3.80	4.15
18	.....	3.72	4.45	3.94	3.95	3.61	3.50	3.70	3.69	3.84	4.05
19	.....	3.64	4.28	4.09	3.83	3.70	3.48	3.62	4.36	3.86	3.88
20	.....	3.68	4.38	4.07	3.79	3.62	3.54	3.62	4.19	3.80	4.14
21	.....	3.73	4.34	3.91	3.76	3.56	3.66	3.56	4.05	3.78	3.99
22	.....	3.70	4.28	3.97	3.73	3.56	3.53	3.66	4.10	3.72	3.80
23	.....	3.82	4.28	3.92	3.71	3.49	3.56	3.62	4.20	3.68	4.56
24	.....	4.70	4.22	4.03	3.75	3.53	3.55	3.58	4.06	3.74	4.68
25	3.63	3.91	4.44	4.11	3.55	3.54	3.62	3.72	3.92	3.76	4.28
26	3.66	4.18	4.75	4.09	3.85	3.60	3.55	3.64	3.82	3.51	4.14
27	3.92	4.46	4.95	3.95	3.69	3.79	3.54	3.68	3.78	3.65	3.97
28	4.07	4.85	5.35	3.83	3.66	3.55	3.56	3.62	3.77	3.69	3.92
29	.....	4.36	5.55	3.83	.....	3.55	3.64	3.64	3.66	4.02	4.22
30	.....	4.14	5.55	3.72	.....	3.55	3.68	3.68	3.66	4.02	4.70
31	.....	3.98	.....	3.69	.....	3.60	3.63	.....	3.69	.....	4.70

NOTE.—The relation of gage height to discharge was known to be affected by ice Feb. 25. It is probable that there was also backwater effect from ice from Jan. 1 until some time in March.

EAST CREEK NEAR RUTLAND, VT.

Location.—At Lester Bridge, on the road from Rutland to Brandon, Vt., about 3 miles north of Rutland, 2½ miles below the union of the two branches which drain Blue Ridge Mountain, and 3½ miles above the confluence with Otter River.

Records available.—August 9 to December 31, 1911.

Drainage area.—47 square miles.

Gage.—Vertical staff fastened to the left-hand downstream side of the bridge.

Channel.—Probably permanent.

Discharge measurements.—Made from the bridge or by wading.

Artificial control.—The flow of the stream is regulated by two dams near the headwaters and one dam about a mile below the station. The upper dams store considerable water. The relation between gage heights and discharge is not affected by backwater from the dam below.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Discharge measurements of East Creek near Rutland, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 7[a]	G. H. Canfield	3.59	46.0
Aug. 9[a]	do	3.69	57.2

[a] Wading 150 feet downstream from bridge.

WINOOSKI RIVER ABOVE STEVENS BRANCH, NEAR MONTPELIER, VT.

Location.—At the plant of the Corry-Deavitt & Frost Co., 3 miles above Montpelier, Vt., above the several large tributaries that enter in the vicinity of Montpelier.

Records available.—May 18, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff bolted to a bowlder on the right bank about 100 feet below the power plant; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from the lower railroad bridge about half a mile below the gage.

Artificial control.—As the power plant is operated on a 24-hour schedule, daily fluctuations in the stage of the river are usually not great.

Winter flow.—Considerable effect by anchor ice.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with State of Vermont. Gage heights have been furnished by the Corry-Deavitt & Frost Electric Co.

Discharge measurements of Winooski River above Stevens Branch, near Montpelier, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 21 [a]	G. H. Canfield	2.64	136
21 [b]	do	2.19	43.6
Aug. 5 [b]	do	2.19	43.9
5 [c]	do	1.75	8.5
6	do	2.38	71.9

[a] One turbine at 0.8 gate opening; other turbine at full gate opening.
[b] Only one turbine running at 0.5 gate opening.
[c] Neither wheel in operation; discharge indicates amount of water passing through the plant when the turbines are not being used.

NOTE.—First measurement made at railroad bridge below; all others made in tailrace of power plant.

WINOOSKI RIVER AT MONTPELIER, VT.

Location.—At the covered wooden highway bridge near the Central Vermont Railroad station in Montpelier and near the plant of the Colton Manufacturing Co., just above the mouth of Dog River.

Records available.—May 19, 1909, to December 31, 1911.
Drainage area.—Not measured.
Gage.—Chain, attached to the highway bridge; datum unchanged.
Channel.—Probably permanent.
Discharge measurements.—Made from a footbridge about half a mile below the highway bridge.
Winter flow.—Relation between gage heights and discharge during the winter months is sometimes affected by ice.
Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.
Cooperation.—Station established in cooperation with the State of Vermont; gage readings furnished by the Colton Manufacturing Co.

Discharge measurements of Winooski River at Montpelier, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 20 [a]	G. H. Canfield	4.18	236
Aug. 6 [b]	do	3.35	17.1

[a] Made from suspension bridge one-half mile below gage.
[b] Made by wading 1 mile below gage.

WORCESTER BRANCH OF WINOOSKI RIVER AT MONTPELIER, VT.

Location.—At Montpelier, a short distance below the plant of the Lane Manufacturing Co., near the junction of Worcester Branch with the main stream.
Records available.—May 15, 1909, to December 31, 1911.
Drainage area.—Not measured.
Gage.—Vertical staff fastened to a stone wall and tree about 100 feet below the plant; datum unchanged.
Channel.—Probably permanent.
Discharge measurements.—Made from a steel highway bridge about 300 feet below the gage.
Winter flow.—Relation between gage height and discharge during the winter months is materially affected by ice.
Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.
Cooperation.—Station established in cooperation with the State of Vermont. Gage readings furnished by the Lane Manufacturing Co.

Discharge measurements of Worcester Branch of Winooski River at Montpelier, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 20 [a]	G. H. Canfield	1.07	28.0
Aug. 6 [b]	do	.80	4.9

[a] Made from highway bridge about 500 feet below gage.
[b] Made by wading near the gage. Power plant not in operation; measurement indicates leakage through wheels.

DOG RIVER AT NORTHFIELD, VT.

Location.—At the wooden highway bridge about 600 feet below the dam of the Rabidou Lumber Co. and about three-fourths of a mile from the railroad station at Northfield, Vt.

Records available.—May 14, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff attached to the highway bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from the highway bridge to which the gage is fastened, and also from a highway bridge near Norwich University.

Winter flow.—Relation between gage height and discharge during the winter months seriously affected by ice.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont. With the exception of the computations of results and a few discharge measurements, all of the data for this station have been collected by students of Norwich University under the direction of Prof. C. S. Carleton.

The following discharge measurement was made by G. H. Canfield by wading 100 feet above the bridge:

June 19, 1911: Gage height, 1.00 foot; discharge, 120 second-feet.

LAMOILLE RIVER AT JOHNSON, VT.

Location.—At the highway bridge in the town of Johnson on the main road from the railroad station to the post office about 400 feet above the mouth of Ginon River.

Records available.—July 14, 1910, to December 31, 1911; from July 28, 1909, to July 13, 1910, a station was maintained on the Lamoille at Morrisville.

Drainage area.—Not measured.

Gage.—Chain, fastened to the hand rail of the bridge.

Channel.—Probably permanent; bed composed of gravel; ledge rock projects from the left bank; a small gravel riffle about 350 feet below the bridge will prevent backwater at the gage.

Discharge measurements.—At high stages made from footbridge; at low stages made by wading about 500 feet above the bridge.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the two mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established and maintained in cooperation with the State of Vermont.

Discharge measurements of Lamoille River at Johnson, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 27	G. H. Canfield	2.12	104
Aug. 5[a]	do	2.09	95.8

[a] Made by wading 400 feet above the bridge.

MISSISQUOI RIVER NEAR RICHFORD, VT.

Location.—At the highway bridge 200 feet below the Central Vermont Railroad bridge, 3 miles downstream from Richford, about 3 miles below the mouth of North Branch, and 2 miles above the mouth of Trout River.

Records available.—May 29, 1909, to December 31, 1911.

Drainage area.—300 square miles.

Gage.—Chain fastened to the downstream side of the bridge; installed June 26, 1911. From May 29, 1909, to December 31, 1910, the gage was just below the plant of the Sweat, Comings Company; this site was found unsatisfactory because of the great daily fluctuations caused by the operation of the turbines.

Channel.—Deep; banks not liable to be overflowed; bed composed of gravel, bowlders, and rock ledge; current sluggish at low stages. A well-defined riffle about half a mile downstream protects the gage from backwater from the mills.

Discharge measurements.—At high stages made from downstream side of bridge; at low stages by wading.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont.

Discharge measurements of Missisquoi River near Richford, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 26	G. H. Canfield	5.10	188
Aug. 4[a]	do	4.74	82.2

[a] Measurement made by wading ¼ mile above the gage.

TRIBUTARY THROUGH ST. FRANCIS RIVER.

CLYDE RIVER AT WEST DERBY, VT.

Location.—Just below the plant of the Newport Electric Light Co., at West Derby, Vt.

Records avaliable.—May 25, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, in two sections; low section about 75 feet below the plant; high-water section nailed to a tree on the right bank 10 feet farther downstream; datum unchanged.

Channel.—Bed rough; fall of river rapid near and below the station.

Discharge measurements.—Made from highway bridge about half a mile below the gage.

Artificial control.—At West Derby are two dams both operated under the same management; at the upper dam part of the water is used by a paper mill and the remainder is delivered to the water wheels at the electric plant through a steel penstock; the total operating head from this dam is about 108 feet. All the flow from the second dam is diverted to the wheels in the power house, giving a head of about 30 feet. Practically no water is stored at the upper dam, but a pond of considerable size may be made by building a dam above this point.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation bteween the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont. Gage heights furnished by the Newport Electric Light Co.

Discharge measurements of Clyde River at West Derby, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 24	G. H. Canfield	2.17	125
25	do	2.13	117
Aug. 3	do	1.90	78.4
3[a]	C. C. Covert	1.92	82
3[b]	do	1.88	71.9
Oct. 27	do	2.26	165

[a] Water backed up by mill, 300 feet below bridge.
[b] Made by wading above bridge.

MISCELLANEOUS DISCHARGE MEASUREMENTS IN ST. LAWRENCE RIVER BASIN.

The following miscellaneous discharge measurements were made in the St. Lawrence River basin in 1911:

Miscellaneous measurements in St. Lawrence River drainage basin in 1911.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
June 4	Pigeon River	Lake Superior	6 miles above Cascades, Minn.	107
May 29	Arrow River	Pigeon River	½ mile above mouth	284
July 9	Temperance River	Lake Superior	600 feet above highway bridge near Schroeder, Minn.	35
Aug. 4	do	do	do	106
Oct. 6	do	do	do	180
July 13	Cross River	do	Near mouth near Schroeder, Minn.	[a] 7.6
Aug. 1	do	do	do	90
Oct. 6	do	do	do	66
May 7	Manitou River	do	At mouth, Minn	119
Aug. 5	do	do	do	147
Oct. 6	do	do	do	121
Apr. 23	Silver Creek	do	2 miles above mouth	16
May 8	Baptism River	do	At mouth, Minn	135
July 22	do	do	do	19
Aug. 5	do	do	do	272
Oct. 7	do	do	do	139
July 29	Gooseberry River	do	do	27
Aug. 6	do	do	do	15
Apr. 25	do	do	do	49
May 9	Lester River	do	do	16

Date.	Stream.	Tributary to—	Locality.	Gage height.[b]	Discharge.
				Feet.	*Sec.-ft.*
Mar. 15	Canaseraga Creek	Genesee River	Shakers Crossing, N. Y.	14.35	[c] 1,500
30	do	do	do	17.84	1,180
26	do	do	do	21.15	[d] 242
Aug. 26	Tailrace, Mount Morris power plant.	do	50 feet above the bridge, Mount Morris, N. Y.	[e] 2.52	179
May 20	Salmon River	Lake Ontario	Highway bridge 1½ miles west of Redfield, N. Y.	[f] 11.64	413
Aug. 10	Palmer Creek	Ausable River	Near bridge between Miners Hotel and railroad station, Ausable Forks, N. Y.		.8
Aug. 8	Cold River	Otter Creek	Railroad bridge near Rutland, Vt.		[g] 7.8

[a] Logging dams closed.
[b] Distance from reference point to water surface.
[c] About 300 second-feet from Genesee River on account of diversion for power. Some indication of back water from Genesee River.
[d] Measurement of diversion from Genesee River in tailrace gave 179 second-feet.
[e] Gage at highway bridge below mills.
[f] Reference point, top of crossbeam upstream side, 45 feet from right abutment.
[g] Does not represent total discharge. There is a diversion through an old power canal about 1 mile above point of measurement. This condition ascertained from a local engineer after measurement was made.

SUMMARY OF DISCHARGE PER SQUARE MILE.

The following summary of discharge per square mile is given to allow ready comparison of relative rates of run-off from different areas in the St. Lawrence River drainage basin. It shows in a general way the seasonal distribution of run-off and the effect of snow, ground, surface, and artificial storage. But the most important fact worth noting is the almost entire lack of uniformity of agreement between any two stations. It indicates that the discharge of each stream is a law unto itself, and that all projects dependent upon stream flow, if they are to be developed along the safest and most economical lines, must be based on records of stream flow collected with great care over a long series of years as near the location of the project under consideration as possible:

Summary of discharge, in second-feet per square mile, for river stations in the St. Lawrence River drainage basin in 1911.

	Drainage area.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	Sq. m.													
St. Louis River near Thomson, Minn.	3,420	0.08	0.09	0.25	1.15	1.30	0.81	0.31	1.04	1.29	0.56	0.24	0.17	0.61
Whiteface River at Meadowlands, Minn.	442	....	....	....	.....	1.74	1.40	.45	1.57	1.62	.70	....	....	....
Cloquet River near Independence, Minn.	698	.13	.14	.19	1.15	2.11	1.20	.47	.58	1.37	.88	.36	.07	.72
Escanaba River near Escanaba, Mich.	800	.34	.38	.62	3.25	2.16	1.03	.91	2.51	.91	1.84	1.44	1.25	1.39
Menominee River near Iron Mountain, Mich.	2,420	.35	.41	.62	1.60	2.04	.90	.70	1.48	.77	1.41	.95	1.06	1.03
Wolf River at Keshena, Wis.	797	.44	.50	.63	.94	1.01	.99	.64	.67	.85	1.84	1.91	1.25	.98
Manistee River near Sherman, Mich.	900	1.16	1.11	1.39	1.86	1.84	1.41	1.07	1.01	1.02	1.42	1.48	1.58	1.37
Huron River at Geddes, Mich.	757	.44	.82	.56	.74	.35	.22	.11	.11	.16	.43	.59	.63	.42
Huron River at Flat Rock, Mich.	1,000	.62	1.05	.53	.70	.37	.28	.16	.14	.16	.45	.64	.67	.48
Genesee River at St. Helena, N. Y.	1,030	2.67	1.52	2.67	2.59	.71	.64	.14	.48	.61	.99	1.41	1.78	1.35
Genesee River at Jones Bridge, near Mount Morris, N. Y.	1,410	2.48	1.56	2.80	2.21	.64	.45	.13	.41	.54	.76	1.10	1.52	1.21
Genesee River at Rochester, N. Y.	2,360	2.17	1.61	2.67	2.17	.61	.46	.19	.25	.38	.60	.87	1.30	1.11
Canadice Lake outlet near Hemlock, N. Y.	12.6	.39	.44	.78	.84	.32	.33	.31	.29	.29	.30	.33	.34	.41
Salmon River at Stillwater Bridge, near Redfield, N. Y.	191	....	....	....	.....	.....	.....	.80	.58	1.24	2.74	4.40	6.49	....
Salmon River at Pulaski, N. Y.	264	....	....	....	12.8	3.30	2.47	.86	.50	1.23	2.20	3.83	5.80	....
Orwell Brook near Altmar, N. Y.	22.1	.....	.....	.....	.....	.....	.....	.76	.36	.84	1.29	3.01	4.05	....
Black River at Boonville, N. Y.	279	1.34	.99	2.18	8.28	3.91	2.05	.23	.28	.60	1.29	2.84	4.70	2.39
Black River at Felts Mills, N. Y.	1,851	1.44	.99	1.59	6.26	3.21	1.60	.45	.58	.72	1.12	2.22	3.81	1.99
Moose River at Moose River, N. Y.	346	1.73	1.16	2.02	7.60	4.80	1.71	.93	.58	.70	2.26	2.73	4.83	2.59
Oswegatchie near Ogdensburg, N. Y.	1,580	2.97	1.15	2.25	6.22	2.20	1.36	.55	.24	.52	.72	1.69	3.41	1.85
Raquette River at Raquette Falls, near Coreys, N. Y.	418	.89	.82	.74	3.97	7.11	2.97	.65	.24	.52	1.07	1.57	3.09	1.97
Raquette River at Piercefield, N. Y.	723	.81	.99	.75	2.81	5.71	2.22	.75	.40	.49	.42	1.09	2.61	1.59
Raquette River at Massena Springs, N. Y.	1,170	1.20	1.03	1.15	4.10	4.99	2.15	.75	.37	.45	.63	1.17	2.69	1.73
Bog River at Tupper Lake, N. Y.	132	.91	.76	.91	5.93	5.48	2.17	.61	.18	.38	.56	1.87	3.41	1.93

INDEX.