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DEPARTMENT OF THE INTERIOR
Hubert Work, Secretary

U. S. GEOLOGICAL SURVEY
George Otis Smith, Director

WATER-SUPPLY PAPER 564

SURFACE WATER SUPPLY OF THE
UNITED STATES

1923

PART IV. ST. LAWRENCE RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
S. B. SOULÉ, A. H. HORTON, LASLEY LEE, A. W. HARRINGTON
and C. H. PIERCE, District Engineers

Prepared in cooperation with the States of
WISCONSIN, OHIO, NEW YORK, and VERMONT



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Geological Survey,
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Oklahoma City, Okla.

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SURFACE WATER SUPPLY OF ST. LAWRENCE RIVER BASIN, 1923

AUTHORIZATION AND SCOPE OF WORK

This volume is one of a series of 14 reports presenting records of measurements of flow made on streams in the United States during the year ending September 30, 1923.

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

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

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry 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 years ending June 30, 1895-1924

1895	\$12, 500. 00
1896	20, 000. 00
1897 to 1900, inclusive	50, 000. 00
1901 to 1902, inclusive	100, 000. 00
1903 to 1906, inclusive	200, 000. 00
1907	150, 000. 00
1908 to 1910, inclusive	100, 000. 00
1911 to 1917, inclusive	150, 000. 00
1918	175, 000. 00
1919	148, 244. 10
1920	175, 000. 00
1921 to 1923, inclusive	180, 000. 00
1924	170, 000. 00

In the execution of the work many private and State organizations have cooperated, either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on pages 5 and 6.

Measurements of stream flow have been made at about 5,600 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1923, 1,590 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous 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 water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS

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

“Second-foot” is an abbreviation for “cubic feet per second.” A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of one foot per second. It is generally used as a fundamental unit from which others are computed.

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

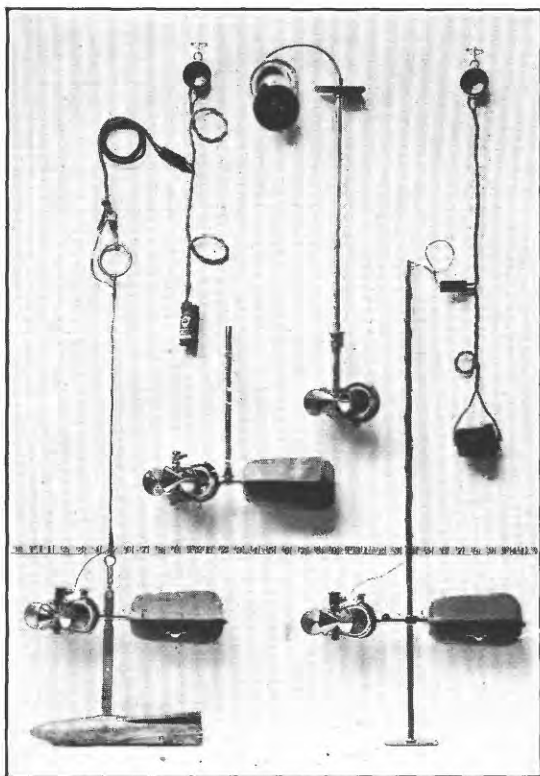
“Run-off in inches” is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

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

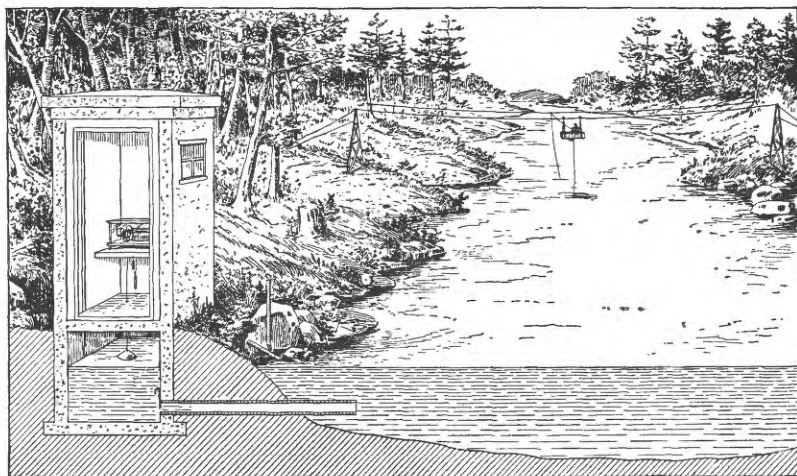
The following terms not in common use are here defined:

“Stage-discharge relation,” an abbreviation for the term “relation of gage height to discharge.”

“Control,” a term used to designate the section or sections of the stream channel below the gage which determine the stage-discharge



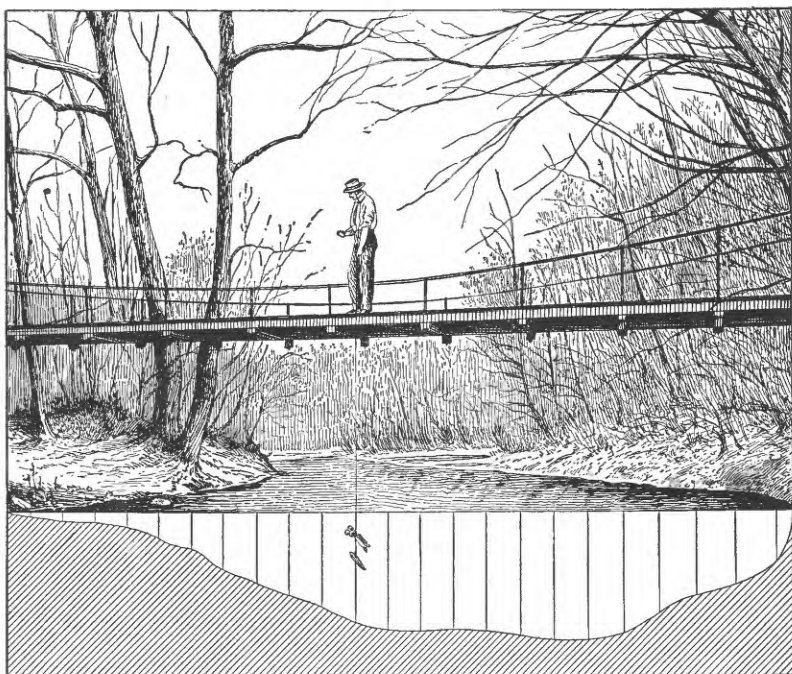
A. PRICE CURRENT METERS



B. TYPICAL GAGING STATION



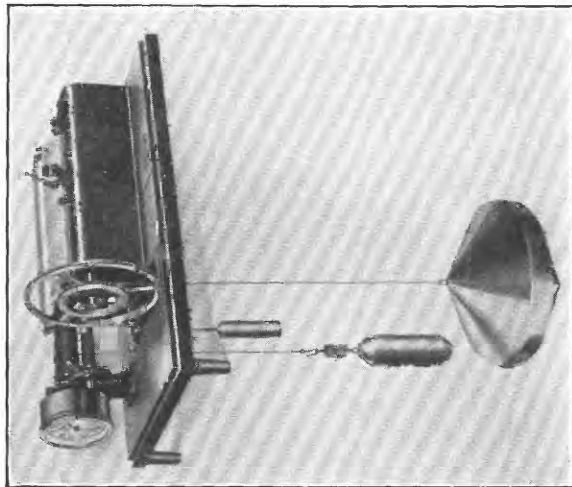
A



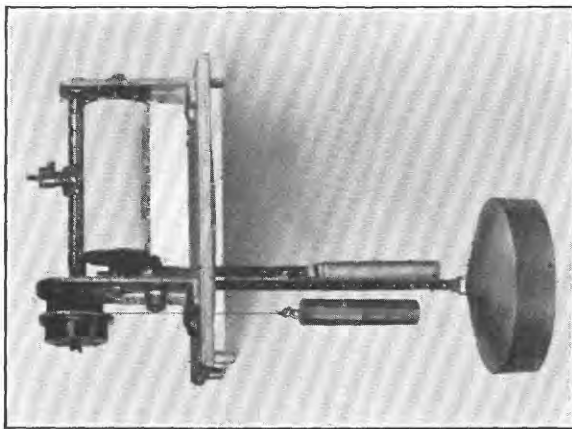
B

TYPICAL GAGING STATIONS

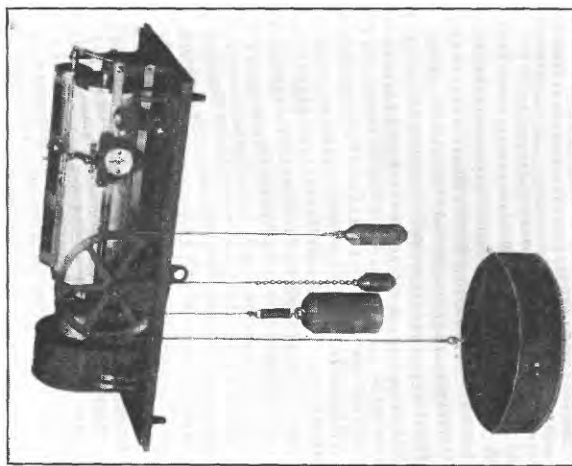
A, For wading measurement; B, for bridge measurement



A



B



C

WATER-STAGE RECORDERS

A, Au; B, Gurley; C, Stevens

relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a gaging station is that point on the gage—the gage height—at which water ceases to flow over the control.

EXPLANATION OF DATA

The data presented in this report cover the year beginning October 1, 1922, and ending September 30, 1923. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff or chain gage or from water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I-III.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage. The application of the daily gage heights to these rating tables gives the daily discharge from which the monthly and yearly mean discharge is computed.

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

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

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

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuations the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders, the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet per second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 2, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

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

A paragraph in the description of the station gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage height to the rating table to obtain the daily discharge.

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

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

Many gaging stations on streams in the irrigated areas of the United States are situated above most of the diversions from those streams, and the discharge recorded does not show the water supply available for further development, as prior appropriations below the stations must first be satisfied. To give an idea of the amount of prior appropriations, a paragraph on diversions is presented in each station description. The figures given can not be considered exact but represent the best information available.

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

COOPERATION

The work in Wisconsin during the year ending September 30, 1923, was done in cooperation with the Railroad Commission of Wisconsin, C. M. Larson, chief engineer. The United States Engineer Corps cooperated in maintaining the stations on Fox River at Berlin and at Rapide Croche Dam and on Wolf River at New London.

The station on Little Calumet River at Harvey, Ill., was maintained in cooperation with the Illinois Department of Public Works and Buildings, Division of Waterways, W. L. Sackett, superintendent; gage reader paid by the Sanitary District of Chicago.

The work in Ohio was done in cooperation with the Ohio Cooperative Topographic Survey, C. E. Sherman, inspector.

The work in New York was carried on in cooperation with the State of New York, Frank M. Williams, State engineer and surveyor, prior to January 1, 1923, and Dwight B. La Du, State engineer and surveyor, after that date. The following organizations cooperated at certain other stations: Rochester Gas & Electric Corporation (Genesee River at Driving Park Avenue, Rochester, N. Y.); the city of Rochester (Conesus Creek near Lakeville, N. Y., and Canadice Lake outlet near Hemlock, N. Y.); Utica Gas & Electric Co. (East Branch of Fish Creek at Taberg, N. Y.); Black River Regu-

lating District (Black River at Watertown, N. Y., and Moose River at McKeever, N. Y.); Beaver River Power Corporation and Northern New York Utilities (Inc.) (Beaver River at Eagle Falls, near Number Four, N. Y.); the Commission for the Improvement of Oswegatchie River (East Branch of Oswegatchie River at Cranberry Lake, N. Y.); International Paper Co. (Raquette River at Piercesfield, N. Y., and Lake George at Rogers Rock, N. Y.); New York & Pennsylvania Co. (Bouquet River at Willsboro, N. Y.); Plattsburg Gas & Electric Co. (Saranac River near Plattsburg, N. Y.).

The work in Vermont was carried on in cooperation with the State, the cooperating official being George A. Reed, State engineer. The following organizations and individuals cooperated in maintaining one or more gaging stations: Montpelier & Barre Light & Power Co. (Mollys Brook near Marshfield and Jail Branch at East Barre); Charles T. Middlebrook (Green River at Garfield); and Newport Electric Light Co. (Clyde River at West Derby).

DIVISION OF WORK

Data for stations in the Lake Superior and Lake Michigan drainage basins in Wisconsin and Michigan were collected and prepared for publication under the direction of S. B. Soulé, district engineer, assisted by E. E. Foster and J. H. Olson.

Data for the station in Illinois were collected and prepared for publication by H. E. Grosbach, district engineer.

Data for stations on Huron River at Barton, Mich., and Tittabawassee River at Freeland, Mich., were prepared for publication by A. H. Horton, district engineer, assisted by W. C. Wiggins.

Data for stations in Ohio were collected and prepared for publication under the direction of Lasley Lee, district engineer, assisted by E. E. R. Dornbach, V. B. Lamoureux, F. R. Morgan, W. W. Perrin, W. A. Werner, and L. L. Dickson.

Data for stations in New York were collected and prepared for publication under the direction of A. W. Harrington, district engineer, assisted by E. B. Shupe, J. L. Lamson, B. F. Howe, A. E. Johnson, and Agnes D. Buchanan.

Data for stations in Vermont were collected and prepared for publication under the direction of C. H. Pierce, district engineer, assisted by W. E. Armstrong, L. H. McCarthy, H. F. Hill, jr., and E. W. Downs.

The manuscript was assembled and reviewed by O. D. Mussey.

GAGING-STATION RECORDS

STREAMS TRIBUTARY TO LAKE SUPERIOR

WEST BRANCH OF MONTREAL RIVER AT GILE, WIS.

LOCATION.—In sec. 27, T. 46 N., R. 2 E., 800 feet upstream from highway bridge at Gile, Iron County, $2\frac{1}{2}$ miles southwest of Hurley, Wis., and 4 miles upstream from junction of east and west branches.

DRAINAGE AREA.—About 78 square miles¹ (measured on map of Wisconsin Soil Survey; scale, 1 inch=3 miles).

RECORDS AVAILABLE.—April 26, 1918, to September 30, 1923.

GAGE.—Sloping gage bolted to rock ledge on left bank of river a few hundred feet upstream from pump house of Ottawa Mine; read by Carl Lang.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge 800 feet below gage or by wading.

CHANNEL AND CONTROL.—Control formed by permanent rock ledge across narrow section of stream about 15 feet downstream from gage. Fall at control about 4 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.20 feet April 21 (discharge, 1,480 second-feet); minimum stage, 1.60 feet October 10 and 11 (discharge, 5.4 second-feet).

1918-1923: Maximum stage recorded, that of April 21, 1923; minimum stage, 1.32 feet July 23, 1918, and September 7, 1921 (discharge, about 2.4 second-feet).

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; not seriously affected by ice.

Rating curve used well defined below 710 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. On dates when gage was not read (generally only Sundays) discharge was interpolated and is subject to small errors. Records good.

Discharge measurements of West Branch of Montreal River at Gile, Wis., during the year ending September 30, 1923

[Made by E. E. Foster]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 21.....	1.82	9.3
July 20.....	2.70	42

¹Supersedes figure published in previous reports

Daily discharge, in second-feet, of West Branch of Montreal River at Gile, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.8	14	60	8.8	7.9	6.1	7.1	214	30	59	38	11
2	9.4	14	66	8.5	8.1	6.7	7.2	198	28	52	34	18
3	9.4	14	58	8.3	7.9	7.0	7.4	184	31	50	31	26
4	8.3	14	50	8.1	8.0	7.1	7.6	170	34	63	26	34
5	7.2	16	34	7.6	8.1	7.2	7.9	158	45	76	22	28
6	7.2	17	26	7.4	8.3	7.2	7.9	158	60	125	18	26
7	6.3	19	26	7.3	8.1	7.2	8.1	158	92	250	15	23
8	6.3	23	24	7.2	8.1	7.2	8.6	184	110	292	14	21
9	6.3	28	23	7.2	8.1	7.0	9.2	184	125	335	13	20
10	5.4	31	22	7.2	8.1	7.0	12	184	130	290	11	18
11	5.4	36	20	7.0	7.8	7.0	16	184	135	250	14	17
12	7.2	39	18	7.0	7.4	7.0	24	184	105	214	21	16
13	6.3	42	16	7.0	7.2	7.0	34	184	87	214	28	15
14	5.4	42	16	7.3	7.2	7.2	42	184	63	170	24	14
15	6.3	36	15	7.6	7.0	7.2	48	158	52	145	20	14
16	7.2	34	14	8.1	7.0	7.0	55	135	42	120	15	13
17	8.3	36	13	8.5	6.8	7.0	115	130	36	87	15	12
18	8.3	38	12	9.0	6.8	7.1	135	125	30	63	14	12
19	9.4	37	10	8.5	6.7	7.2	250	125	28	48	21	14
20	9.4	36	9.4	8.1	6.7	7.2	1,130	130	32	40	28	14
21	11.0	36	9.4	8.1	6.5	7.2	1,480	135	158	36	36	14
22	13.0	45	9.9	8.1	6.5	7.2	985	125	310	39	32	15
23	15.0	42	10	8.3	6.5	7.2	490	110	290	42	28	14
24	20	42	10	8.3	6.3	7.2	415	92	237	96	22	14
25	19	42	10	8.1	6.3	7.2	385	76	184	79	18	15
26	20	40	10	8.1	6.3	7.2	335	60	170	66	16	13
27	18	38	9.9	8.3	6.1	7.0	310	56	170	48	15	10
28	18	38	9.7	8.3	5.9	7.0	290	52	125	40	14	9.6
29	17	30	9.4	8.3	-----	7.0	261	48	83	46	14	9.4
30	16	45	9.4	8.1	-----	7.0	232	40	66	52	12	11
31	15	-----	9.1	7.9	-----	7.0	-----	32	-----	48	9.4	-----

NOTE.—Gage not read Sundays; discharge interpolated.

Monthly discharge of West Branch at Montreal River at Gile, Wis., for the year ending September 30, 1923

[Drainage area, 78 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	20	5.4	10.6	0.136	0.16
November	45	14.0	32.1	.412	.46
December	66	9.1	20.6	.264	.30
January	9.0	7.0	7.92	.102	.12
February	8.3	5.9	7.20	.0924	.10
March	7.2	6.1	7.06	.0905	.10
April	1,480	7.1	237	3.04	3.39
May	214	32	134	1.72	1.98
June	310	28	103	1.32	1.47
July	335	36	114	1.46	1.68
August	38	9.4	20.6	.264	.30
September	34	9.4	16.4	.210	.23
The year	1,480	5.4	59.2	.759	10.29

STREAMS TRIBUTARY TO LAKE MICHIGAN

MENOMINEE RIVER AT TWIN FALLS, NEAR IRON MOUNTAIN, MICH.

LOCATION.—In sec. 12, T. 40 N., R. 31 W., at power plant of Peninsular Power Co., $3\frac{1}{2}$ miles north of city of Iron Mountain, Mich. Pine River enters from right 3 miles below station.

DRAINAGE AREA.—1,790 square miles.

RECORDS AVAILABLE.—January 1, 1914, to September 30, 1923.

GAGES.—Staff and float gages used to determine effective head on water wheels.

DISCHARGE.—The daily discharge was computed from hourly determinations of the flow through the turbines computed from a record of the number of wheels in operation, the kilowatt output, and the effective head. To the average flow through the turbines is added the water passing over the spillway, through the gates, down the log sluice, and leakage through the idle wheels and through the dam.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge recorded during the year, 10,000 second-feet April 23; minimum mean daily discharge, 618 second-feet August 23.

1914-1923: Maximum mean daily discharge recorded, 16,700 second-feet April 23 and 24, 1916; minimum mean daily discharge, 274 second-feet August 10, 1919.

REGULATION.—Besides the regulation at this power plant, the flow is subject to the regulation of a power plant on Brule River about 5 miles above this point, owned by the same company. Owing to variations in demand, the daily discharge bears no relation to the natural flow, but the mean monthly discharge probably corresponds closely to the natural flow.

ACCURACY.—Discharge records published in the following tables were obtained by adding 10 per cent to discharge as computed from power-plant records.

This correction is based upon the results of five current-meter measurements made in 1919 and 1922 by the United States Geological Survey at a point about 1 mile downstream from power plant.

COOPERATION.—Daily-discharge records furnished by Mead and Seastone, consulting engineers, Madison, Wis.

Daily discharge, in second-feet, of Menominee River at Twin Falls, near Iron Mountain, Mich., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	1,020	937	1,310	988	771	780	726	5,000	1,220	1,200	1,020	950
2.....	1,040	806	1,320	942	805	861	845	5,300	1,150	1,230	1,130	705
3.....	943	917	823	880	915	906	887	5,170	904	1,330	1,060	647
4.....	1,050	991	1,220	902	912	1,170	772	4,650	1,260	974	1,160	1,030
5.....	1,070	968	1,030	884	967	972	770	4,380	1,180	1,030	1,040	1,130
6.....	962	922	1,080	925	927	956	666	4,500	1,960	1,110	989	987
7.....	932	960	1,180	965	938	824	660	4,230	2,960	1,230	1,100	1,150
8.....	895	932	958	953	996	744	896	3,450	3,760	1,980	1,000	1,120
9.....	824	938	1,040	908	981	725	729	3,220	3,490	2,180	992	957
10.....	796	1,020	1,020	967	927	713	691	2,880	2,500	3,000	957	998
11.....	764	1,180	947	1,010	732	696	864	2,450	2,700	3,050	846	1,070
12.....	850	847	952	940	768	860	893	2,080	2,460	2,420	746	1,140
13.....	949	1,100	874	956	783	795	1,030	2,940	1,860	2,170	720	1,170
14.....	952	1,150	904	949	767	844	768	2,690	1,570	2,060	685	1,150
15.....	1,010	1,600	931	837	682	896	740	2,290	1,530	1,410	688	1,130
16.....	965	1,410	970	806	631	917	798	2,460	1,560	1,470	674	932
17.....	896	1,520	1,040	785	639	902	866	2,470	1,120	1,320	683	1,110
18.....	778	1,600	969	774	735	780	1,240	1,870	1,280	1,150	691	1,110
19.....	864	1,280	954	707	708	736	1,040	1,370	1,270	1,130	635	1,040
20.....	901	2,040	890	729	619	752	2,350	1,960	1,420	1,160	630	1,020
21.....	910	1,870	895	757	671	867	5,000	2,400	2,310	1,100	632	1,060
22.....	954	1,370	866	763	664	1,040	7,940	2,420	1,710	745	632	949
23.....	923	1,300	864	749	676	902	10,000	2,120	2,830	1,080	618	1,100
24.....	1,040	1,340	739	873	697	892	9,170	1,480	1,610	1,270	705	968
25.....	1,040	946	774	970	689	723	7,150	1,820	2,720	1,250	773	1,000
26.....	1,070	820	981	865	893	866	7,740	1,260	2,420	1,160	712	1,030
27.....	965	1,170	956	759	825	867	7,130	1,160	1,450	1,160	672	1,060
28.....	966	1,110	773	692	790	870	6,460	1,160	1,130	1,130	718	908
29.....	1,020	1,270	732	688	-----	876	6,310	1,210	1,430	849	842	817
30.....	980	1,140	815	749	-----	806	5,940	1,390	1,720	1,160	870	971
31.....	937	-----	1,020	755	-----	928	-----	1,340	-----	1,050	763	-----

Monthly discharge of Menominee River at Twin Falls, near Iron Mountain, Mich., for the year ending September 30, 1923

[Drainage area, 1,790 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	1,070	764	944	0.527	0.61
November.....	2,040	806	1,180	.659	.74
December.....	1,320	732	962	.537	.62
January.....	1,010	688	852	.476	.55
February.....	996	619	790	.441	.46
March.....	1,170	696	854	.477	.55
April.....	10,000	660	3,040	1.70	1.90
May.....	5,300	1,160	2,680	1.50	1.73
June.....	3,760	904	1,880	1.05	1.17
July.....	3,050	745	1,440	.804	.93
August.....	1,160	618	819	.458	.53
September.....	1,170	647	1,010	.564	.63
The year.....	10,000	618	1,370	.765	10.42

MENOMINEE RIVER BELOW KOSS, MICH.

LOCATION.—In sec. 9, T. 34 N., R. 27 W., at power plant of Menominee & Marinette Light & Traction Co., 4 miles below Koss, Marinette County, Mich., and 3 miles west of Ingalls, Mich. Little Cedar River, draining an area entirely in Michigan, enters from left half a mile below station.

DRAINAGE AREA.—3,790 square miles.

RECORDS AVAILABLE.—July 1, 1913, to September 30, 1923.

DISCHARGE.—Daily discharge was computed from hourly determinations of the flow through the turbines (from kilowatt output and effective head) plus discharge through the gates and over the spillway. No account was taken of the water passing through the exciter turbine, nor waste over the "trash gate" at the power house. This amount was, however, relatively small.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 18,700 second-feet April 23; minimum mean daily discharge, 938 second-feet August 20.

1913-1923: Maximum mean daily discharge recorded, 23,200 second-feet April 23 and 25, 1916; minimum mean daily discharge, 926 second-feet November 24, 1922.

REGULATION.—Above the station are the following power plants: Sturgeon Falls, owned by Pennsylvania Iron Mining Co., 50 miles; Little Quinnesec, owned by Kimberly Clark, 57 miles; Upper Quinnesec, owned by Oliver Iron Mining Co., 62 miles; Twin Falls, owned by Peninsular Power Co. With the exception of the Kimberly Clark dam at Little Quinnesec, the dams furnish power for utility and mining uses, so that the flow past the dams is comparatively uniform. The Kimberly Clark dam is used for paper mills and regulates the flow on Sundays and holidays. The effect of this regulation generally is felt at the station on Tuesdays. The monthly flow probably represents the natural flow.

ACCURACY.—A discharge measurement was made September 12, 1922, at highway bridge about 4 miles below station which checks the discharge as computed from the power-plant records within 4 per cent. See Water-Supply Paper 524 for statement regarding earlier measurements. Records good.

COOPERATION.—Daily discharge records furnished by Edward Daniell, general manager of the Menominee & Marinette Light & Traction Co.

Daily discharge, in second-feet, of Menominee River below Koss, Mich., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	1,770	1,890	2,510	1,400	1,460	1,560	1,260	12,300	2,810	2,490	2,250	1,440
2.....	1,778	1,780	2,420	1,420	1,380	1,530	1,510	9,760	2,380	2,640	2,120	1,600
3.....	1,710	1,760	1,980	1,640	1,630	1,450	1,460	10,200	2,340	2,290	1,880	1,980
4.....	1,830	1,760	2,050	1,740	1,340	1,270	1,570	8,700	2,710	1,860	2,010	1,680
5.....	1,830	1,770	1,540	1,660	1,340	1,420	1,710	8,870	2,540	2,280	1,720	1,720
6.....	1,810	1,920	1,410	1,740	1,330	1,390	1,640	7,620	3,330	2,340	2,080	1,840
7.....	1,770	1,640	1,750	1,400	1,610	1,660	1,660	7,640	4,380	2,840	2,000	2,440
8.....	1,790	1,820	1,790	1,530	1,600	1,710	1,130	7,600	6,710	2,780	2,000	2,440
9.....	1,850	1,930	1,940	1,460	1,640	1,610	1,570	6,960	8,470	3,060	1,720	1,750
10.....	1,470	1,790	1,940	1,780	1,490	1,530	1,410	6,540	10,100	4,050	1,770	2,440
11.....	1,590	2,080	1,970	1,680	1,260	1,100	1,680	6,190	9,400	3,900	1,450	1,850
12.....	1,690	2,050	1,810	1,670	1,560	1,490	1,680	5,390	7,880	4,840	1,710	2,120
13.....	1,500	2,110	1,820	1,570	1,450	1,400	1,700	3,690	6,380	4,720	1,550	1,570
14.....	1,560	1,900	1,540	1,380	1,410	1,480	1,930	4,240	5,510	3,920	1,520	1,500
15.....	1,300	2,040	1,440	1,630	1,420	1,610	2,480	5,420	4,760	3,840	1,460	2,140
16.....	1,620	2,260	1,560	1,480	1,160	1,660	2,560	4,980	4,440	3,640	1,400	1,810
17.....	1,560	2,540	1,280	1,700	1,180	1,610	3,330	4,350	4,240	3,490	1,250	2,180
18.....	1,810	2,700	1,600	1,640	1,150	1,460	3,870	4,710	3,450	3,170	1,150	1,780
19.....	1,700	2,420	1,400	1,470	1,310	1,570	5,840	4,680	3,370	3,200	1,380	1,920
20.....	1,770	2,780	1,710	1,630	995	1,480	7,330	4,900	3,320	2,120	938	2,010
21.....	1,630	2,760	1,630	1,490	1,450	1,640	13,500	4,430	3,340	2,660	1,170	2,050
22.....	1,540	3,360	1,640	1,190	1,330	1,590	17,100	5,800	3,460	2,180	1,160	1,920
23.....	1,720	2,800	1,540	1,350	1,170	1,400	18,700	5,920	4,060	2,680	1,240	1,950
24.....	1,530	2,580	1,380	1,350	1,100	1,520	18,200	5,500	4,530	2,410	1,410	1,980
25.....	1,860	2,680	1,480	1,340	1,100	1,420	18,200	4,900	4,690	2,560	1,330	1,670
26.....	1,780	2,330	1,540	1,400	1,180	1,640	17,300	4,070	3,680	2,730	1,280	1,780
27.....	1,820	1,890	1,380	1,530	1,230	1,500	15,700	4,060	4,140	2,560	1,160	1,780
28.....	1,880	1,790	1,590	1,360	1,390	1,590	14,700	3,320	3,760	2,620	995	1,750
29.....	1,740	2,140	1,660	1,590	-----	1,500	14,800	2,660	2,900	2,350	1,160	1,790
30.....	1,840	2,450	1,550	1,400	-----	1,700	12,800	2,710	2,550	2,150	1,190	1,520
31.....	1,520	-----	1,390	1,670	-----	1,620	-----	2,760	-----	2,050	1,450	-----

Monthly discharge of Menominee River below Koss, Mich., for the year ending September 30, 1923

[Drainage area, 3,790 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Persquare mile	
October.....	1,880	1,300	1,700	0.449	0.52
November.....	3,360	1,640	2,190	.578	.64
December.....	2,510	1,280	1,680	.443	.51
January.....	1,780	1,190	1,530	.404	.47
February.....	1,640	995	1,350	.356	.37
March.....	1,710	1,100	1,520	.401	.46
April.....	18,700	1,130	6,930	1.83	2.04
May.....	12,300	2,660	5,820	1.54	1.78
June.....	10,100	2,340	4,520	1.19	1.33
July.....	4,840	1,860	2,920	.770	.86
August.....	2,250	938	1,510	.398	.46
September.....	2,440	1,440	1,880	.496	.55
The year.....	18,700	938	2,800	.739	10.02

PINE RIVER NEAR FLORENCE, WIS.

LOCATION.—In secs. 23 and 26, T. 39 N., R. 17 E., at highway bridge 8 miles southwest of Florence, Florence County, and 12 miles above mouth of river. Popple River enters from right 200 feet above station.

DRAINAGE AREA.—488 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 22, 1914, to September 30, 1923.

GAGE.—Chain gage fastened to guardrail on upstream side of bridge; read by William Taft.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Coarse gravel and stones; left bank high and not subject to overflow; extremely high water may overflow right bank around approach to bridge.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge recorded during year, 2,220 second-feet, April 23; minimum mean daily discharge, 112 second-feet, March 31. Both maximum and minimum occurred during the period when discharge was based on power-house records and were partly the result of regulation.

1914–1923: Maximum stage recorded, 9.25 feet at noon April 23, 1916 (discharge, approximately 4,520 second-feet); minimum discharge, that of March 31, 1923.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—None except during period December 1 to April 27, for which period discharge is based on records of power plant about 3 miles below station and is affected by loss and gain in storage in the service reservoir at that plant.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 144 and 1,710 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except for period December 1 to April 27, when no gage heights were available and the greater part of the period the stage-discharge relation was affected by ice. For this period the records are based on power-house records and are fair. For the remainder of the year, the records are good.

The following discharge measurement was made by E. E. Foster:

July 28, 1923: Gage height, 1.96 feet; discharge, 298 second-feet.

Daily discharge, in second-feet, of Pine River near Florence, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	204	193	272	211	209	173	204	1,410	412	678	262	226
2	204	193	272	221	209	190	198	1,410	397	644	262	226
3	193	182	222	218	209	199	154	1,360	352	610	262	215
4	182	182	250	203	206	124	174	1,360	352	576	250	215
5	182	193	275	218	202	197	173	1,360	412	508	238	215
6	172	204	255	203	193	201	244	1,260	576	444	238	238
7	162	204	236	170	182	142	227	1,220	945	382	226	311
8	162	215	233	202	182	173	173	1,130	1,760	382	215	367
9	162	226	234	202	182	221	237	990	1,760	382	215	367
10	162	226	198	202	182	136	216	945	1,660	444	215	367
11	172	238	238	199	166	228	155	900	1,560	476	204	338
12	172	250	253	204	194	201	151	815	1,460	508	193	311
13	182	250	220	199	187	190	224	815	1,410	542	193	286
14	182	250	218	186	177	145	254	780	1,310	542	193	262
15	182	262	216	199	160	191	258	780	1,170	508	193	250
16	182	262	210	199	160	147	265	746	990	508	193	238
17	182	274	176	207	139	176	270	746	945	476	193	238
18	193	274	193	201	151	209	272	746	815	444	215	238
19	204	298	185	185	186	145	462	746	815	412	215	250
20	204	298	170	198	173	148	1,310	815	855	397	215	250
21	215	298	173	146	140	182	1,510	815	1,040	352	226	262
22	215	324	174	211	142	181	2,190	815	1,040	352	226	262
23	215	338	195	234	136	173	2,220	746	990	382	215	238
24	204	315	166	191	149	153	2,180	678	990	412	215	226
25	204	274	194	201	175	122	1,990	610	945	412	215	215
26	204	238	196	191	133	196	1,880	576	900	298	215	204
27	204	261	213	199	133	194	1,840	542	900	298	204	193
28	204	272	221	166	217	156	1,510	508	855	286	204	193
29	204	273	218	204	-----	148	1,460	476	780	286	193	193
30	204	272	221	225	-----	159	1,410	476	712	274	193	182
31	204	-----	193	214	-----	112	-----	444	-----	262	204	-----

Monthly discharge of Pine River near Florence, Wis., for the year ending September 30, 1923

[Drainage area, 488 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	215	162	191	0.391	0.45
November	338	182	251	.514	.57
December	275	166	215	.441	.51
January	234	146	200	.410	.47
February	217	133	174	.357	.37
March	228	112	171	.350	.40
April	2,220	151	794	1.63	1.82
May	1,410	444	871	1.78	2.05
June	1,760	352	970	1.99	2.22
July	678	262	435	.891	1.03
August	262	193	216	.443	.51
September	367	182	253	.518	.58
The year	2,220	112	395	.809	10.98

PIKE RIVER AT AMBERG, WIS.

LOCATION.—In sec. 15, T. 35 N., R. 21 E., at Chicago, Milwaukee & St. Paul Railway bridge half a mile south of Amberg, Marinette County, 1 mile below junction of two branches of the Pike River, and 11 miles above mouth.

DRAINAGE AREA.—240 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—February 26, 1914, to September 30, 1923.

GAGE.—Chain gage fastened to guardrail on upstream side of bridge; read by Frank Bunce.

DISCHARGE MEASUREMENTS.—Made from a highway bridge a quarter of a mile downstream from the bridge to which the gage is attached or by wading.

CHANNEL AND CONTROL.—Solid rock and some loose granite boulders; channel permanent but very rough at gage. Banks medium high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.04 feet at 7.45 a. m. April 21 (discharge, 1,870 second-feet); minimum mean daily discharge, 90 second-feet January 30 (stage-discharge relation affected by ice).

1914-1923: Maximum stage recorded, 7.68 feet at 5 p. m. April 10, 1922 (discharge, 2,730 second-feet); minimum mean daily discharge, 65 second-feet January 27, 1922 (stage-discharge relation affected by ice).

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except when affected by ice. Rating curve well defined between 120 and 1,120 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating curve, except when stage-discharge relation was affected by ice, for which period it was ascertained by applying to the rating table daily gage heights corrected for ice effect by means of discharge measurements, observer's notes, and weather records. Open-water records good except during high stages a few days in April, for which they are fair; winter records fair.

Discharge measurements of Pike River at Amberg, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
Oct. 19	E. E. Foster.....	Feet 1.91	Sec.-ft. 170	Feb. 26	J. H. Olson.....	Feet * 2.40	Sec.-ft. 104
Jan. 16	J. H. Olson.....	* 2.05	130	July 24	E. E. Foster.....	1.83	160

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Pike River at Amberg, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	158	169	244	120	110	110	150	493	217	202	138	118
2.....	154	176	148	130	110	120	160	444	217	204	134	122
3.....	148	169	204	125	110	130	170	412	192	187	131	142
4.....	148	162	303	125	110	125	180	380	192	204	128	150
5.....	142	169	148	120	110	120	205	364	258	273	122	158
6.....	142	192	142	110	110	120	230	333	288	303	118	162
7.....	142	199	215	115	110	120	260	333	444	288	118	192
8.....	169	185	160	120	115	120	290	333	546	258	122	204
9.....	176	199	120	125	120	120	320	348	904	230	118	192
10.....	169	204	150	130	125	125	260	380	698	230	118	169
11.....	162	204	170	125	130	130	200	412	582	217	118	148
12.....	162	204	160	120	130	135	150	364	476	202	118	142
13.....	158	204	170	120	130	140	180	341	444	187	118	134
14.....	154	217	180	120	120	135	205	318	348	182	118	122
15.....	158	210	160	125	110	130	260	318	318	194	118	122
16.....	169	204	120	130	110	125	320	348	288	217	114	118
17.....	180	217	110	120	115	120	395	380	258	200	109	118
18.....	182	230	120	110	120	120	546	364	244	182	104	138
19.....	185	244	110	105	120	120	990	348	217	167	109	142
20.....	185	244	120	100	120	130	1,400	460	217	165	109	148
21.....	192	258	110	110	120	140	1,850	582	303	160	128	158
22.....	185	273	120	120	130	160	1,800	546	396	150	138	148
23.....	185	273	120	120	130	180	1,460	476	348	140	133	142
24.....	180	204	120	120	120	150	1,120	396	303	160	128	138
25.....	180	169	120	120	110	120	862	364	288	158	122	134
26.....	176	193	135	120	100	115	738	333	318	148	118	128
27.....	169	217	150	120	100	110	698	303	217	148	122	122
28.....	162	273	130	120	105	105	620	273	204	148	134	122
29.....	162	185	110	105	-----	100	582	244	197	158	128	122
30.....	162	192	120	90	-----	120	546	217	190	158	122	118
31.....	169	-----	120	100	-----	140	-----	217	-----	154	122	-----

NOTE.—Stage-discharge relation affected by ice Dec. 7 to Apr. 17. Gage not read and discharged interpolated Oct. 6, 18, Nov. 15, 26, Apr. 23, May 13, 18, July 17, 27, Aug. 3, 10, 23, and Sept. 4.

Monthly discharge of Pike River at Amberg, Wis., for the year ending September 30, 1923

[Drainage area, 240 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	192	142	167	0.696	0.80
November.....	273	162	208	.867	.97
December.....	303	110	149	.621	.72
January.....	130	90	117	.488	.56
February.....	130	100	116	.483	.50
March.....	180	100	127	.529	.61
April.....	1,850	150	572	2.38	2.66
May.....	582	217	369	1.54	1.78
June.....	904	190	337	1.40	1.56
July.....	303	140	193	.804	.93
August.....	138	104	122	.508	.59
September.....	204	118	142	.592	.66
The year.....	1,850	90	218	.908	12.34

PESHTIGO RIVER AT HIGH FALLS, NEAR CRIVITZ, WIS.

LOCATION.—In sec. 1, T. 32 N., R. 18 E., at High Falls, near Crivitz, Marinette County, at power house of Wisconsin Public Service Corporation, 1 mile upstream from Thunder River (coming in from right), and 15 miles by road northwest of Crivitz.

DRAINAGE AREA.—520 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—August 3, 1912, to September 30, 1923.

DISCHARGE.—Owing to backwater caused by construction of the power plant at Johnson Falls, 3 miles downstream from High Falls, the gage-height record from the water-stage recorder formerly used at a site one-fourth mile downstream from the power house at High Falls could not be used for determination of discharge. The daily discharge after September 30, 1922, was, therefore, computed from hourly determinations of flow through the turbines (from kilowatt output and effective head) plus discharge through the gates and over the spillway.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge recorded during year, 2,330 second-feet April 26; minimum mean daily discharge, 51 second-feet October 29, December 17, and January 1.

1912-1923: Maximum stage from water-stage recorder, 7.80 feet at 4.30 p. m. April 11, 1922 (discharge, 3,860 second-feet); minimum stage, 0.97 foot from midnight to 7.20 a. m. October 27, 1919 (discharge, 43 second-feet). Owing to artificial regulation, extremes given do not represent the natural flow.

REGULATION.—Considerable diurnal fluctuation caused by operation of power plant and during log-driving season by manipulation of gates. Mean monthly flow does not represent the natural flow because of storage in the service reservoir.

ACCURACY.—Discharge is computed from hourly readings at the power plant and records are fair.

COOPERATION.—Records of daily discharge furnished by the Wisconsin Public Service Corporation.

The following discharge measurement was made by S. B. Soulé:

October 19, 1922: Gage height, 2.51 feet; discharge, 488 second-feet.

Daily discharge, in second-feet, of Peshtigo River at High Falls, near Crivitz, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	120	588	344	51	286	365	52	1,380	748	52	268	164
2	224	406	293	141	289	384	577	1,490	482	273	255	209
3	233	260	71	167	221	651	542	1,180	285	493	274	190
4	316	185	480	180	84	143	287	977	468	244	269	259
5	309	52	761	160	259	445	277	1,080	680	355	153	385
6	270	408	327	182	292	501	611	1,070	473	518	312	348
7	299	438	294	78	269	536	500	937	607	596	284	562
8	257	430	465	343	290	620	281	885	772	490	240	659
9	269	393	553	216	221	520	228	891	1,410	449	243	222
10	289	412	247	234	174	492	230	916	1,690	789	187	318
11	281	201	240	228	80	112	219	911	1,920	833	119	428
12	272	231	295	186	262	538	324	916	1,790	630	52	431
13	251	299	217	170	283	341	483	511	1,310	550	266	373
14	439	291	275	302	156	328	472	852	1,170	609	335	248
15	86	250	216	194	139	316	375	951	1,160	492	290	194
16	291	131	206	228	155	361	613	943	1,130	617	288	190
17	291	236	51	200	142	557	668	941	980	871	267	297
18	281	250	231	330	64	314	719	816	888	869	247	301
19	261	52	234	250	193	421	871	765	825	573	52	266
20	267	284	223	321	208	316	964	436	850	548	276	469
21	217	504	168	52	202	499	1,020	568	846	431	319	465
22	188	427	208	285	239	504	684	747	815	261	223	161
23	492	300	124	316	388	571	1,090	781	796	410	225	99
24	454	267	52	287	122	270	1,670	833	351	462	338	316
25	440	290	52	287	79	228	2,270	784	778	357	199	357
26	445	418	317	277	316	291	2,330	823	886	317	52	400
27	433	340	417	261	397	308	2,180	569	905	263	235	266
28	282	280	348	185	371	291	2,120	739	867	188	341	268
29	51	314	314	290	-----	292	1,840	899	742	122	281	162
30	356	338	219	317	-----	291	1,670	345	356	254	214	72
31	472	-----	120	311	-----	205	-----	692	-----	294	244	-----

Monthly discharge of Peshtigo River at High Falls, near Crivitz, Wis., for the year ending September 30, 1923

[Drainage area, 520 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Persquare mile	
October	492	51	295	0.567	0.65
November	588	52	309	.594	.66
December	761	51	270	.519	.60
January	343	51	227	.437	.50
February	397	64	221	.425	.44
March	651	112	387	.744	.86
April	2,330	52	872	1.68	1.87
May	1,490	345	859	1.65	1.90
June	1,920	285	899	1.73	1.93
July	871	52	458	.881	1.02
August	341	52	235	.452	.52
September	659	72	303	.583	.65
The year	2,330	51	445	.856	11.60

OCONTO RIVER NEAR GILLETT, WIS.

LOCATION.—In sec. 34, T. 28 N., R. 18 E., at highway bridge $2\frac{1}{2}$ miles south-east of Gillett, Oconto County.

DRAINAGE AREA.—678 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—June 7, 1906, to March 30, 1909; January 6, 1914, to September 30, 1923.

GAGE.—Chain gage attached to iron railing on upstream side of bridge; read by Harvey Gilbertson. Zero of gage was raised 4.0 feet January 6, 1914.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Gravel; permanent. Left bank of medium height and not subject to overflow. During extremely high stages water may overflow around right end of bridge.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during year, 3,930 second-feet April 20-22; minimum discharge, about 195 second-feet January 10.

1906-1923: Maximum stage recorded, 9.1 feet at 3 p. m. April 11, 1922, caused by failure of a dam at Pulcifer, 4 miles upstream (discharge, 6,470 second-feet). Minimum open-water discharge, 95 second-feet June 3 and 6, 1907.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent, except as affected by ice. Rating curve well defined between 300 and 1,850 second-feet and fairly well defined between 1,850 and 6,500 second-feet. Gage read to quarter-tenths once daily. Daily discharge obtained by applying daily gage height to rating table, except for period when stage-discharge relation was affected by ice, for which it was obtained by applying to rating table daily gage height corrected for ice effect by means of two discharge measurements observer's notes, and weather records. Open-water records excellent, except for extremely high stages, for which they are good; records for winter period are fair.

Discharge measurements of Oconto River near Gillett, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
Jan. 17	J. H. Olson	<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 27	do	• 2.52	338
July 29	E. E. Foster	• 2.78	345
		1.22	382

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Oconto River near Gillett, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	415	510	560	305	325	380	340	1,770	485	350	370	350
2	438	510	610	305	325	380	340	1,530	738	460	350	350
3	438	510	560	300	325	380	320	1,450	535	415	330	370
4	438	560	585	290	325	380	405	1,150	535	438	330	392
5	438	585	590	300	325	380	450	1,290	660	585	312	392
6	370	585	470	305	315	380	490	1,150	635	510	295	370
7	370	510	445	290	305	380	540	792	738	560	312	392
8	415	510	425	270	305	380	590	975	1,150	585	312	460
9	415	510	565	230	305	380	660	1,040	792	585	312	460
10	438	510	540	195	305	380	725	1,040	635	560	312	438
11	460	560	515	240	305	380	940	1,010	1,610	585	312	415
12	510	415	515	270	305	400	1,160	940	685	510	312	392
13	370	460	515	290	305	425	1,300	910	660	535	295	370
14	350	560	515	305	305	400	1,430	880	1,610	585	263	370
15	330	560	515	330	305	380	1,500	792	1,610	535	312	350
16	460	510	515	360	305	380	1,570	1,290	1,290	585	295	330
17	660	560	515	350	305	380	2,260	370	1,290	535	295	350
18	560	560	490	340	320	380	2,950	370	1,690	485	330	370
19	510	535	470	340	340	380	3,690	975	2,090	510	330	370
20	510	850	450	340	315	390	3,930	975	2,410	460	350	415
21	510	820	425	320	290	405	3,930	710	1,930	460	370	415
22	312	820	415	305	300	425	3,930	910	1,290	350	370	392
23	370	792	405	320	325	445	3,690	940	350	415	392	392
24	685	710	370	340	325	425	3,530	880	312	438	350	392
25	610	685	340	330	325	405	3,210	792	350	415	350	460
26	510	510	340	325	340	390	3,130	765	485	392	350	438
27	460	485	340	325	360	380	2,410	710	660	370	350	415
28	485	535	330	325	370	380	2,410	685	485	370	350	415
29	370	535	325	330	-----	380	2,170	585	460	370	370	392
30	585	535	315	340	-----	360	1,930	765	392	392	370	370
31	510	-----	305	330	-----	340	-----	685	-----	370	-----	-----

NOTE.—Stage-discharge relation affected by ice Dec. 5 to Apr. 21.

Monthly discharge of Oconto River near Gillett, Wis., for the year ending September 30, 1923

[Drainage area, 678 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	685	312	461	0.680	0.78
November	850	415	577	.851	.95
December	610	305	460	.678	.78
January	360	195	308	.454	.52
February	370	290	318	.469	.49
March	445	340	388	.572	.66
April	3,930	320	1,860	2.74	3.06
May	1,770	370	940	1.39	1.60
June	2,410	312	952	1.40	1.56
July	585	350	475	.701	.81
August	392	263	333	.491	.57
September	460	330	393	.580	.65
The year	3,930	195	621	.916	12.43

FOX RIVER AT BERLIN, WIS.

LOCATION.—In sec. 16, T. 17 N., R. 13 E., at Government lock and dam, 2½ miles upstream from Berlin, Green Lake County.

DRAINAGE AREA.—1,430 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 1, 1898, to September 30, 1923.

GAGE.—Staff gage located in pool immediately below dam; read by lock tender for United States Engineer Corps.

CHANNEL AND CONTROL.—Sand and gravel, one channel at all stages; banks low and subject to overflow.

DISCHARGE MEASUREMENTS.—Made from downstream side of Huron Street highway bridge in city of Berlin, $2\frac{1}{3}$ miles downstream from gage. Rating curves for gage corrected for any small inflow between the gage and measuring section.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge recorded during year, 6,050 second-feet, April 12; minimum mean daily discharge, 465 second-feet, September 20 and 21.

1898-1923: Maximum mean daily discharge, 6,400 second-feet, March 28, 30, 1916; minimum mean daily discharge, 250 second-feet, February 1-4, 1900.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation practically permanent except for effect of ice. Rating curve well defined between 800 and 6,000 second-feet. Gage read three times daily; in general, however, noon reading alone is used in determination of daily discharge. Daily discharge ascertained by applying mean daily gage height to rating table, corrected for period of ice effect by means of curves based on discharge measurements and observer's notes. Open-water records good; winter records roughly approximate.

COOPERATION.—Records have been collected and computations of daily discharge made by United States Engineer Corps. Open-water records obtained from rating curves based on discharge measurements made by United States Geological Survey.

Daily discharge, in second-feet, of Fox River at Berlin, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	865	735	1,060	675	735	830	1,520	2,750	905	645	535	590
2.....	865	800	1,060	645	765	975	1,570	2,600	865	615	560	615
3.....	830	800	1,020	590	765	1,180	1,910	2,450	865	675	535	645
4.....	830	830	975	590	590	1,270	2,100	2,380	865	675	535	615
5.....	800	830	975	590	590	1,220	2,520	2,240	830	645	535	590
6.....	800	940	940	615	560	1,320	3,080	2,100	800	645	535	590
7.....	800	975	975	615	560	1,360	3,530	1,980	765	645	510	675
8.....	800	1,020	975	645	590	1,420	3,820	1,850	765	645	535	675
9.....	765	1,020	865	645	590	1,460	4,230	1,740	765	645	510	675
10.....	765	1,020	830	645	590	1,520	4,790	1,620	735	615	510	645
11.....	765	1,020	800	645	615	1,520	5,790	1,520	735	705	510	645
12.....	765	1,020	765	645	615	1,620	6,050	1,420	705	705	490	590
13.....	765	940	765	645	615	1,620	5,650	1,320	735	675	490	590
14.....	765	975	735	645	615	1,620	5,520	1,220	705	615	490	615
15.....	800	1,020	705	675	615	1,620	5,650	1,270	705	615	490	615
16.....	765	1,020	675	705	615	1,680	5,390	1,180	705	590	490	590
17.....	765	1,020	645	705	590	1,680	5,150	1,180	675	560	490	590
18.....	800	1,140	645	705	590	1,680	4,910	1,180	645	560	490	560
19.....	800	1,180	645	705	590	1,680	4,670	1,140	645	560	490	490
20.....	765	1,020	615	705	590	1,680	4,450	1,320	645	560	490	465
21.....	765	1,220	615	705	590	1,620	4,120	1,360	675	560	510	465
22.....	765	1,220	615	705	615	1,570	4,120	1,360	675	535	510	490
23.....	735	1,220	615	705	615	1,570	4,020	1,360	645	535	510	535
24.....	735	1,270	615	705	615	1,620	3,920	1,320	615	535	510	535
25.....	765	940	615	705	645	1,620	3,720	1,270	645	535	510	590
26.....	765	975	615	705	645	1,570	3,530	1,220	675	535	510	590
27.....	765	1,020	615	705	705	1,570	3,440	1,140	675	535	535	590
28.....	735	1,020	615	735	765	1,570	3,260	1,060	705	535	535	560
29.....	705	975	615	735	-----	1,520	3,080	975	645	560	560	535
30.....	735	1,020	615	705	-----	1,570	2,910	975	645	560	560	535
31.....	735	-----	645	705	-----	1,520	-----	940	-----	535	560	-----

Monthly discharge of Fox River at Berlin, Wis., for the year ending September 30, 1923

[Drainage area, 1,430 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	865	705	777	0.543	0.63
November	1,270	735	1,010	.706	.79
December	1,060	615	757	.529	.61
January	735	590	673	.471	.54
February	765	560	628	.439	.46
March	1,680	830	1,490	1.04	1.20
April	6,050	1,520	3,950	2.76	3.08
May	2,750	940	1,530	1.07	1.23
June	905	615	722	.505	.56
July	705	535	599	.419	.48
August	560	490	517	.362	.42
September	675	465	583	.408	.46
The year	6,050	465	1,100	.769	10.46

FOX RIVER AT RAPIDE CROCHE DAM, NEAR WRIGHTSTOWN, WIS.

LOCATION.—At Rapide Croche dam, in sec. 4, T. 21 N., R. 19 E., 2 miles from Wrightstown, Brown County, and 19 miles downstream from Lake Winnebago.

RECORDS AVAILABLE.—March 3, 1896, to September 30, 1923.

DRAINAGE AREA.—6,150 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

DETERMINATION OF DISCHARGE.—The dam owned by the United States Government and operated by the United States Engineer Corps to aid navigation is made of timber and is equipped with four needle sluice gates which are used only in times of high water. A vertical staff gage at the lower end of the canal leading to the lock and about a quarter of a mile below the dam is read five times daily at 7 a. m., 9 a. m., noon, 3 p. m., and 6 p. m. The mean flow for the day is computed from a formula, using the five gage heights for the day, assuming gradual changes in gage height between the readings and weighting the different gage heights by elapsed time.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 13,700 second-feet May 1-3; minimum mean daily discharge, 1,180 second-feet September 3.

1918-1923: Maximum mean daily discharge, 20,100 second-feet April 23, 1922; minimum mean daily discharge, 742 second-feet August 15, 1921.

REGULATION.—The flow past the station is controlled by regulation in Lake Winnebago, which has an area of 215 square miles, and to some extent by dams between the outlet of Lake Winnebago and the station. The dams are operated for the development of power and in the interests of navigation. Throughout the period covered by the records the same storage conditions have existed.

ACCURACY.—Records good.

COOPERATION.—The records were collected and computation of daily discharge made by the United States Engineer Corps, based on curves which were developed by current-meter measurements made by engineers of the United States Geological Survey.

No discharge measurements were made at this station during the year.

Daily discharge, in second-feet, of Fox River at Rapide Croche dam, near Wrightstown, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	1, 910	3, 270	3, 340	3, 570	4, 950	5, 450	4, 590	13, 700	5, 120	3, 570	2, 230	2, 040
2-----	1, 950	3, 160	2, 740	4, 090	4, 370	5, 820	5, 520	13, 700	5, 240	3, 050	2, 160	1, 620
3-----	2, 940	3, 290	2, 730	4, 090	4, 020	5, 900	5, 950	13, 700	4, 430	3, 710	2, 460	1, 180
4-----	2, 870	3, 270	2, 790	4, 300	3, 320	5, 060	5, 800	13, 400	4, 390	2, 450	2, 300	1, 640
5-----	2, 830	2, 980	3, 140	4, 540	3, 910	4, 970	6, 200	13, 500	4, 920	2, 850	1, 580	2, 000
6-----	2, 610	2, 920	3, 030	4, 510	4, 390	5, 280	6, 740	12, 900	4, 830	3, 880	1, 600	2, 140
7-----	2, 620	3, 380	3, 230	3, 520	4, 550	5, 320	6, 650	12, 700	4, 710	4, 130	2, 000	2, 100
8-----	2, 010	3, 290	3, 840	3, 890	4, 670	5, 310	5, 570	12, 600	4, 490	3, 010	2, 000	2, 010
9-----	2, 760	3, 320	3, 700	4, 560	4, 550	6, 010	5, 820	9, 710	4, 480	3, 130	1, 970	1, 600
10-----	2, 940	3, 600	2, 420	4, 580	4, 360	6, 090	8, 000	10, 160	3, 370	4, 530	2, 010	1, 760
11-----	2, 920	3, 060	2, 340	4, 670	3, 830	5, 280	9, 890	9, 520	3, 560	4, 670	1, 400	2, 040
12-----	2, 840	2, 740	3, 310	4, 770	4, 460	5, 690	9, 160	7, 120	4, 910	4, 660	1, 260	2, 130
13-----	2, 850	2, 760	4, 100	4, 920	5, 010	6, 440	8, 350	6, 030	5, 220	4, 630	1, 620	2, 120
14-----	2, 900	3, 120	3, 850	4, 200	4, 470	6, 460	8, 220	5, 980	5, 110	4, 630	2, 060	2, 100
15-----	2, 680	3, 110	3, 930	4, 460	3, 910	6, 500	7, 880	5, 970	5, 080	3, 380	1, 890	2, 020
16-----	3, 520	2, 950	3, 820	4, 920	4, 880	6, 440	8, 360	5, 440	4, 920	3, 010	1, 860	1, 600
17-----	3, 690	2, 940	2, 740	4, 660	4, 930	6, 320	9, 140	5, 730	3, 480	3, 200	1, 950	1, 720
18-----	3, 670	3, 060	2, 080	5, 050	4, 240	5, 450	9, 600	5, 910	3, 690	3, 260	2, 000	2, 190
19-----	3, 720	2, 860	3, 780	4, 770	4, 570	6, 160	10, 100	5, 850	4, 910	3, 440	1, 530	2, 210
20-----	3, 740	2, 580	4, 230	4, 800	5, 220	6, 760	10, 100	4, 980	5, 000	3, 190	1, 370	2, 250
21-----	3, 810	3, 120	4, 180	4, 490	5, 790	6, 330	10, 500	4, 630	5, 000	3, 190	2, 140	2, 280
22-----	2, 620	3, 280	4, 190	4, 510	5, 850	6, 240	10, 600	6, 060	5, 000	2, 390	2, 090	2, 260
23-----	2, 570	3, 270	4, 160	4, 810	5, 820	6, 230	11, 200	7, 080	4, 890	2, 410	2, 000	1, 790
24-----	3, 710	3, 160	3, 130	4, 880	5, 750	6, 020	12, 300	7, 300	3, 650	2, 460	1, 980	2, 000
25-----	3, 480	3, 200	2, 890	5, 020	5, 160	5, 270	12, 600	7, 190	3, 640	2, 370	1, 740	2, 160
26-----	3, 450	2, 890	3, 960	5, 010	5, 230	5, 560	13, 000	7, 080	4, 700	2, 440	1, 330	2, 410
27-----	3, 390	2, 730	3, 960	4, 810	5, 480	5, 480	13, 100	5, 980	4, 680	2, 410	1, 570	2, 130
28-----	3, 330	3, 120	3, 980	4, 060	5, 380	5, 330	13, 400	5, 750	4, 720	2, 440	1, 960	2, 240
29-----	2, 790	3, 180	4, 120	4, 480	-----	5, 520	13, 000	5, 560	4, 610	1, 850	1, 840	1, 960
30-----	2, 780	3, 240	3, 910	4, 800	-----	5, 640	13, 200	5, 270	4, 640	1, 920	1, 920	1, 490
31-----	3, 230	-----	3, 110	4, 820	-----	5, 500	-----	5, 290	-----	2, 110	1, 980	-----

Monthly discharge of Fox River at Rapide Croche dam, near Wrightstown, Wis., for the year ending September 30, 1923

[Drainage area, 6,150 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October-----	3, 810	1, 910	3, 000	0. 488	0. 56
November-----	3, 600	2, 580	3, 100	. 504	. 56
December-----	4, 230	2, 080	3, 440	. 560	. 65
January-----	5, 050	3, 520	4, 530	. 737	. 85
February-----	5, 850	3, 320	4, 750	. 772	. 80
March-----	6, 760	4, 970	5, 800	. 943	1. 09
April-----	13, 400	4, 590	9, 150	1. 49	1. 66
May-----	13, 700	4, 630	8, 250	1. 34	1. 54
June-----	5, 240	3, 370	4, 580	. 745	. 83
July-----	4, 670	1, 850	3, 170	. 515	. 59
August-----	2, 460	1, 260	1, 860	. 302	. 35
September-----	2, 410	1, 180	1, 970	. 320	. 36
The year-----	13, 700	1, 180	4, 460	. 725	9. 84

WOLF RIVER AT KESHENA, WIS.

LOCATION.—In sec. 26, T. 28 N., R. 15 E., at highway bridge at Keshena, Shawano County, 3 miles below junction with West Branch of Wolf River.

DRAINAGE AREA.—840 square miles.

RECORDS AVAILABLE.—May 9, 1907, to March 31, 1909; February 10, 1911, to September 30, 1923.

GAGE.—Chain gage fastened to downstream side of bridge December 9, 1914; May 9, 1907, to November 29, 1914, vertical staff gage fastened to downstream abutment; both gages at same datum. Read by G. Sloniker.

DISCHARGE MEASUREMENTS.—Made from bridge to which gage is attached.

CHANNEL AND CONTROL.—Gravel; smooth and practically permanent. Banks of medium height, overflow improbable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.6 feet April 21 and 22 (discharge, 3,180 second-feet); minimum discharge, about 365 second-feet April 2 (stage-discharge relation affected by ice).

1907–1909; 1911–1923: Maximum stage recorded, 7.30 feet at 6.30 p. m. April 10, 1922 (discharge, 4,390 second-feet); minimum discharge during open-water periods, 275 second-feet September 26, 1908.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—The river and its main tributaries above Keshena are controlled to some extent by logging dams.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined throughout. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except for period when stage-discharge relation was affected by ice, for which it was ascertained by applying to rating table mean daily gage height corrected for ice effect by means of two discharge measurements, observer's notes, and weather records. Open-water records excellent; winter records fair.

Discharge measurements of Wolf River at Keshena, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 19	Soulé and Foster.....	1.84	646	Apr. 23	S. B. Soulé.....	5.48	3,090
Jan 18	J. H. Olson.....	* 2.97	540	June 24	E. E. Foster.....	2.71	1,070
Feb. 28	do.....	* 3.05	473				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Wolf River at Keshena, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	600	600	770		535	460	380	2,000	770	860	600	565
2	600	640	680		515	460	365	1,930	815	815	600	640
3	600	640	600		515	480	410	1,790	815	860	600	725
4	600	600	640		445	460	445	1,650	725	910	565	725
5	600	640			445	480	445	1,580	1,130	910	565	725
6	600	725		590	445	480	480	1,440	1,130	960	565	725
7	600	640			460	480	550	1,370	1,250	960	600	725
8	600	600			460	445	495	1,370	1,720	910	600	725
9	600	640			460	445	535	1,370	1,720	770	565	680
10	600	640			460	445	610	1,370	1,650	860	530	565
11	600	640		550	445	425	695	1,370	1,650	910	530	680
12	600	600		535	445	445	805	1,310	1,720	1,070	530	640
13	600	640		515	460	445	900	1,250	1,650	1,010	530	640
14	600	815		550	460	445	1,050	960	1,580	910	530	600
15	600	640		550	445	445	1,000	1,250	1,510	860	530	565
16	600	600		550	480	445	1,160	1,250	1,440	815	530	530
17	640	600		535	460	445	1,280	1,250	1,310	770	530	530
18	680	815	635	550	460	445	1,400	1,130	1,250	770	565	565
19	640	910		550	445	445	1,790	960	1,250	725	565	600
20	640	1,130		535	460	425	2,540	1,310	1,250	680	565	600
21	640	910		515	445	445	3,100	1,720	1,310	640	680	640
22	640	815		495	460	480	3,180	1,440	1,310	640	680	640
23	640	565		515	460	480	3,100	1,250	1,190	640	640	640
24	640	725		495	460	480	3,020	1,250	1,070	680	600	600
25	640	640		495	460	460	2,860	1,070	1,010	640	565	640
26	600	600		480	425	445	2,780	1,130	1,010	640	565	600
27	565	640		480	460	425	2,700	1,130	960	640	565	600
28	565	640		495	460	410	2,540	910	910	640	600	565
29	565	680		495		410	2,380	770	910	600	600	565
30	565	725		515		410	2,220	910	860	600	565	565
31	600			515		380		960		600	565	

NOTE.—Stage-discharge relation affected by ice Dec. 5 to Apr. 19.

Monthly discharge of Wolf River at Keshena, Wis., for the year ending September 30, 1923

[Drainage area, 840 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	680	565	608	0.724	0.83
November	1,130	565	690	.821	.92
December	770		640	.762	.88
January		480	542	.645	.74
February	535	425	462	.550	.57
March	480	380	447	.532	.61
April	3,180	365	1,510	1.80	2.01
May	2,000	770	1,300	1.55	1.79
June	1,720	725	1,230	1.46	1.63
July	1,070	600	784	.933	1.08
August	680	530	575	.685	.79
September	725	530	627	.746	.83
The year	3,180	365	785	.935	12.68

WOLF RIVER AT NEW LONDON, WIS.

LOCATION.—In sec. 12, T. 22 N., R. 14 E., at Pearl Street highway bridge, New London, Waupaca County. Embarrass River enters from right three-fourths of a mile above station, and Little Wolf River, also from right, 5 miles below.

DRAINAGE AREA.—2,240 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1923. Unpublished gage heights March 1, 1899, to September 30, 1913, are in files of the office of the United States Engineer Corps, Milwaukee, Wis.

GAGE.—Staff gage fastened to right hand downstream pier of Pearl Street Bridge. Datum of gage raised 0.641 foot on March 1, 1911, according to information of the United States Engineer Corps. Zero of gage is at elevation 748.874 feet above mean sea level, New York City datum.

DISCHARGE MEASUREMENTS.—Made from Shawano Street Bridge four blocks below gage.

CHANNEL AND CONTROL.—Sand, hardpan, and mud; not permanent. Control not well defined. Banks at the gage fairly high. During flood stages the water from Embarrass River flows across the city of New London into the channel of Wolf River below the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.2 feet at 8 a. m. April 24 (discharge, 10,100 second-feet); minimum stage, 1.0 foot at 8 a. m. August 17, 20, and 21 (discharge, 780 second-feet).

1914-1923: Maximum stage recorded, 11.4 feet at 8 a. m. April 13, 1922 (discharge, 15,500 second-feet); minimum discharge, 700 second-feet February 6-9, 1918. The office of the United States Engineer Corps reports a stage of 11.6 feet on April 16, 1888.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Little, if any, diurnal fluctuation, owing to operation of power plant above the station, has been observed at the gage; monthly flow natural.

ACCURACY.—Stage-discharge relation not permanent. Rating curves used before and after period of ice effect fairly well defined. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table, except for period when stage-discharge relation was affected by ice, for which it was obtained by applying to rating table mean daily gage height corrected for ice effect by means of two discharge measurements, observer's notes, and weather records. Open-water records fair; winter records poor.

Discharge measurements of Wolf River at New London, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 18	E. E. Foster.....	2.08	1,120	Mar. 2	J. H. Olson.....	3.20	923
Jan. 20	J. H. Olson.....	* 3.00	999	June 22	E. E. Foster.....	4.65	2,510

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Wolf River at New London, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	1,170	1,090	1,570	1,020	985	880	1,530	5,950	1,960	1,530	1,020	910
2-----	1,210	1,060	1,570	1,020	985	915	1,570	5,440	1,760	1,480	980	980
3-----	1,090	1,130	1,490	1,020	985	1,020	2,050	5,020	1,760	1,440	945	980
4-----	1,170	1,130	1,610	1,020	985	1,210	2,400	4,900	1,960	1,320	910	1,022
5-----	1,130	1,210	1,530	985	985	1,250	2,500	4,680	2,160	1,280	910	1,020
6-----	1,130	1,290	1,450	985	985	1,290	2,890	4,170	2,210	1,910	910	1,200
7-----	1,090	1,330	1,410	985	985	1,330	3,360	3,990	2,260	1,960	910	1,240
8-----	1,090	1,410	1,410	985	950	1,330	3,500	3,900	2,360	2,010	910	1,283
9-----	1,090	1,410	1,410	985	950	1,330	3,360	3,740	2,360	2,110	910	1,200
10-----	1,130	1,330	1,370	985	950	1,330	3,500	3,580	2,480	2,210	910	1,160
11-----	1,090	1,290	1,330	985	950	1,290	3,820	3,430	2,600	2,160	840	1,200
12-----	1,020	1,210	1,290	985	950	1,290	4,370	3,360	2,660	2,060	875	1,200
13-----	1,060	1,330	1,250	985	950	1,290	5,600	3,220	2,660	1,710	875	1,050
14-----	1,060	1,330	1,210	985	950	1,330	6,790	3,020	2,600	1,620	840	980
15-----	1,060	1,370	1,170	985	915	1,330	7,540	2,960	2,600	1,620	840	980
16-----	1,090	1,410	1,060	985	915	1,370	7,540	2,900	2,600	1,620	810	980
17-----	1,090	1,410	1,020	985	915	1,330	7,280	2,840	2,600	1,480	780	945
18-----	1,130	1,370	1,020	985	915	1,330	7,540	2,840	2,480	1,400	810	945
19-----	1,130	1,410	1,020	985	880	1,330	8,090	2,780	2,420	1,360	810	910
20-----	1,130	1,650	985	985	880	1,330	8,090	2,840	2,480	1,280	780	875
21-----	1,130	1,770	985	985	880	1,330	8,380	2,900	2,420	1,200	780	945
22-----	1,130	1,900	985	985	880	1,370	9,350	2,900	2,360	1,160	875	1,020
23-----	1,170	2,000	985	985	880	1,370	9,710	2,900	2,210	1,120	875	1,050
24-----	1,170	2,050	915	985	880	1,410	10,100	2,900	2,160	1,120	945	1,050
25-----	1,130	1,850	915	985	880	1,410	9,710	2,900	2,010	1,080	945	1,050
26-----	1,130	1,730	985	985	880	1,410	8,690	2,900	2,010	1,080	910	1,050
27-----	1,060	1,530	985	985	880	1,490	8,380	2,780	2,010	1,050	980	1,020
28-----	1,060	1,450	985	985	880	1,530	7,540	2,600	1,860	1,080	945	1,020
29-----	1,060	1,450	985	985	-----	1,530	7,030	2,480	1,710	1,080	875	1,020
30-----	1,130	1,610	985	985	-----	1,490	6,560	2,260	1,620	1,020	980	1,020
31-----	1,090	-----	1,060	985	-----	1,530	-----	2,160	-----	1,020	910	-----

NOTE.—Stage-discharge relation affected by ice Dec. 5 to Apr. 6.

Monthly discharge of Wolf River at New London, Wis., for the year ending September 30, 1923

[Drainage area, 2,240 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October-----	1,210	1,020	1,110	0.496	0.57
November-----	2,050	1,060	1,450	.647	.72
December-----	1,610	915	1,190	.531	.61
January-----	1,020	985	990	.442	.51
February-----	985	880	929	.415	.43
March-----	1,530	880	1,320	.590	.68
April-----	10,100	1,530	5,960	2.66	2.97
May-----	5,950	2,160	3,390	1.51	1.74
June-----	2,660	1,620	2,240	1.00	1.12
July-----	2,210	1,020	1,470	.656	.76
August-----	1,020	780	890	.397	.46
September-----	1,280	875	1,040	.464	.52
The year-----	10,100	780	1,830	.817	11.09

EMBARRASS RIVER NEAR EMBARRASS, WIS.

LOCATION.—At highway bridge on line between T. 26 N., R. 14 E., and T. 26 N., R. 15 E., 1 mile downstream from mouth of Mill Creek and 4 miles upstream from Embarrass, Waupaca County.

DRAINAGE AREA.—395 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—June 5, 1919, to September 30, 1923.

GAGE.—Chain gage fastened to downstream handrail; read by Charles Murawski.

CHANNEL AND CONTROL.—Bed of channel at gage and downstream heavy gravel. Riffle 100 feet downstream forms control. Right bank not subject to overflow; left bank of medium height and will be overflowed at stage of about 9 feet.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.70 feet at 8 a. m. April 22 (discharge, 3,500 second-feet); minimum stage, 2.38 feet at 7 a. m. July 23 (discharge, about 34 second-feet).

1919-1923: Maximum stage recorded, 11.50 feet at 4 p. m. April 10, 1922 (discharge, about 6,760 second-feet); minimum stage, that of July 23, 1923.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—Several dams above station create head for development of power, but they do not have enough storage to cause any but slight daily fluctuation.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 114 and 2,800 second-feet; extended beyond these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except during period when stage-discharge relation was affected by ice, for which it was obtained by applying to rating table mean daily gage height corrected for ice effect by means of two discharge measurements, observer's notes, and weather records. Open-water records good except at low stages, for which they are fair; winter records fair.

Discharge measurements of Embarrass River near Embarrass, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Jan. 19		<i>Feet</i>	<i>Sec.-ft.</i>	Apr. 23	S. B. Soulé.....	<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 1	J. H. Olson.....	* 3.52	138	June 22	E. E. Foster.....	7.45	2,720
	.....do.....	* 3.90	138			3.14	216

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Embarrass River near Embarrass, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	183	200	299	100	140	140	70	550	196	135	135	149
2	180	270	342	100	125	140	80	598	217	152	143	152
3	173	217	303	115	80	140	80	526	478	235	132	158
4	170	232	278	115	140	125	100	502	455	574	124	203
5	173	262	135	70	155	115	100	455	478	303	122	210
6	170	295	365	80	185	115	90	432	432	342	132	190
7	164	255	340	125	90	115	155	386	526	364	130	155
8	167	307	260	115	90	80	205	386	622	574	143	193
9	167	243	240	140	170	90	303	432	697	502	104	214
10	164	117	220	155	90	80	299	455	697	432	83	221
11	167	278	185	140	170	70	364	409	502	299	107	180
12	167	255	170	100	155	115	647	409	432	207	86	155
13	167	295	185	100	170	125	1,010	342	346	247	109	152
14	167	251	155	140	100	90	1,060	320	364	278	77	140
15	170	262	155	125	125	100	1,010	303	320	266	109	140
16	167	251	155	155	170	100	1,120	346	282	210	132	140
17	170	274	80	140	205	90	1,300	386	243	183	122	130
18	193	364	125	140	100	100	1,960	386	217	140	130	155
19	173	364	90	125	170	115	2,590	364	186	143	95	164
20	173	598	140	60	100	115	3,220	478	180	140	114	177
21	203	574	115	115	90	140	3,430	598	255	217	100	180
22	196	598	100	115	185	115	3,430	622	247	140	100	200
23	214	478	125	125	170	100	2,730	574	196	39	127	200
24	207	386	125	125	80	80	2,020	455	193	86	164	196
25	183	320	125	70	115	80	1,600	386	161	132	140	170
26	167	342	140	70	140	90	1,300	324	137	170	119	177
27	164	303	125	140	140	90	1,120	278	143	132	146	164
28	170	307	115	140	80	90	955	278	152	132	143	158
29	177	255	115	140	90	824	207	167	140	119	143	143
30	190	225	115	155	80	747	235	158	132	203	152	152
31	186	115	80	80	80	80	196	196	149	190	190	190

NOTE.—Stage-discharge relation affected by ice Dec. 6 to Apr. 8.

Monthly discharge of Embarrass River near Embarrass, Wis., for the year ending September 30, 1923

[Drainage area, 395 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	214	164	177	0.448	0.52
November	598	117	313	.792	.88
December	365	80	179	.453	.52
January	155	60	117	.296	.34
February	205	80	133	.337	.35
March	140	70	103	.261	.30
April	3,430	70	1,130	2.86	3.19
May	622	196	407	1.03	1.19
June	697	137	323	.818	.91
July	574	39	232	.587	.68
August	203	77	125	.316	.36
September	221	130	171	.433	.48
The year	3,430	39	283	.716	9.72

LITTLE WOLF RIVER AT ROYALTON, WIS.

LOCATION.—In sec. 1, T. 22 N., R. 13 E., at highway bridge at Royalton, Waupaca County, 4 miles above mouth of river.

DRAINAGE AREA.—485 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 13, 1914, to September 30, 1923.

GAGE.—Sloping gage on left bank 150 feet upstream from highway bridge; read by J. C. Jensen. Prior to August 20, 1915, a chain gage fastened to upstream side of highway bridge was used. Datum of sloping gage is 0.75 foot higher than that of the chain gage; owing to change in slope, however, difference between the readings on the slope gage and chain gage is not constant.

DISCHARGE MEASUREMENTS.—Made from cable 500 feet upstream from gage or by wading.

CHANNEL AND CONTROL.—Stream bed gage section consists of heavy gravel and rock; fairly permanent. At measuring section bed is fine, smooth gravel. Neither bank is overflowed to any extent at flood stages.

EXTREMES OF DISCHARGE.—Maximum open-water stage during year, 5.4 feet at 8 a. m. April 15 (discharge, 3,700 second-feet); minimum discharge, 160 second-feet several days in January.

1914-1923: Maximum discharge recorded, 5,780 second-feet at 7 a. m. April 10 and 5 p. m. April 11, 1922; minimum discharge, about 120 second-feet January 20, 1922.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—The few power plants above the station have little storage; no diurnal fluctuation has been observed at the gage.

ACCURACY.—Stage-discharge relation permanent throughout the year. Rating curve well defined below 3,220 second-feet; gage read to quarter-tenths twice daily. Daily discharge obtained by applying mean daily gage height to rating table, except for period when stage-discharge relation was affected by ice, for which it was obtained by applying to rating table mean daily gage height corrected for ice effect by means of two discharge measurements, observer's notes, and weather records. Open-water records good; winter records fair.

Discharge measurements of Little Wolf River at Royalton, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 18	S. B. Soulé.....	1.59	283	Mar. 5	J. H. Olson.....	2.58	285
Jan. 22	J. H. Olson.....	*1.87	212	June 22	E. E. Foster.....	1.53	265

* Stage-discharge relation affected by ice.

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Daily discharge, in second-feet, of Little Wolf River at Royalton, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	257	248	501	170	215	245	340	800	276	241	234	227
2	248	238	466	170	225	275	560	740	310	227	234	227
3	280	267	501	180	205	260	710	770	472	284	241	223
4	273	273	466	170	195	340	770	740	310	310	227	251
5	267	305	560	160	185	295	830	740	276	392	219	241
6	248	293	590	170	195	320	935	620	310	501	213	251
7	267	305	560	170	205	340	900	590	530	444	234	342
8	267	305	590	170	185	340	970	560	472	680	227	461
9	243	280	445	170	185	390	1,210	530	407	900	234	328
10	248	273	445	160	195	320	1,570	472	328	865	241	310
11	267	280	445	160	185	295	1,879	461	366	770	234	260
12	232	323	365	170	205	275	2,290	461	328	590	241	270
13	211	352	340	170	205	260	2,740	417	276	461	227	241
14	238	305	275	160	200	275	3,100	428	310	310	219	241
15	280	280	245	170	195	275	3,700	461	284	342	207	241
16	257	293	215	185	215	260	3,460	444	297	310	186	270
17	201	472	205	185	195	245	2,860	461	284	284	207	270
18	243	501	180	180	195	260	2,740	444	284	318	207	260
19	314	530	180	185	185	275	2,740	800	310	284	203	260
20	323	620	180	180	205	260	2,620	680	276	284	207	251
21	386	620	170	180	205	260	2,740	560	270	276	234	276
22	352	650	180	185	215	245	2,740	620	270	284	227	376
23	386	590	170	215	245	235	2,620	590	276	270	219	407
24	181	590	180	235	260	235	2,510	530	260	241	207	376
25	217	530	170	235	215	245	2,510	444	270	234	207	328
26	217	439	185	245	205	260	1,770	392	310	245	213	356
27	232	361	185	235	195	260	1,300	310	284	241	227	328
28	238	371	170	235	205	295	1,300	342	260	245	234	310
29	248	501	180	225	-----	260	1,130	310	270	245	207	270
30	238	501	170	205	-----	245	865	310	251	241	219	297
31	243	-----	170	215	-----	260	-----	310	-----	241	227	-----

NOTE.—Stage-discharge relation affected by ice Dec. 9 to Apr. 14.

Monthly discharge of Little Wolf River at Royalton, Wis., for the year ending September 30, 1923

[Drainage area, 485 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Persquare mile	
October	386	181	261	0.538	0.62
November	650	238	397	.819	.91
December	590	170	312	.643	.74
January	245	160	189	.390	.45
February	260	185	204	.421	.44
March	390	235	278	.578	.66
April	3,700	340	1,880	3.88	4.33
May	800	310	527	1.09	1.26
June	530	251	314	.647	.72
July	900	227	373	.769	.89
August	241	186	221	.456	.53
September	461	223	292	.602	.67
The year	3,700	160	436	.899	12.22

WAUPACA RIVER NEAR WAUPACA, WIS.

LOCATION.—Near north line of sec. 1, T. 21 N., R. 12 E., at highway bridge 4 miles downstream from Waupaca, Waupaca County.

DRAINAGE AREA.—305 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—October 18, 1917, to September 30, 1923. June 28, 1916, to October 18, 1917, records were obtained at a station near Weyauwega, 1 mile downstream from present site.

GAGE.—Chain gage, bolted to upstream handrail of bridge; read by George Radtke.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed consists of fine gravel and clay; clean and free from vegetation. Control not well defined and is not permanent. Right bank high and seldom overflowed; left bank of medium height and is overflowed at a stage of about 6 feet.

ICE.—Stage-discharge relation seriously affected by ice.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.4 feet at 9 a. m. April 13 (discharge, 2,410 second-feet); minimum discharge, 115 second-feet January 6 and February 24 (stage-discharge relation affected by ice).

1918-1923: Maximum open-water stage recorded, 5.6 feet March 17, 1919 (discharge, 2,600 second-feet); minimum stage, 1.28 feet November 21, 1920 (discharge, 96 second-feet).

REGULATION.—Power plants at Waupaca and above on the main stream and also several on Crystal River may cause slight fluctuation during low stages. Pondage at the various plants is small and mean monthly discharge is believed to represent closely the natural flow.

ACCURACY.—Stage-discharge relation probably permanent during year. Rating curve fairly well defined between 180 and 700 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, except for period when stage-discharge relation was affected by ice, for which it was obtained by applying to rating table daily gage height corrected for ice effect by means of two discharge measurements, observer's notes, and weather records. Open-water records fair; winter records poor.

Discharge measurements of Waupaca River near Waupaca, Wis., during the year ending September 30, 1923

Date	Made by—	Gage ¹ height	Dis- charge	Date	Made by—	Gage height	Dis- charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 18	S. B. Soule.....	1.80	203	Mar. 3	J. H. Olson.....	3.80	280
Jan. 21	J. H. Olson.....	* 2.77	176	June 20	E. E. Foster.....	1.98	260

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Waupaca River near Waupaca, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	236	209	296	150	150	150	210	280	183	209	183	196
2	236	209	296	150	150	150	280	280	196	209	183	209
3	209	222	265	150	160	220	680	265	222	183	196	236
4	209	222	250	135	150	265	960	265	222	183	170	209
5	209	222	250	150	150	310	840	265	196	222	196	209
6	209	296	250	115	160	265	330	250	196	574	183	196
7	209	265	250	160	150	280	345	250	209	574	170	236
8	209	236	250	170	160	265	345	250	196	265	170	222
9	209	250	235	160	150	259	400	265	196	222	170	222
10	209	209	235	150	135	185	400	250	209	296	170	222
11	209	222	235	125	135	210	1,020	250	222	296	236	196
12	209	222	220	150	140	210	1,610	250	250	265	209	170
13	209	236	220	150	150	210	2,410	250	222	250	209	183
14	209	222	220	160	140	235	2,050	250	158	222	170	170
15	209	209	195	170	130	220	1,230	250	196	222	170	183
16	196	209	195	135	125	220	780	296	209	209	170	183
17	209	222	170	150	150	220	636	250	196	222	170	183
18	209	236	170	160	160	330	680	265	209	196	170	183
19	209	329	160	160	160	310	680	250	183	183	183	183
20	196	296	160	160	135	310	636	312	222	183	196	209
21	222	280	160	155	170	280	636	364	236	196	196	209
22	209	280	170	150	160	310	680	280	265	196	183	209
23	196	265	135	160	160	295	595	280	222	209	183	209
24	209	236	150	185	115	280	456	265	222	209	183	183
25	209	236	160	185	150	250	382	250	222	236	183	170
26	209	222	160	150	160	220	382	250	312	183	183	183
27	196	209	170	160	160	310	346	222	280	196	183	183
28	196	196	195	160	150	210	296	209	250	209	183	196
29	209	196	195	160	-----	310	312	196	236	196	196	209
30	222	236	170	170	-----	280	312	196	222	209	183	209
31	209	-----	160	170	-----	265	-----	209	-----	196	196	-----

NOTE.—Stage-discharge relation affected by ice Dec. 5 to Apr. 8.

Monthly discharge of Waupaca River near Waupaca, Wis., for the year ending September 30, 1923

[Drainage area, 305 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	236	196	209	0.685	0.79
November	296	196	237	.777	.87
December	296	135	205	.672	.77
January	185	115	155	.508	.59
February	170	115	149	.489	.51
March	330	150	252	.826	.95
April	2,410	210	697	2.29	2.56
May	364	196	257	.843	.97
June	312	158	219	.718	.80
July	574	183	239	.784	.90
August	236	170	185	.607	.70
September	236	170	199	.652	.73
The year	2,410	115	250	.820	11.14

SHEBOYGAN RIVER NEAR SHEBOYGAN, WIS.

LOCATION.—In sec. 28, T. 15 N., R. 23 E., 2 miles west of Sheboygan, Sheboygan County, and $2\frac{1}{2}$ miles above mouth.

DRAINAGE AREA.—403 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—June 30, 1916, to September 30, 1923.

GAGE.—Chain gage fastened to upstream side of bridge; read by Wilma Opge-north.

DISCHARGE MEASUREMENTS.—From highway bridge or by wading. At extreme flood stages measurement may be made from Chicago & North Western Railway Bridge, one-third mile downstream.

CHANNEL AND CONTROL.—Control is a well-defined riffle 200 feet below bridge. Stream bed composed of heavy gravel, free from aquatic growth. Banks are of medium height and are rarely overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.5 feet at 8.30 a. m. April 5 (discharge, 3,800 second-feet). Minimum discharge, 5 second-feet January 5 and 6 (stage-discharge relation affected by ice).

1916–1923: Maximum stage recorded, 9.40 feet at 7 a. m. March 26, 1920 (discharge, 7,140 second-feet); minimum stage, 1.48 feet at 4.30 p. m. August 27, 1922, caused by shutdown of power plants (discharge, about 1 second-foot).

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Operation of small power plants upstream causes a small amount of diurnal fluctuation at low stages.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve well defined throughout the range of stage occurring during the year. Gage read to hundredths twice daily; slight diurnal fluctuation during low-water periods probably impairs the accuracy of the mean daily gage height. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to table of daily discharge. Open-water records good; winter records poor.

Discharge measurements of Sheboygan River near Sheboygan, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 7	S. B. Soulé.....	2.05	49.5	June 17	E. E. Foster.....	2.10	59.8
Dec. 20	.....do.....	* 2.26	23.0	Aug. 18	S. B. Soulé.....	1.87	16
Apr. 8	.....do.....	5.63	2,010				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Sheboygan River near Sheboygan, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	60	70	48	55	85	610		165	66	35	37	40
2	46	38	72	65	55		610	148	58	41	32	58
3	32	109	48	75	55			145	70	35	51	43
4	58	93	70	55	85		2,400	126	44	62	41	38
5	70	68	100	5	100		3,800	126	46	46	33	41
6	58	81	85	5	45	610	3,700	118	52	38	33	38
7	48	74	75	20	20		3,300	93	62	46	29	43
8	70	72	40	15	30		2,760	96	66	51	37	51
9	66	66	20	20	40		2,760	115	84	52	32	32
10	46	66	40	30	25		2,850	120	41	51	51	35
11	74	74	30	30	40	610	3,030	74	46	44	41	33
12	74	72	30	25	25		2,760	79	43	51	40	37
13	84	72	20	10	40		2,760	62	46	44	30	32
14	60	84	15	20	40		1,950	66	40	33	29	34
15	68	104	25	15	40		1,150	88	46	41	32	24
16	66	68	25	10	25	610	1,150	120	43	37	26	44
17	76	56	20	25	30		905	88	49	26	40	21
18	62	68	25	15	25		795	79	64	43	23	62
19	66	66	40	25	30		690	112	46	43	30	44
20	62	76	25	20	40		690	204	68	43	24	52
21	62	101	25	25	40	610	590	201	60	33	58	68
22	49	74	40	55	30		640	186	43	26	18	68
23	64	79	55	55	55		540	168	43	28	35	41
24	48	35	55	40	45		518	152	28	37	26	48
25	54	46	15	30	40		428	148	44	34	123	51
26	44	48	20	40	75	610	640	115	41	37	54	44
27	56	44	10	40	125		193	101	88	33	34	44
28	58	58	40	40	45		158	86	56	26	37	37
29	44	62	45	40	-----		216	84	40	33	68	56
30	72	66	40	40	-----		201	79	46	29	40	54
31	64	-----	40	100	-----		-----	60	-----	29	37	-----

NOTE.—Stage-discharge relation affected by ice Dec. 5 to Apr. 3. Gage not read Mar. 1 to Apr. 3. Daily discharge, Dec. 5 to Feb. 28, determined from gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records. Mean discharge, Mar. 1 to Apr. 3, estimated by comparison with discharge of Milwaukee River. Braced figures show mean discharge for periods indicated.

Monthly discharge of Sheboygan River near Sheboygan, Wis., for the year ending September 30, 1923

[Drainage area, 403 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	84	44	60.7	0.151	0.17
November	109	35	69.7	.173	.19
December	100	10	39.9	.099	.11
January	100	5	33.7	.084	.10
February	125	20	47.5	.118	.12
March	-----	-----	610	1.51	1.74
April	3,800	158	1,450	3.60	4.02
May	204	60	116	.288	.33
June	88	28	52.3	.130	.14
July	62	26	38.9	.097	.11
August	123	18	39.4	.098	.11
September	68	21	43.8	.109	.12
The year	3,800	5	216	.536	7.26

MILWAUKEE RIVER NEAR MILWAUKEE, WIS.

LOCATION.—In NW. $\frac{1}{4}$ sec. 5, T. 7 N., R. 22 E., immediately above an old quarry near north limits of Milwaukee, Milwaukee County, half a mile below concrete highway bridge, 1 mile above Mineral Spring road, and $5\frac{1}{2}$ miles above confluence of Milwaukee and Menominee Rivers.

DRAINAGE AREA.—661 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch = 6 miles).

RECORDS AVAILABLE.—April 30, 1914, to September 30, 1923.

GAGE.—Slope gage set in concrete foundations on left bank of river; prior to April 18, 1918, chain gage fastened to cantilever arms supported by posts. Both gages at same datum. Gage read by Mrs. Richard Kuehl.

CHANNEL AND CONTROL.—Bed of channel at gage heavy gravel. About 200 feet below gage is a rock outcrop, affording a 4-foot fall which forms the control and is permanent. Below the control the river flows in an artificial channel, which at one time was a quarry. Left bank above and below the control high and not subject to overflow; right bank above control of medium height; below the control the right bank is artificial and of such height as to be seldom overflowed.

DISCHARGE MEASUREMENTS.—Made by wading immediately above gage; at high stages from a railroad bridge one-fourth mile below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.7 feet at 3 p. m. April 7 (discharge, 6,820 second-feet); minimum stage recorded, 0.39 foot several times August 18–20 (discharge, 38 second-feet).

1914–1923: Maximum stage recorded, 9 feet March 20, 1918 (discharge, 15,100 second-feet, revised); minimum discharge recorded, about 26 second-feet August 2, 1916.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—No diurnal fluctuation at gage resulting from operation of small plants above.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined throughout range of stage which occurred during the year. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as shown in footnote to table of daily discharge. Open-water records excellent; winter records fair.

Discharge measurements of Milwaukee River near Milwaukee, Wis., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 8	S. B. Soule.....	0.66	88	June 15	E. E. Foster.....	0.80	121
Dec. 21	do.....	0.87	62	Aug. 17	S. B. Soule.....	.45	45.4
Apr. 8	do.....	4.86	5,240				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Milwaukee River near Milwaukee, Wis., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	99	188	175	150	250	1,100	552	280	121	118	75	75
2	89	130	208	130	115	1,540	585	289	92	92	71	73
3	73	105	243	85	115	1,720	2,830	280	124	97	97	71
4	148	167	208	130	115	2,410	5,200	243	152	92	89	71
5	114	175	87	115	100	2,680	4,990	230	171	82	71	80
6	67	167	167	100	100	2,410	5,200	226	270	75	80	89
7	175	167	188	130	75	2,150	6,820	226	338	87	97	102
8	87	217	130	130	75	1,540	4,990	221	432	92	69	118
9	80	208	190	115	165	1,320	3,640	212	409	92	61	118
10	148	188	85	115	130	1,430	2,680	208	392	80	52	121
11	145	188	55	115	130	1,320	2,410	208	234	105	67	97
12	167	188	75	115	115	900	2,280	188	188	94	55	75
13	137	208	65	115	85	490	2,020	167	152	82	49	75
14	114	230	85	130	100	520	1,600	160	145	71	61	92
15	145	323	75	250	100	318	1,430	118	134	71	73	94
16	137	275	75	250	130	270	2,280	364	92	55	55	67
17	137	252	75	115	130	248	2,410	280	77	61	49	52
18	148	252	40	150	130	270	1,600	338	71	80	38	82
19	137	323	75	165	150	270	1,320	432	1,160	73	41	63
20	130	298	65	190	130	318	900	730	392	71	38	239
21	105	230	55	130	130	270	810	810	308	61	67	318
22	99	230	55	150	100	248	810	692	270	52	55	208
23	118	208	55	130	115	270	770	420	226	45	55	188
24	105	275	55	130	150	855	730	392	105	97	52	188
25	118	252	85	150	230	900	655	270	87	80	45	145
26	114	175	100	150	550	900	520	226	71	75	52	118
27	99	208	75	130	855	730	520	208	134	105	71	111
28	99	167	115	150	1,100	655	460	234	167	105	87	118
29	105	252	100	150	-----	364	420	196	134	97	80	108
30	114	208	100	130	-----	810	376	160	124	75	75	92
31	175	-----	115	130	-----	655	-----	145	-----	75	71	-----

NOTE.—Stage-discharge relation affected by ice Dec. 8 to Feb. 26. Daily discharge determined from gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records.

Monthly discharge of Milwaukee River near Milwaukee, Wis., for the year ending September 30, 1923

[Drainage area, 661 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	ea	Per square mile	
October	175	67	120	0.182	0.21
November	323	105	215	.325	.36
December	243	40	106	.160	.18
January	250	85	140	.212	.24
February	1,100	75	202	.306	.32
March	2,680	248	964	1.46	1.68
April	6,820	376	2,060	3.12	3.48
May	810	118	295	.446	.51
June	1,160	71	226	.342	.38
July	118	45	81.8	.124	.14
August	97	38	64.5	.098	.11
September	318	52	115	.174	.19
The year	6,820	38	381	.576	7.80

LITTLE CALUMET RIVER AT HARVEY, ILL.

LOCATION.—In NW. $\frac{1}{4}$ sec. 9, T. 36 N., R. 14 E., at Illinois Central Railroad bridge, 800 feet north of railroad station at One hundred and forty-seventh Street, Harvey, Cook County, and 11 miles above mouth of river.

DRAINAGE AREA.—570 square miles (measured on map issued by United States Geological Survey; scale, 1: 500,000).

RECORDS AVAILABLE.—Daily discharge, October 1, 1916, to September 30, 1923. Daily gage heights collected by Sanitary District of Chicago, June 10, 1907, to September 30, 1916.

GAGE.—Vertical staff gage attached to bridge pier; read by Mrs. H. Wurtman.

DISCHARGE MEASUREMENTS.—Made from highway bridge 2,000 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed of river composed of clay and gravel. Low-water control gravel and boulders; shifts occasionally. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.35 feet at 8 a. m. September 3 (discharge, 1,840 second-feet); minimum stage, 2.96 feet July 24–26 and August 2 and 3 (discharge, 51 second-feet).

1907–1923: Maximum stage recorded, 13.4 feet March 6, 1908 (discharge not determined). Minimum discharge from 1917 to 1922, estimated at less than 25 second-feet in January, 1918.

ACCURACY.—Stage-discharge relation practically permanent during year except as affected by ice. Rating curve well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except as shown in footnote to table of daily discharge. Open-water records good; winter records fair.

Discharge measurements of Little Calumet River at Harvey, Ill., during the year ending September 30, 1923

[Made by H. E. Grosbach]

Date	Gage height	Discharge
Jan. 23.....	<i>Feet</i> • 3.29	<i>Sec.-ft.</i> 102
Feb. 8.....	• 3.40	87.1
May 17.....	5.58	911

* Stage-discharge relation affected by ice.

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Daily discharge, in second-feet, of Little Calumet River at Harvey, Ill., for the year ending September, 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	56	88	104			341	590	123	590	84	53	207
2	56	100	125			468	590	112	548	84	51	220
3	56	92	116			431	590	102	508	77	51	1,840
4	56	96	112			358	590	96	508	81	59	1,040
5	56	100	146			324	548	96	468	146	70	680
6	56	108	139			341	508	92	431	112	77	548
7	63	100	146		100	376	508	84	815	134	88	635
8	70	100	157			394	508	84	680	123	134	590
9	73	104	169			376	468	84	590	116	181	548
10	81	108	146			431	468	92	508	112	146	508
11	146	104	139			431	431	92	468	108	815	508
12	134	100				1,130	431	141	431	104	1,130	590
13	123	123				1,420	412	292	412	92	680	548
14	110	152				815	394	262	376	88	508	508
15	123	157				770	376	262	358	82	431	508
16	123	146		110		1,570	341	770	324	73	341	468
17	112	139				1,220	324	1,040	292	73	308	431
18	104	139				1,040	308	770	277	70	277	431
19	104	139				680	262	680	248	66	248	431
20	100	139				1,040	234	770	220	63	234	431
21	100	125	115		230	860	234	815	181	59	234	431
22	92	125				860	220	860	157	53	181	412
23	100	123				905	207	860	123	52	157	394
24	100	123				860	194	815	108	51	139	376
25	92	123				815	194	770	88	51	123	341
26	92	100				770	181	770	81	51	108	324
27	100	108				770	157	725	73	56	130	309
28	96	112				725	146	680	88	59	207	292
29	92	100				680	134	680	92	56	194	277
30	92	112				680	123	635	88	53	181	262
31	88					635		590		53	194	

NOTE.—Discharge estimated Dec. 12 to Feb. 28, on account of ice, from gage-height record, discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for periods indicated.

Monthly discharge of Little Calumet River at Harvey, Ill., for the year ending September 30, 1923

[Drainage area, 570 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	146	56	91.8	0.161	0.19
November	157	88	116	.204	.23
December			123	.216	.25
January			110	.193	.22
February			170	.298	.31
March	1,570	324	726	1.27	1.46
April	590	123	356	.625	.70
May	1,040	84	459	.805	.93
June	815	73	338	.593	.66
July	146	51	80.1	.141	.16
August	1,130	51	249	.437	.50
September	1,840	207	503	.882	.98
The year	1,840	51	277	.486	6.59

STREAMS TRIBUTARY TO LAKE HURON

TITTABAWASSEE RIVER AT FREELAND, MICH.

LOCATION.—At highway bridge at Freeland.

DRAINAGE AREA.—2,530 square miles.

RECORDS AVAILABLE.—August 22, 1903, to December 31, 1909; January 1, 1912, to September 30, 1923.

COOPERATION.—Daily-discharge record furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

Daily discharge, in second-feet, of Tittabawassee River at Freeland, Mich., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	646	990	1,110	787	750	1,600	4,250	2,570	2,060	870	489	646
2	786	930	1,200	838	858	1,740	5,800	2,400	1,940	870	513	620
3	930	1,020	1,240	804	804	3,480	6,750	2,320	1,820	845	489	700
4	700	1,050	1,240	787	750	6,360	7,500	2,230	1,780	785	513	900
5	675	1,270	1,270	750	700	10,900	8,100	2,190	1,780	930	489	1,170
6	675	1,410	1,600	750	718	11,400	9,140	1,980	1,820	1,240	489	930
7	700	1,300	1,760	967	750	9,760	9,320	1,980	1,860	1,240	489	990
8	930	1,270	1,760	928	770	8,700	13,200	1,940	2,320	1,080	465	1,080
9	1,240	1,240	1,660	858	750	8,100	14,400	1,900	2,270	990	416	930
10	1,600	1,200	1,520	838	770	6,360	13,700	2,740	2,230	870	416	900
11	1,600	1,200	1,300	804	770	5,480	12,500	2,920	2,060	760	416	870
12	1,560	1,240	1,240	787	750	5,800	11,400	2,740	2,020	700	234	815
13	1,520	1,200	1,130	750	750	6,360	9,660	2,570	1,820	646	234	760
14	1,600	1,170	1,110	750	750	6,590	8,700	2,570	1,740	592	310	730
15	1,600	1,110	1,110	770	718	6,360	7,500	2,740	1,670	646	128	700
16	1,520	1,080	1,110	770	663	5,800	6,930	4,250	1,600	786	128	700
17	1,450	1,050	1,110	787	648	6,140	6,590	8,100	1,560	760	128	646
18	1,340	1,080	1,080	804	648	6,590	6,540	16,800	1,520	730	128	620
19	1,110	1,110	1,020	804	718	9,320	6,360	12,500	1,480	700	128	646
20	960	1,140	1,000	787	735	8,340	6,250	9,660	1,450	646	154	675
21	930	1,140	983	821	735	8,520	6,140	14,400	1,450	646	234	700
22	900	1,140	967	866	750	8,700	5,860	16,800	1,600	566	358	675
23	870	1,170	928	928	770	8,700	5,530	9,320	1,740	540	529	646
24	900	1,140	910	866	770	9,320	5,280	8,460	1,600	566	588	646
25	870	1,140	866	838	787	10,700	5,120	5,280	1,480	566	588	646
26	845	1,110	858	787	804	9,760	3,760	4,750	1,240	592	529	646
27	815	1,110	787	750	804	7,500	3,150	4,150	1,140	592	481	646
28	815	1,100	866	770	821	6,700	2,840	3,760	930	620	566	620
29	930	1,080	838	750	-----	6,140	2,660	3,480	900	566	646	620
30	960	1,080	787	770	-----	5,280	2,570	3,150	900	540	700	592
31	990	-----	750	750	-----	4,750	-----	2,400	-----	465	675	-----

Monthly discharge of Tittabawassee River at Freeland, Mich., for the year ending September 30, 1923

[Drainage area, 2,530 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,600	646	1,060	0.419	0.48
November	1,410	930	1,140	.451	.50
December	1,760	750	1,130	.447	.52
January	967	750	807	.319	.37
February	858	648	750	.296	.31
March	11,400	1,600	7,140	2.82	3.25
April	14,400	2,570	7,250	2.87	3.20
May	16,800	1,900	5,260	2.08	2.40
June	2,320	900	1,660	.656	.73
July	1,240	465	741	.293	.34
August	700	128	408	.161	.19
September	1,170	592	749	.296	.33
The year	16,800	128	2,350	.929	12.62

NOTE.—Monthly and yearly discharge computed by engineers of U. S. Geological Survey from daily-discharge record furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

STREAMS TRIBUTARY TO LAKE ERIE**HURON RIVER AT BARTON, MICH.**

LOCATION.—At dam and power plant of Eastern Michigan Edison Co. at Barton near Ann Arbor.

DRAINAGE AREA.—723 square miles.

RECORDS AVAILABLE.—January 1, 1914, to September 30, 1923.

DETERMINATION OF DISCHARGE.—Flow computed from records of operation of power plant, the flow through undersluice during floods, and the depth of flow over dam. The flow through the power house is determined from a calibration of the turbines by means of a specially constructed weir, the crest of which was formed by a $\frac{1}{4}$ by 5 inch milled plate, the discharge over the weir being computed by Bazin's formula for free overflow. The greater part of the flood water passes through undersluices in the power-house foundations, and this flow is determined from a weir calibration of the sluices. Water flows over crest of dam only a few days during year.

COOPERATION.—Daily-discharge record furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

Daily discharge, in second-feet, of Huron River at Barton, Mich., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	146	171	181	198	213	444	493	285	232	6	147	70
2.....	142	162	199	204	195	499	457	262	244	128	143	6
3.....	140	160	167	216	252	839	428	282	101	87	140	6
4.....	146	196	193	194	147	849	528	265	228	51	155	87
5.....	141	151	218	212	207	903	582	254	236	115	6	78
6.....	163	208	185	195	195	831	614	198	164	104	131	80
7.....	215	186	184	157	182	849	640	267	210	114	142	90
8.....	156	183	185	212	182	787	647	202	255	100	121	98
9.....	139	185	188	212	185	789	534	248	202	92	132	72
10.....	161	186	186	197	191	745	545	232	175	194	108	90
11.....	207	182	187	153	114	780	573	242	210	135	73	104
12.....	148	164	187	190	181	994	507	309	190	152	6	103
13.....	185	190	134	204	193	1,010	485	262	166	141	130	102
14.....	182	212	169	178	174	930	457	261	169	141	121	101
15.....	184	195	188	203	153	921	471	326	171	165	122	111
16.....	185	201	182	193	179	1,230	475	376	146	140	121	6
17.....	192	197	167	124	189	1,160	488	480	140	159	112	102
18.....	178	259	172	236	34	1,050	467	503	141	163	55	130
19.....	170	136	167	176	205	986	482	545	151	138	6	107
20.....	162	199	184	212	186	937	370	540	147	144	110	168
21.....	197	185	183	199	169	856	388	532	219	211	85	250
22.....	151	200	178	203	153	883	385	498	129	53	94	246
23.....	174	185	184	192	153	919	386	493	113	144	84	214
24.....	159	189	157	226	191	862	365	440	67	142	83	226
25.....	160	197	184	261	39	770	349	411	140	133	47	169
26.....	171	155	191	197	240	736	336	373	127	115	6	183
27.....	173	201	204	192	312	673	324	303	130	138	96	204
28.....	197	199	191	186	453	688	347	283	149	106	78	185
29.....	109	187	183	206	-----	575	283	279	130	51	77	208
30.....	197	161	200	202	-----	497	326	229	122	153	85	162
31.....	174	-----	195	207	-----	542	-----	257	-----	153	79	-----

Monthly discharge of Huron River at Barton, Mich., for the year ending September 30, 1923

[Drainage area, 723 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	215	109	168	0.232	0.27
November.....	259	136	186	.257	.29
December.....	218	134	183	.253	.29
January.....	294	124	201	.278	.32
February.....	453	34	188	.260	.27
March.....	1,230	444	824	1.14	1.31
April.....	647	283	458	.633	.71
May.....	545	198	337	.466	.54
June.....	255	67	167	.231	.26
July.....	211	6	125	.173	.20
August.....	155	6	93.4	.129	.15
September.....	250	6	125	.173	.19
The year.....	1,230	6	255	.353	4.80

NOTE.—Monthly and yearly discharge computed by engineers of U. S. Geological Survey from daily-discharge record furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

MAUMEE RIVER AT ANTWERP, OHIO

LOCATION.—At highway bridge 1 mile north of Antwerp, Paulding County.

DRAINAGE AREA.—2,130 square miles (area in Ohio measured on topographic maps, area in Michigan on United States Geological Survey map of Michigan, and area in Indiana on General Land Office map).

RECORDS AVAILABLE.—September 1, 1921, to September 30, 1923.

GAGE.—Chain gage on highway bridge; read by H. G. Carr.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 500 feet above and below gage. One channel at all stages. Left bank high; right bank fairly high. Control for low water is rock and gravel riffle about half a mile below gage; control for high water is long stretch of river below gage. Zero flow would occur at zero gage height.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 16.5 feet at 7.40 a. m. March 18 (discharge, 14,400 second-feet); minimum stage, 1.10 feet October 3-6 (discharge, 145 second-feet).

1921-1923: Maximum stage recorded, 16.8 feet at 7.30 a. m. April 2, 1922 (discharge, 14,700 second-feet); minimum stage, 1.08 feet at 6 p. m. September 9, 1921 (discharge, 133 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except when affected by ice. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as shown in footnote to table of daily discharge. Open-water records good; winter records fair.

The following discharge measurement was made by F. R. Morgan:
August 20, 1923: Gage height, 1.77 feet; discharge, 344 second-feet.

Daily discharge, in second-feet, of Maumee River at Antwerp, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	150	182	194	3,500	1,950	3,100	890	428	445	194	445	248
2	147	182	194	3,680	2,910		790	428	410	194	340	263
3	145	207	182	3,070	3,230		745	392	392	207	308	263
4	145	194	182	2,160	2,750		745	358	358	207	392	308
5	145	194	207	2,020	4,800		745	358	340	207	375	410
6	145	207	248	1,680	1,800	4,900	2,590	324	324	220	655	358
7	167	234	248	1,440		3,680	3,860	308	340	410	465	340
8	194	207	263	1,140		2,990	3,500	308	340	510	340	485
9	248	194	278	940		2,300	2,990	308	340	610	278	525
10	248	194	324	840		3,410	2,670	324	358	565	234	445
11	234	194	324	655	1,000	5,300	2,230	324	358	745	234	340
12	220	194	324	700		7,930	1,740	1,040	428	1,740	207	308
13	234	194	308	840		10,900	1,380	3,320	392	2,020	248	263
14	248	194	278	700		11,000	1,140	4,220	392	1,380	263	234
15	220	194	278	2,670		9,900	990	4,400	358	1,040	248	207
16	220	207	324	4,400	1,000	12,100	890	11,000	324	745	565	194
17	207	207	324	4,130		14,100	890	11,990	324	790	655	182
18	194	207	308	2,910		14,200	840	11,600	308	610	565	169
19	194	220	278	2,370		13,300	840	10,500	278	428	428	169
20	194	220	278	2,370		10,500	790	7,710	263	340	308	207
21	182	220	278	2,370	1,000	8,260	745	5,100	234	293	278	410
22	182	207	278	2,440		4,600	700	2,830	234	263	248	940
23	182	207	263	2,300		3,320	655	1,950	220	220	207	1,040
24	194	194	263	1,680		3,150	610	1,560	207	220	194	990
25	194	194	263	1,560		2,830	565	1,260	194	263	182	745
26	182	207	263	1,440	1,000	2,440	525	990	194	248	169	565
27	182	207	293	1,200		2,300	485	890	182	234	182	428
28	182	194	610	990		2,020	485	745	182	428	220	375
29	182	194	1,200	1,140		1,620	465	610	194	840	293	324
30	182	182	2,370	1,810		1,260	445	565	194	745	308	263
31	182	2,090	1,560	1,560	1,040	1,040	485	485	655	248	248	248

NOTE.—Stage-discharge relation affected by ice Feb. 5 to Mar. 3; discharge estimated from study of observer's notes, weather records, and records of flow at near-by points. Braced figures show mean discharge for periods indicated.

Monthly discharge of Maumee River at Antwerp, Ohio, for the year ending September 30, 1923

[Drainage area, 2,130 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	248	145	191	0.089	0.10
November	234	182	201	.094	.10
December	2,370	182	436	.205	.24
January	4,400	655	1,960	.920	1.06
February	3,230	-----	1,590	.746	.78
March	14,200	1,040	5,720	2.69	3.10
April	3,860	445	1,230	.577	.64
May	11,900	308	2,790	1.31	1.51
June	445	182	304	.143	.16
July	2,020	194	568	.267	.31
August	655	169	325	.153	.18
September	1,040	169	400	.188	.21
The year	14,200	145	1,320	1.620	8.39

MAUMEE RIVER AT WATERVILLE, OHIO

LOCATION.—At highway bridge at Waterville, Lucas County.

DRAINAGE AREA.—6,310 square miles (area in Ohio measured on topographic maps, area in Michigan on United States Geological Survey map of Michigan, and area in Indiana on General Land Office map).

RECORDS AVAILABLE.—November 19, 1898, to December 31, 1901, and August 26, 1921, to September 30, 1923.

GAGE.—Chain gage on highway bridge; read by John Rhodes.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Stream bed is rock ledge. One channel at all stages. Channel straight for half a mile above and below gage. Island one-eighth mile above gage. Control permanent. Zero flow would occur at gage height 1 foot.

ICE.—Stage-discharge relation affected by ice during severe winters.

EXTREMES OF DISCHARGE.—Maximum combined discharge of river and canal during year, 39,000 second-feet March 18; minimum combined daily discharge, 345 second-feet December 5.

1921-1923: Maximum combined discharge of river and canal, 41,700 second-feet April 2, 1922; minimum combined discharge, 299 second-feet September 8, 1921.

REGULATION.—Flow at extremely low water may be affected by regulation of Auglaize River at dam of Defiance Gas & Electric Co., near Defiance.

DIVERSIONS.—Water is diverted into Miami and Erie Canal at Grand Rapids and carried past station. For record of this diversion, see page 53.

ACCURACY.—Stage-discharge relation permanent; not seriously affected by ice.

Rating curve well defined up to 25,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for winter which are fair owing to possible ice effect.

Discharge measurements of Maumee River at Waterville, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 3	E. E. R. Dornbach.....	1.52	75.9	Aug. 1	Lee and Dickson.....	2.04	596
6	do.....	1.46	59.2	2	do.....	1.94	478
May 12	do.....	4.31	6,220	15	F. R. Morgan.....	1.92	397

Daily discharge, in second-feet, of Maumee River at Waterville, Ohio, for the year ending September, 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	151	80	56	14,400	6,820	3,040	1,840	424	940	70	585	99
2.....	89	108	53	18,700	9,500	4,530	1,540	734	762	67	448	99
3.....	75	80	60	16,500	11,400	4,210	1,270	678	720	80	295	99
4.....	60	80	57	11,900	12,400	7,690	1,360	337	572	63	706	89
5.....	89	67	53	8,130	9,040	12,800	2,410	276	448	63	337	99
6.....	67	99	56	4,870	4,870	13,400	11,900	337	379	70	295	80
7.....	63	53	53	5,230	4,060	11,900	17,600	276	598	80	850	184
8.....	99	80	108	4,060	2,910	8,580	16,000	400	734	70	972	520
9.....	50	70	60	3,040	2,530	6,400	12,400	238	295	80	400	1,180
10.....	67	67	379	3,600	2,530	6,400	7,250	295	850	89	295	820
11.....	118	53	99	2,780	2,060	14,900	5,600	134	624	108	200	706
12.....	70	70	70	3,310	1,180	23,200	4,530	3,310	790	80	257	496
13.....	80	56	99	3,310	3,310	31,000	3,040	4,870	880	2,290	118	276
14.....	80	60	184	2,060	10,400	31,600	2,660	16,500	972	3,040	151	167
15.....	94	62	412	7,690	12,800	26,500	2,530	19,800	400	2,410	424	108
16.....	89	63	650	20,900	10,400	36,100	2,180	32,100	358	1,740	520	89
17.....	99	53	424	22,000	8,130	37,800	2,060	36,700	348	3,900	316	70
18.....	108	62	496	13,100	5,990	39,000	1,950	34,400	316	1,170	295	118
19.....	80	67	472	12,400	5,230	33,800	1,360	26,500	257	1,040	358	70
20.....	70	56	460	8,580	3,040	29,900	1,270	19,800	200	762	316	337
21.....	68	56	496	7,250	2,910	18,200	1,270	14,400	118	520	496	850
22.....	70	63	460	9,960	2,180	13,900	1,450	9,960	219	348	200	972
23.....	80	60	448	11,400	1,950	10,900	880	5,990	448	200	200	1,100
24.....	80	62	424	8,580	1,180	11,900	1,270	3,460	200	257	134	1,640
25.....	80	108	219	5,990	1,450	10,900	1,100	2,530	104	184	134	1,450
26.....	80	62	184	4,530	1,740	8,580	1,070	1,840	80	108	67	1,180
27.....	89	60	184	4,530	1,950	6,820	972	2,060	70	89	65	790
28.....	70	63	200	2,530	2,660	5,230	870	1,450	62	200	151	546
29.....	89	70	1,740	2,290	-----	3,600	706	1,360	53	316	99	448
30.....	67	50	8,130	5,990	-----	3,310	424	1,170	70	520	118	337
31.....	63	-----	8,130	6,820	-----	2,290	-----	790	-----	650	99	-----

Monthly discharge, in second-feet, of Maumee River and Miami and Erie Canal at Waterville, Ohio, for the year ending September 30, 1923

Month	Maximum (com- bined)	Minimum (com- bined)	Mean		
			River	Canal	Combined
October	643	377	81.7	359	441
November	500	354	68.0	328	396
December	8,650	345	804	400	1,200
January	22,500	2,570	8,280	472	8,750
February	13,200	1,620	5,160	441	5,610
March	39,000	2,580	15,400	281	15,700
April	18,000	860	3,690	386	4,070
May	37,100	531	7,840	410	8,250
June	1,400	476	429	428	857
July	4,320	435	667	438	1,100
August	1,440	488	319	448	767
September	2,090	464	501	420	921
The year	39,000	345	3,620	401	4,020

TIFFIN RIVER NEAR STRYKER, OHIO

LOCATION.—In sec. 17, T. 6 N., R. 4 E., at highway bridge 2 miles southwest of Stryker, Williams County.

DRAINAGE AREA.—450 square miles; revised (area in Ohio measured on topographic maps; area in Michigan on United States Geological Survey map, scale 1:1,000,000).

RECORDS AVAILABLE.—September 1, 1921, to September 30, 1923.

GAGE.—Chain gage on highway bridge; read by Lowell Allison.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Channel straight for 400 feet above and below gage.

One channel at all stages. Banks high and brushy. Control for low water is ruin of old timber milldam half a mile below gage; control for high water is long stretch of river below gage. Zero flow would occur at zero gage height.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.2 feet at 5.10 p.m. March 17 (discharge, 1,840 second-feet); minimum stage, 1.13 feet August 3 and 4, and 7 a.m. August 10 (discharge, 16 second-feet).

1921-1923: Maximum stage recorded, 13 feet at 5.30 p.m. April 1, 1922 (discharge, 1,990 second-feet); minimum stage, 1.10 feet at 8.35 a.m. August 16, 1922 (discharge, 15 second-feet).

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except for period of ice effect, for which they are fair.

The following discharge measurement was made by F. R. Morgan:

August 18, 1923: Gage height, 1.69 feet; discharge, 64.4 second-feet.

Daily discharge, in second-feet, of Tiffin River near Stryker, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	22	46	61	588	187	722	133	78	72	31	18	31
2	24	61	56	556	380	756	152	78	66	31	21	24
3	24	72	62	305	556	773	152	72	59	28	16	30
4	22	78	72	187	508	988	173	72	60	29	16	28
5	27	78	83	140		1,170	275	66	47	32	120	25
6	26	78	95	173		1,200	654	72	89	27	83	34
7	39	72	78	126		722	826	66	215	30	39	72
8	51	72	107	83		476	671	59	245	40	25	95
9	44	72	101	89		320	492	66	215	38	22	66
10	44	72	66	89	200	444	365	66	187	40	18	55
11	39	66	61	101		756	320	78	126	50	19	46
12	38	66	60	66		1,310	275	95	101	78	556	40
13	47	66	66	72		1,590	215	140	89	66	773	36
14	57	66	66	89		1,760	201	133	78	61	844	26
15	59	72	58	126		1,650	201	572	72	47	396	28
16	52	83	51	290		1,700	230	1,020	78	33	187	24
17	49	78	54	396		1,780	260	1,170	215	32	83	20
18	40	78	52	201		1,740	230	1,020	72	28	61	19
19	46	83	48	335		1,590	187	722	53	25	53	22
20	49	83	46	380	150	1,370	159	671	52	21	42	51
21	48	78	44	412		916	146	688	48	24	34	350
22	49	72	54	396		620	140	492	38	22	29	808
23	58	72	57	350		790	133	320	43	24	28	492
24	58	66	58	166		540	120	215	36	24	26	215
25	51	66	61	140	72	476	107	166	34	25	24	114
26	53	66	61	120	201	412	107	146	31	26	22	83
27	53	66	72	107	588	350	95	120	36	25	28	78
28	51	56	126	107	705	290	101	107	37	31	30	72
29	55	60	140	101		230	95	95	40	28	29	89
30	57	61	120	95		201	89	95	42	25	37	95
31	61		173	107		173		78		24	39	

NOTE.—Stage-discharge relation affected by ice Feb. 5-24; discharge estimated from study of observer's notes, weather records, and records of flow of near-by streams. Braced figures indicate mean discharge for period indicated.

Monthly discharge of Tiffin River near Stryker, Ohio, for the year ending September 30, 1923

[Drainage area, 450 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	61	22	44.9	0.100	0.12
November	83	46	70.2	.156	.17
December	173	44	74.5	.166	.19
January	588	66	209	.464	.53
February			239	.531	.55
March	1,780	173	897	1.99	2.29
April	826	89	243	.540	.60
May	1,170	59	285	.633	.73
June	245	31	85.9	.191	.21
July	78	21	33.7	.075	.09
August	844	16	120	.267	.31
September	808	19	106	.236	.26
The year	1,780	16	201	.447	6.05

AUGLAIZE RIVER NEAR FORT JENNINGS, OHIO

LOCATION.—SE. $\frac{1}{4}$ sec. 15, T. 1 S., R. 5 E., at highway bridge $3\frac{1}{2}$ miles northeast of Fort Jennings, Putnam County, and 6 miles by river above mouth of Ottawa River.

DRAINAGE AREA.—333 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 31, 1921, to September 30, 1923.

GAGE.—Chain gage on highway bridge; read by G. S. Hedrick.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 300 feet above and 1,000 feet below gage. Right bank high; left bank fairly high, subject to overflow at extremely high stages. One channel at all stages. Prior to October 29, 1922, control for low water was loose rock dam 800 feet below gage. On that date an opening was made in the center of the loose rock dam down to bedrock in order to lower pool at the gage and allow submerged quarry coffer dam 500 feet below the gage to form control for low water. Zero flow would occur at gage height 0.3 foot, from measurements made after pool was lowered.

EXTREMES OF STAGE.—Maximum stage recorded during period of record, 15.6 feet April 19, 1922; minimum discharge probably occurred October 4, 1921.

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Gage read to hundredths once daily. Record reliable. Rating curve not yet developed for high water. Stage-discharge relation very unstable prior to October 29, 1922.

Discharge measurements of Auglaize River near Fort Jennings, Ohio, during the years ending September 30, 1921-1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
1921		<i>Feet</i>	<i>Sec.-ft.</i>	1922		<i>Feet</i>	<i>Sec.-ft.</i>
Aug. 31	Lamoureux and Lee.....	2.40	50.5	June 3	E. E. R. Dornbach.....	3.06	185
Oct. 25	do.....	2.87	51.3	July 10	do.....	2.98	189
1922				15	do.....	4.73	505
Mar. 13	Lasley Lee.....	4.38	536	Aug. 23	do.....	2.20	43.6
17	do.....	4.56	596	Oct. 29	Lasley Lee.....	1.55	41.5
May 1	E. E. R. Dornbach.....	2.86	161	1923			
6	do.....	3.48	314	May 8	E. E. R. Dornbach.....	1.81	62.5
May 29	do.....	4.50	515	Aug. 20	F. R. Morgan.....	1.39	31.4

*Daily gage height, in feet, of Auglaize River near Fort Jennings, Ohio, for the period
August 31, 1921, to September 30, 1923*

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1921								
1		2.40	11		2.50	21		2.04
2		2.30	12		2.40	22		2.30
3		2.28	13		2.48	23		2.28
4		2.08	14		2.26	24		2.24
5		2.10	15		2.04	25		2.80
6		2.20	16		2.46	26		2.26
7		2.30	17		2.50	27		2.22
8		2.12	18		2.24	28		2.44
9		2.18	19		2.16	29		2.42
10		2.32	20		2.10	30		2.44
						31	2.40	

Daily gage height, in feet, of Auglaize River near Fort Jennings, Ohio, for the period August 31, 1921, to September 30, 1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1921-22												
1.....	2.46	3.1	3.4	2.68	2.80	3.2	13.5	2.86	3.1	2.88	2.40	2.48
2.....	2.22	4.3	3.3	2.92	6.3	3.0	10.2	2.86	3.1	2.82	2.36	2.62
3.....	2.00	4.1	4.8	2.98	8.5	3.0	6.1	3.0	3.0	2.70	2.40	6.0
4.....	1.94	3.3	3.8	2.96	7.4	3.0	4.9	4.8	2.92	2.60	2.36	8.8
5.....	2.22	2.98	3.4	7.3	5.0	2.86	4.3	4.1	2.86	2.50	2.46	6.8
6.....	2.22	2.82	3.2	7.3	4.3	2.88	3.9	3.4	2.86	2.46	2.40	4.0
7.....	2.46	2.76	3.1	4.5	3.7	3.7	3.6	3.2	2.82	2.38	2.36	3.2
8.....	2.54	2.72	3.0	3.7	3.5	4.0	5.2	3.1	2.76	2.84	2.32	2.96
9.....	2.52	2.70	3.0	3.4	3.3	3.6	7.6	3.0	2.68	4.1	2.48	2.82
10.....	2.40	2.66	2.98	3.2	3.2	3.5	5.3	3.5	3.0	3.0	2.48	3.5
11.....	2.34	2.80	2.94	3.1	3.2	5.0	9.1	5.4	3.7	3.0	2.42	7.1
12.....	2.36	3.2	2.94	3.2	3.4	5.8	10.6	4.7	3.7	3.1	2.48	6.4
13.....	2.40	3.4	3.0	3.0	3.4	4.4	6.8	7.2	3.1	6.1	2.40	4.4
14.....	2.28	3.4	3.2	2.92	3.1	4.8	5.8	4.5	2.88	7.0	2.40	3.4
15.....	2.40	4.4	3.3	2.92	2.88	9.6	11.3	3.4	2.76	4.6	2.40	3.0
16.....	2.44	4.0	3.3	2.72	2.68	4.8	13.0	3.1	2.72	3.4	2.44	2.86
17.....	2.30	4.1	3.4	2.66	2.78	4.3	8.2	3.0	2.60	3.4	2.50	2.78
18.....	2.24	6.4	8.0	2.82	2.90	3.5	12.3	3.1	2.60	2.82	2.40	2.64
19.....	2.26	8.3	8.8	4.1	2.92	3.5	15.6	5.9	2.60	2.84	2.44	2.60
20.....	2.50	9.8	5.7	4.7	5.4	4.2	11.1	11.2	2.54	2.84	2.14	2.58
21.....	2.36	7.0	4.3	3.6	5.3	4.3	5.2	11.0	2.52	2.70	2.46	2.56
22.....	2.50	4.4	3.5	3.3	7.3	3.8	4.4	7.8	2.50	2.66	2.36	2.50
23.....	2.60	3.8	3.4	3.1	7.7	4.1	3.9	4.9	2.50	2.62	2.12	2.44
24.....	2.60	3.5	4.2	3.0	7.5	5.6	3.6	4.0	2.56	2.58	2.42	2.38
25.....	2.88	4.0	6.0	3.0	4.8	4.6	3.3	6.0	2.48	2.52	2.44	2.44
26.....	2.82	3.9	4.4	3.2	3.7	4.1	3.1	6.5	2.60	2.42	2.58	2.46
27.....	2.90	4.2	3.4	2.88	3.3	6.6	3.1	7.4	2.56	2.46	2.66	2.48
28.....	2.84	4.4	3.1	2.88	3.3	9.0	3.0	6.2	2.38	2.48	2.56	2.46
29.....	2.82	4.2	3.1	2.78	-----	8.4	2.94	4.6	2.52	2.44	2.62	2.42
30.....	3.0	3.6	2.82	2.78	-----	7.4	2.88	3.6	2.74	2.42	2.62	2.44
31.....	3.1	-----	2.88	2.76	-----	12.4	-----	3.3	-----	2.42	2.56	-----
1922-23												
1.....	2.42	1.48	1.62	9.8	4.6	4.4	2.52	2.12	2.10	1.72	1.56	1.92
2.....	2.50	1.42	1.54	9.2	5.4	3.50	2.42	1.98	2.10	1.70	1.68	2.00
3.....	2.48	1.34	1.62	6.2	5.6	3.12	2.42	1.82	2.06	1.76	1.70	1.66
4.....	2.50	1.24	1.60	5.5	4.4	4.6	2.52	1.74	1.82	1.66	1.80	1.76
5.....	2.52	1.36	1.78	4.4	3.45	5.8	5.4	1.76	1.88	1.62	2.00	1.92
6.....	2.50	1.26	1.70	3.6	4.4	4.6	9.6	1.78	1.90	1.80	1.72	1.82
7.....	2.56	1.20	1.78	3.45	4.2	4.0	7.2	1.62	2.10	1.78	1.78	1.72
8.....	2.62	1.30	1.86	3.22	3.60	3.50	5.0	1.81	1.98	1.82	1.50	1.80
9.....	2.56	1.28	1.80	4.1	3.60	3.28	3.80	1.70	2.06	1.60	1.64	1.80
10.....	2.60	1.16	1.82	5.1	2.96	5.1	3.32	1.88	2.24	1.88	1.86	1.44
11.....	2.62	1.32	2.26	4.2	2.68	6.8	3.14	1.96	2.18	1.74	1.72	1.74
12.....	2.70	1.20	2.14	3.75	2.34	8.8	2.20	3.75	2.16	2.28	1.66	1.78
13.....	2.68	1.28	2.92	3.45	7.0	9.4	2.82	10.6	2.26	1.90	1.30	1.62
14.....	2.66	1.30	2.08	5.1	6.4	6.2	2.76	12.0	2.24	1.42	1.64	1.72
15.....	2.62	1.26	2.04	11.7	4.0	4.6	2.94	9.6	2.60	1.56	1.56	1.70
16.....	2.64	1.20	2.00	9.8	4.4	11.7	2.82	12.2	2.18	1.68	1.72	1.66
17.....	2.54	1.58	1.96	5.7	4.8	11.9	2.72	10.1	2.08	1.80	1.40	1.44
18.....	2.52	1.62	1.76	4.3	4.4	7.0	2.52	6.0	2.26	1.74	1.64	1.52
19.....	2.50	1.72	1.82	3.55	4.4	5.0	2.54	4.6	2.36	1.68	1.74	1.64
20.....	2.62	1.62	1.80	2.28	3.60	3.65	2.48	3.95	2.14	1.66	1.38	1.76
21.....	2.66	1.78	1.88	5.3	3.24	3.22	2.40	3.50	1.98	1.70	1.66	1.84
22.....	2.66	1.76	1.94	7.8	3.04	3.40	2.40	3.20	1.90	1.62	1.40	1.66
23.....	2.62	1.76	1.90	5.4	2.82	8.4	2.22	2.94	1.86	1.44	1.68	1.50
24.....	2.56	1.72	1.76	4.1	2.70	5.6	2.20	2.82	1.96	1.70	1.60	1.56
25.....	2.56	1.74	1.68	3.45	2.70	4.4	2.12	2.68	1.58	1.66	1.54	1.70
26.....	2.64	1.62	1.58	3.20	2.60	3.80	2.12	2.56	1.74	1.66	1.72	1.48
27.....	2.60	1.56	1.62	3.12	3.50	3.40	2.16	2.50	1.70	1.60	1.34	1.40
28.....	2.60	1.56	7.1	6.4	5.2	3.06	2.16	2.48	1.82	1.67	1.74	1.52
29.....	1.56	1.60	8.8	7.6	-----	2.86	2.06	2.32	1.70	1.72	2.06	1.50
30.....	1.80	1.64	7.0	5.2	-----	2.80	1.92	2.20	1.92	1.52	1.60	1.50
31.....	1.44	-----	5.7	4.2	-----	2.60	-----	2.06	-----	1.62	1.80	-----

AUGLAIZE RIVER NEAR DEFIANCE, OHIO

LOCATION.—In NE. $\frac{1}{4}$ sec. 9, T. 3 N., R. 4 E. at dam and power plant of Defiance Gas & Electric Co., 3 miles south of Defiance, Defiance County.

DRAINAGE AREA.—2,320 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 20 to October 24, 1903; April 13, 1915, to September 30, 1923.

GAGES.—Vertical staff gage on upstream side of power plant at right end of dam. Auxiliary staff gage in tailwater. Gages set to mean sea level datum. Crest of dam is 688 feet and top of flashing 689.75 feet above mean sea level. Gages read hourly by power-plant attendants.

DISCHARGE MEASUREMENTS.—Made from highway bridge $1\frac{3}{4}$ miles below dam or by wading.

DISCHARGE.—Daily discharge ascertained by power company from hourly readings on head and tail gages, log sheets of power plant, and ratings of crest of dam, Taintor gates, and turbines.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 20,800 second-feet May 17; minimum mean daily discharge, 18 second-feet August 31.

1915-1923: Maximum mean daily discharge, 36,100 second-feet March 18, 1919; minimum mean daily discharge, 7 second-feet June 30, 1918.

ICE.—Determination of discharge over dam and through plant not seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—Flow regulated by Defiance Gas & Electric Co. Record of discharge not corrected for storage.

ACCURACY.—Discharge ascertained by power company has been checked by current-meter measurements made below dam at various stages and found accurate. The leakage through dam and power plant has been determined for various stages below crest level by current-meter measurements made by wading below dam when power plant was shut down. The leakage varies from 7 second-feet at headwater elevation 679 feet to 41 second-feet at headwater elevation 688 feet. All daily discharge figures below 300 second-feet have been corrected for leakage by engineers of the United States Geological Survey. Records good.

COOPERATION.—Record of daily discharge, not corrected for leakage, furnished by Defiance Gas & Electric Co.

Discharge measurements of Auglaize River near Defiance, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 5	E. E. R. Dornbach.....	80.50	12.8
May 10	do.....	86.90	33.3
Aug. 17	F. R. Morgan.....	86.20	33.6

NOTE.—Add 600 feet to gage heights to reduce to mean sea level datum.

Daily discharge, in second-feet, of Auglaize River near Defiance, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	26	23	46	7,430	3,330	763	454	660	650	343	167	38
2-----	27	24	30	8,950	4,190	813	701	417	777	36	175	21
3-----	27	24	47	5,330	4,860	1,400	686	242	772	153	641	22
4-----	35	98	149	3,560	3,990	2,200	700	281	721	725	448	24
5-----	28	25	432	2,630	2,290	4,200	1,110	299	468	135	226	36
6-----	29	25	148	1,880	1,420	4,060	7,450	72	158	141	37	28
7-----	29	143	129	1,090	1,080	2,940	8,470	302	224	119	35	436
8-----	30	70	129	1,390	1,020	2,030	6,590	109	227	90	196	602
9-----	30	44	31	1,220	1,070	1,420	3,350	112	231	38	368	77
10-----	459	25	47	1,060	1,010	2,340	1,800	119	862	104	31	284
11-----	50	25	44	1,800	611	6,480	1,250	244	301	509	49	248
12-----	80	25	657	1,620	981	10,600	1,120	531	646	523	211	221
13-----	29	26	143	1,310	2,090	13,200	896	6,350	688	505	213	206
14-----	29	59	98	1,420	4,200	12,600	747	11,600	681	836	38	194
15-----	312	59	74	8,740	2,970	8,570	692	12,200	256	734	32	202
16-----	444	42	33	12,500	1,920	13,600	815	18,200	252	713	33	80
17-----	123	127	307	9,140	1,440	20,600	750	20,800	244	633	34	257
18-----	26	27	55	6,480	1,120	19,900	771	13,600	241	640	34	315
19-----	26	28	34	4,580	1,180	10,700	624	8,180	244	569	219	286
20-----	27	98	34	2,610	1,030	4,160	606	4,630	230	532	427	233
21-----	27	99	102	2,320	1,020	2,360	514	3,340	306	584	339	287
22-----	79	93	64	5,240	852	1,640	342	2,440	497	234	313	237
23-----	79	218	36	6,450	875	3,130	709	646	141	411	260	85
24-----	80	245	37	3,550	817	4,990	769	606	37	220	291	260
25-----	86	53	37	2,270	570	4,020	685	561	73	189	313	278
26-----	100	337	38	2,240	1,090	2,730	678	1,300	146	186	41	245
27-----	49	28	403	1,030	1,040	1,720	616	341	182	188	268	185
28-----	141	28	698	1,100	790	1,380	475	650	168	499	313	239
29-----	164	103	3,120	3,610	-----	1,190	84	683	108	223	312	263
30-----	705	29	4,510	3,970	-----	946	524	219	106	185	61	75
31-----	121	-----	3,920	3,310	-----	600	-----	434	-----	162	18	-----

Monthly discharge, in second-feet, of Auglaize River near Defiance, Ohio, for the year ending September 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October-----	705	26	113	May-----	20,800	72	3,550
November-----	337	23	75	June-----	862	37	355
December-----	4,510	30	504	July-----	806	36	362
January-----	12,500	1,030	3,830	August-----	641	18	198
February-----	4,860	570	1,740	September-----	602	21	199
March-----	20,600	600	5,400				
April-----	8,470	84	1,500	The year--	20,800	18	1,490

BLANCHARD RIVER AT GLANDORF, OHIO

LOCATION.—In NE. $\frac{1}{4}$ sec. 17, T. 1 N., R. 7 E., at highway bridge three-fourths mile northeast of Glandorf, Putnam County, and $1\frac{1}{4}$ miles above mouth of Cranberry Creek.

DRAINAGE AREA.—643 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 30, 1921, to September 30, 1923.

GAGE.—Chain gage on highway bridge, read to hundredths once daily by Victor Unterbrink.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 500 feet above and below gage.

Banks fairly high and wooded. One channel at all stages. Control is stretch of channel below gage; practically permanent. Zero flow would occur at gage height 0.7 foot.

EXTREMES OF STAGE.—Maximum stage recorded during year, 19.1 feet at 6 a. m. March 17; minimum stage, 1.68 feet at 6 a. m. October 6 and 7.

1921-1923: Maximum stage recorded, 22.4 feet at 1 p. m. April 1, 1922; minimum stage, 1.58 feet at 11 a. m. and 3 p. m. August 30, and 6 p. m. August 31, 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

Data inadequate for determination of discharge.

Discharge measurements of Blanchard River at Glandorf, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
May 7	E. E. R. Dornbach.....	Feet	Sec.-ft.
Aug. 21	F. R. Morgan.....	2.14	34.0
		1.78	15.7

Daily gage height, in feet, of Blanchard River at Glandorf, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	1.76	1.90	1.92	11.6	7.3	7.0	3.15	2.70	2.72	2.04	2.48	2.19
2-----	1.78	1.90	1.90	11.0	8.7	6.6	3.45	2.64	2.62	2.00	2.48	2.21
3-----	1.76	1.90	1.90	8.0	10.0	6.0	3.45	2.58	2.56	1.98	2.46	2.35
4-----	1.74	1.90	1.90	7.2	8.4	6.4	3.48	2.48	2.50	1.98	2.94	2.19
5-----	1.72	1.88	2.02	6.0	7.4	8.0	6.7	2.58	2.44	1.98	2.70	2.35
6-----	1.68	1.90	1.98	4.8	6.7	7.0	14.2	2.48	2.38	1.98	2.38	2.17
7-----	1.68	1.90	2.06	4.4	6.0	6.4	15.4	2.25	2.80	2.10	2.26	2.23
8-----	1.72	1.90	2.25	3.98	5.4	5.4	12.2	2.18	4.3	2.18	1.98	3.01
9-----	1.78	1.90	2.30	4.0	5.0	4.8	8.6	2.56	3.63	2.40	1.94	2.61
10-----	2.08	1.90	2.26	4.4	4.6	6.5	6.0	2.88	3.38	3.00	1.88	2.41
11-----	2.02	1.90	2.20	5.2	4.5	8.1	4.9	3.02	3.06	2.74	1.86	2.17
12-----	1.90	1.90	2.20	5.1	4.4	13.0	4.3	3.36	2.84	4.5	1.82	2.05
13-----	1.94	1.90	2.14	4.9	8.4	17.2	4.3	11.2	2.65	5.1	3.08	1.97
14-----	1.94	1.90	2.14	7.2	13.7	16.1	4.1	16.2	2.54	4.9	3.02	1.93
15-----	1.94	1.94	2.12	14.7	12.8	17.4	3.86	17.0	2.42	3.96	2.80	1.87
16-----	1.94	1.96	2.08	17.7	8.7	18.8	3.78	18.4	2.52	2.98	2.20	1.85
17-----	1.92	2.00	2.06	15.5	7.4	19.1	3.38	16.6	2.40	2.72	2.00	1.81
18-----	1.90	2.46	2.00	12.4	7.4	17.5	3.26	14.8	2.34	2.64	1.92	1.81
19-----	1.86	2.20	1.96	7.7	7.2	12.4	3.15	12.3	2.26	2.46	1.86	1.81
20-----	1.84	2.02	1.96	5.9	7.0	8.2	3.08	8.4	2.18	2.32	1.82	3.03
21-----	1.82	2.00	1.96	7.7	6.6	7.4	2.96	6.0	2.14	2.22	1.78	3.05
22-----	1.82	1.96	2.00	12.4	6.3	5.1	2.92	5.2	2.12	2.16	1.76	2.87
23-----	1.92	1.92	2.00	14.8	6.1	10.0	2.90	4.6	2.10	1.98	1.73	2.67
24-----	1.95	1.86	2.00	7.6	5.8	12.1	2.90	4.0	2.16	2.76	1.73	2.45
25-----	1.90	1.80	2.12	6.0	5.8	10.8	2.84	3.67	2.26	2.78	1.73	2.27
26-----	1.90	1.80	3.00	5.1	5.6	7.6	2.78	3.57	2.18	2.82	1.73	2.13
27-----	1.90	1.82	4.5	4.6	5.6	5.4	2.76	3.38	2.14	3.10	1.73	2.07
28-----	1.90	1.82	6.7	4.8	7.4	5.0	2.74	3.16	2.10	2.96	2.01	2.03
29-----	1.90	1.84	7.7	8.3	-----	4.8	2.74	2.90	2.10	2.72	2.43	2.01
30-----	1.90	1.84	7.0	9.0	-----	4.4	2.74	2.84	2.08	2.66	2.53	3.69
31-----	1.90	-----	8.8	8.1	-----	3.9	-----	2.78	-----	2.53	2.25	-----

NOTE.—Stage-discharge relation affected by ice Feb. 13 to Mar. 1

MIAMI AND ERIE CANAL AT WATERVILLE, OHIO

LOCATION.—At highway bridge at Waterville, Lucas County, opposite gaging station on Maumee River at Waterville.

RECORDS AVAILABLE.—August 26, 1921, September 30, 1923.

GAGE.—Vertical staff gage on downstream wing wall of left abutment; read by John Rhodes. Prior to September 13, 1922, chain gage on downstream side of highway bridge. Both gages at same datum.

DISCHARGE MEASUREMENTS.—Made from footbridge 500 feet below gage.

CHANNEL AND CONTROL.—Channel straight for a quarter of a mile above and below gage. One channel at all stages. Control is long stretch of channel below gage; shifting. Zero flow occurs at gage height 0.86 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.95 feet January 8 (discharge, 580 second-feet). No flow in canal March 15, when there was break in bank above gage.

1921-1923: Maximum stage recorded, 7.07 feet March 2, 1922 (discharge, 610 second-feet). No flow in canal March 15, 1923.

ICE.—Stage-discharge relation may be affected by ice during severe winters.

REGULATION.—The flow in the canal is regulated at the head gate at Grand Rapids, 10 miles upstream.

ACCURACY.—Stage-discharge relation not permanent; not seriously affected by ice. Gage read to half-tenths once daily. Daily discharge ascertained by shifting-control method. Records fair.

The canal diverts from Maumee River at Grand Rapids, 10 miles above Waterville. The water is used for power at Maumee and Toledo.

Discharge measurements of Miami and Erie Canal at Waterville, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 2	E. E. R. Dornbach.....	5.98	467	Aug. 2	Dickson and Lee.....	6.15	477
May 12	.....do.	6.32	461	15	F. R. Morgan	5.97	440

Daily discharge, in second-feet, of Miami and Erie Canal at Waterville, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	492	360	336	492	478	450	314	423	436	397	478	423
2	478	372	336	520	464	464	303	423	423	397	478	410
3	450	372	303	464	450	506	397	423	397	384	478	410
4	423	336	303	464	550	464	360	423	436	384	478	397
5	410	325	292	464	397	450	314	423	423	372	464	397
6	384	325	325	314	450	450	384	423	436	372	384	384
7	360	325	348	555	450	436	384	423	423	372	404	397
8	360	325	372	580	450	423	397	410	410	372	464	410
9	348	314	397	506	450	423	384	410	384	372	450	450
10	325	303	372	535	436	423	372	423	423	423	450	436
11	325	314	372	492	436	450	410	397	423	506	450	436
12	348	314	397	506	436	478	397	450	410	450	478	423
13	348	303	336	535	436	181	360	325	423	450	450	423
14	348	303	464	506	436	20	384	464	423	464	436	423
15	336	303	450	478	436	0	410	423	410	450	436	423
16	336	314	464	492	423	46	314	372	423	450	464	436
17	348	303	450	478	423	25	348	372	423	423	450	423
18	360	292	450	492	410	25	360	372	423	450	450	410
19	360	292	450	436	410	163	410	450	423	464	450	397
20	348	314	450	336	410	70	410	384	450	464	450	410
21	336	303	450	450	436	145	410	397	464	464	450	436
22	348	314	450	464	450	190	423	348	478	478	464	423
23	360	314	450	423	436	210	397	384	423	478	450	423
24	348	314	436	450	450	220	410	410	423	464	450	450
25	336	336	410	450	436	270	410	436	464	464	436	436
26	348	348	360	450	436	281	410	423	450	464	423	423
27	325	360	325	423	436	270	423	410	450	464	423	423
28	314	348	372	450	450	292	423	410	436	450	423	423
29	303	336	450	464	-----	303	436	423	423	478	410	423
30	314	450	520	478	-----	292	436	423	410	478	423	436
31	314	-----	520	478	-----	292	-----	423	-----	478	436	-----

Monthly discharge, in second-feet, of Miami and Erie Canal at Waterville, Ohio, for the year ending September 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October	492	303	359	May	464	372	410
November	450	292	328	June	478	384	428
December	520	292	400	July	506	372	438
January	580	314	472	August	478	384	448
February	550	397	441	September	450	384	420
March	506	0	281	The year..			401
April	436	303	386				

SANDUSKY RIVER NEAR UPPER SANDUSKY, OHIO

LOCATION.—In sec. 21, T. 2 S., R. 14 E., at highway bridge 2 miles northeast of Upper Sandusky, Wyandot County.

DRAINAGE AREA.—299 square miles (measured on topographic maps).

RECORDS AVAILABLE.—October 20, 1921, to September 30, 1923.

GAGE.—Chain gage on downstream side of highway bridge.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel is straight for 400 feet above gage but is divided by island; straight for 1,000 feet below gage. One channel at all stages. Banks are low and wooded. All water flows under bridge up to gage height 11.3 feet, when road leading to bridge on right bank is overflowed. Control for low water is riffle 200 feet below gage, composed of rock ledge and gravel. At high stages control is long stretch of channel below gage. Zero flow would occur at gage height 0.1 foot, as determined August 14, 1923.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.6 feet at 4.30 p. m. January 15 (discharge, 2,850 second-feet); minimum stage, 1.06 feet at 9 a. m. October 6 (discharge, 7.5 second-feet).

1921-1923: Maximum stage recorded, 8 feet April 18, 1922 (discharge, 4,060 second-feet); minimum stage, that of October 6, 1922.

ICE.—Stage-discharge relation seriously affected by ice.

ACCURACY.—Stage-discharge relation practically permanent except as affected by leaves on control during October, November, and December and by ice during February and March. Rating curve well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except during period of ice effect, for which they are fair.

Discharge measurements of Sandusky River near Upper Sandusky, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 29	Lasley Lee.....	1.27	10.4	Apr. 10	E. E. R. Dornbach....	2.09	188
Nov. 21	E. E. R. Dornbach....	1.35	18.4	May 15	do.....	4.16	1,160
Apr. 10	do.....	2.18	217	Aug. 14	F. R. Morgan.....	1.08	10.8

Daily discharge, in second-feet, of Sandusky River near Upper Sandusky, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	12	12	13	646	373	400	415	31	33	13	11	44
2.....	11	13	13	293	599		415	29	31	13	11	28
3.....	11	13	12	312	842	257	394	27	29	16	11	18
4.....	11	15	15	332	646		505	27	26	40	19	16
5.....	9.0	12	17	207	950	599	1,480	28	23	18	15	50
6.....	7.5	19	21	132	842	505	1,950	24	44	57	19	26
7.....	12	15	24	132	694	293	950	22	102	39	25	373
8.....	19	20	25	257	552	157	437	23	89	528	34	217
9.....	15	20	25	552	312	166	437	28	54	312	22	76
10.....	32	17	24	459	240	275	197	30	37	22	16	39
11.....	24	15	23	312	160	1,390	160	34	33	72	13	26
12.....	23	18	23	257	163	1,000	135	646	31	293	14	21
13.....	19	19	13	132	842	1,180	127	2,460	26	122	12	17
14.....	18	19	15	576	842	599	117	1,060	29	76	11	14
15.....	16	24	15	2,850	800	373	107	1,240	29	44	11	12
16.....	17	25	15	2,610		1,420	98	1,740	29	42	10	12
17.....	16	28	15	694	800	1,880	89	842	21	37	10	12
18.....	16	32	13	1,420		646	76	132	18	24	9.8	11
19.....	14	31	13	257	400	373	68	120	16	20	9.4	12
20.....	12	31	13	223		293	64	482	16	18	10	15
21.....	12	20	13	1,240	400	176	59	373	16	14	10	39
22.....	12	20	13	1,620		223	56	373	14	13	10	217
23.....	12	18	13	437	400	2,460	47	185	13	13	9.8	240
24.....	12	14	17	293		1,420	42	120	14	14	10	43
25.....	12	13	19	223	400	646	39	91	14	14	9.8	28
26.....	12	11	19	179		352	38	76	13	14	10	27
27.....	13	14	25	149	400	275	37	72	13	12	10	22
28.....	11	12	599	552		210	38	59	16	12	31	39
29.....	11	13	1,060	742	400	160	39	50	16	12	29	50
30.....	11	11	482	373		127	33	47	21	12	34	39
31.....	11	---	223	312	400	107	---	38	---	12	54	---

NOTE.—Stage-discharge relation affected by leaves matted on control Oct. 13 to Dec. 29. Method for shifting control used Oct. 13-28. Stage-discharge relation affected by ice Feb. 15 to Mar. 3, flow estimated from study of observer's notes, weather records, and records of flow of near-by streams.

Monthly discharge of Sandusky River near Upper Sandusky, Ohio, for the year ending September 30, 1923

[Drainage area, 299 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	32	7.5	14.3	0.048	0.06
November.....	32	11	18.2	.061	.07
December.....	1,060	12	91.3	.310	.36
January.....	2,850	132	606	2.03	2.34
February.....			588	1.97	2.05
March.....	2,460	107	604	2.02	2.33
April.....	1,950	33	288	.963	1.07
May.....	2,460	22	339	1.14	1.31
June.....	102	13	28.9	.097	.11
July.....	528	12	62.8	.021	.02
August.....	54	9.4	16.5	.055	.06
September.....	373	11	59.4	.199	.22
The year.....	2,850	7.5	225	.753	10.23

SANDUSKY RIVER NEAR MEXICO, OHIO

LOCATION.—In sec. 13, T. 1 N., R. 14 E., at highway bridge $4\frac{1}{4}$ miles north of Mexico, Wyandot County. Honey Creek enters on right 3 miles below station.

DRAINAGE AREA.—776 square miles (measured on topographic maps).

RECORDS AVAILABLE.—March 1 to September 30, 1923, at present site; November 17, 1898, to November 16, 1900, at highway bridge at Mexico.

GAGE.—Chain gage on bridge, read by Lowell Keller.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 800 feet above and below gage.

Right bank high and wooded; left bank fairly high, wooded, subject to overflow at extremely high water. One channel at all stages. Control for low water is riffle of boulders on rock ledge 100 feet below gage; fairly permanent. Control at high stages is long stretch of channel below gage. Zero flow would occur at gage height 0.7 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 11.45 feet at time of discharge measurement May 13 (discharge, 4,900 second-feet); minimum stage recorded, 1.62 feet at 3.35 p. m. August 14 (discharge, 29 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation for low water changed during high water on May 13. Rating curves well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Sandusky River near Mexico, Ohio, during the years ending September 30, 1921-1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
1921 Sept. 8	Lee and Lamoureux...	<i>Feet</i> 1.90	<i>Sec.-ft.</i> 38.8	1922 Aug. 18 29	E. E. R. Dornbach... Lee and Sherman.....	<i>Feet</i> 1.89 2.09	<i>Sec.-ft.</i> 34.9 52.3
1922 Mar. 14	E. E. R. Dornbach....	5.87	1,270	1923 May 13	E. E. R. Dornbach....	11.45	4,900
Apr. 12	do	8.92	2,960	Aug. 14	F. R. Morgan.....	1.63	29.8
May 20	do	12.90	6,130				

Daily discharge, in second-feet, of Sandusky River near Mexico, Ohio, for the period March 1 to September 30, 1923

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,100	170	73	93	56	40	107
2	600	160	71	87	55	35	87
3	495	180	65	81	55	107	68
4	530	249	63	81	81	130	93
5	1,280	2,880	60	87	81	93	230
6	980	3,960	60	76	87	70	122
7	820	3,580	58	230	565	76	1,020
8	530	1,580	54	255	860	70	740
9	355	860	51	282	820	68	390
10	565	600	53	206	705	65	195
11	2,280	408	60	130	670	68	122
12	3,090	356	236	114	740	60	87
13	2,760	276	4,840	93	460	53	68
14	1,880	249	4,840	87	268	30	64
15	1,060	236	4,360	93	174	48	56
16	2,160	224	4,840	87	174	48	53
17	3,160	201	3,800	81	130	46	55
18	2,040	190	1,930	76	100	43	51
19	1,140	160	1,060	70	87	45	49
20	670	150	670	64	81	46	60
21	495	140	600	64	70	45	81
22	1,100	121	740	60	66	41	100
23	3,580	109	530	56	60	45	122
24	3,960	109	311	53	51	48	138
25	2,880	95	242	49	55	41	100
26	1,100	92	184	43	64	41	76
27	705	85	164	53	70	56	70
28	495	89	146	58	70	58	93
29	408	85	130	66	66	122	155
30	290	82	122	64	55	195	155
31	236		107		48	164	

Monthly discharge of Sandusky River near Mexico, Ohio, for the period March 1 to September 30, 1923

[Drainage area, 776 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
March	3,960	236	1,380	1.78	2.05
April	3,960	82	589	.759	.85
May	4,840	51	985	1.27	1.46
June	282	43	97.9	.126	.14
July	860	48	223	.288	.33
August	195	30	67.6	.087	.10
September	1,020	49	160	.206	.22

EAST BRANCH OF BLACK RIVER AT ELYRIA, OHIO.

LOCATION.—At Fuller Street Bridge, $1\frac{1}{4}$ miles southeast of center of Elyria, Lorain County, and 3 miles by river above junction with West Branch.

DRAINAGE AREA.—211 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 8, 1922, to September 30, 1923.

GAGE.—Chain gage on bridge, read to hundredths twice daily by Mrs. A. B. Coon and Mrs. Joe Wojcik.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 1,000 feet above and 700 feet below gage. Banks high and clean, not subject to overflow. One channel at all stages. Low-water control is a solid rock ledge extending diagonally across channel 25 feet below gage. Control for high stages is long stretch of channel below gage. Zero flow would occur at gage height 0.52 foot.

EXTREMES OF STAGE.—Maximum stage recorded during period of record, 4.5 feet at 5.40 p. m. April 6, 1923; minimum stage recorded, 0.57 foot at 7.30 a. m. and 5.30 p. m. October 5 and 9.30 a. m. October 6, 1922.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

Data inadequate for determination of discharge.

Discharge measurements of East Branch of Black River at Elyria, Ohio, during the years ending September 30, 1922 and 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
1922		<i>Feet</i>	<i>Sec.-ft.</i>	1923		<i>Feet</i>	<i>Sec.-ft.</i>
July 8	Lee and Sherman.....	1.28	71.6	Aug. 30	L. L. Dickson	1.54	133
27	E. E. R. Dornbach.....	.89	12.2	Sept. 11	E. E. R. Dornbach.....	.82	7.6
				11	L. L. Dickson .....	.80	8.1
1923							
Aug. 6	L. L. Dickson	1.42	97.5				

Daily gage height, in feet, of East Branch of Black River at Elyria, Ohio, for the period July 8, 1922, to September 30, 1923

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1922				1922				1922			
1	-----	0.74	0.76	11	0.98	0.74	0.80	21	0.84	0.68	0.74
2	-----	.74	.76	12	1.09	.72	.76	22	.82	.66	.72
3	-----	.74	.79	13	.97	.72	.74	23	.81	.66	.72
4	-----	.70	.68	14	.96	.74	.72	24	.80	.68	.70
5	-----	.71	1.28	15	.92	.73	.72	25	.88	.69	.70
6	-----	.71	1.10	16	.87	.72	.72	26	.90	.69	.67
7	-----	.70	.94	17	.82	.72	.71	27	.88	.68	.62
8	1.27	.73	.88	18	.82	.71	.71	28	.81	.72	.60
9	1.43	.78	.84	19	.87	.70	.74	29	.76	.75	.62
10	1.10	.80	.80	20	.87	.69	.72	30	.76	.74	.66
								31	.74	.78	-----

Daily gage height, in feet, of East Branch of Black River at Elyria, Ohio, for the period July 8, 1922, to September 30, 1923—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1922-23												
1	0.64	0.76	0.82	1.06	1.36	1.43	1.12	0.86	1.00	0.78	0.77	1.10
2	.62	.76	.83	1.04	1.42	1.55	1.08	.85	.98	.78	.78	1.03
3	.62	.77	.84	1.02	1.46	1.73	.99	.84	1.06	.80	.80	.99
4	.63	.77	.84	1.03	1.48	1.90	1.04	.83	1.04	.82	.82	.92
5	.57	.75	.84	1.06	1.48	1.95	2.31	.82	.96	.80	1.16	.88
6	.60	.77	.84	1.08	1.40	1.84	4.44	.84	.94	.82	1.40	.78
7	.64	.78	.85	1.04	1.34	1.64	4.38	.86	.92	.84	2.24	.83
8	.68	.77	.86	1.04	1.24	1.38	4.16	.92	.80	1.36	1.96	.94
9	.68	.76	.87	1.06	1.14	1.84	3.86	.96	.76	1.34	1.24	.91
10	.68	.89	.88	1.06	1.04	2.49	3.36	1.21	.76	1.26	1.00	.86
11	.69	.92	.88	1.08	1.06	3.20	2.86	1.56	.80	1.24	.90	.82
12	.70	.87	.88	1.08	1.11	3.16	1.56	2.16	.82	1.16	.89	.86
13	.68	.85	.85	1.09	1.18	2.80	1.16	2.76	.80	1.16	.88	.79
14	.68	.84	.86	1.12	1.26	2.20	1.16	2.91	.82	1.11	.88	.77
15	.68	.88	.86	1.66	1.34	1.70	1.16	2.91	.80	1.16	.86	.73
16	.68	.86	.86	2.15	1.41	2.08	1.16	2.97	.78	1.14	.84	.72
17	.70	.84	.88	2.08	1.46	2.68	1.15	2.95	.80	1.12	.82	.73
18	.72	.85	.88	1.99	1.34	2.40	1.15	2.34	.78	1.11	.81	.77
19	.74	.74	.89	1.86	1.20	1.68	1.14	1.46	.78	.96	.80	.73
20	.74	.77	.90	1.80	1.12	1.38	1.14	1.39	.76	.94	.81	.99
21	.76	.86	.90	2.34	1.10	1.41	1.14	1.41	.86	.86	.81	1.62
22	.76	.87	.90	2.18	1.08	2.08	1.16	1.34	.96	.78	.84	1.86
23	.78	.86	.91	2.04	1.08	3.11	1.14	1.25	1.01	.76	.79	1.32
24	.77	.86	.91	1.97	1.08	2.81	1.13	1.23	1.01	.68	.79	1.14
25	.77	.86	.92	1.95	1.08	2.11	1.09	1.21	.96	.78	.77	.98
26	.76	.84	.93	1.96	1.08	1.68	1.00	1.08	.78	.76	.83	.96
27	.74	.82	.92	2.02	1.49	1.31	.94	1.06	.76	.76	.83	.89
28	.75	.82	.94	1.91	1.48	1.23	.92	1.04	.76	.74	1.02	.96
29	.75	.82	1.00	1.80	-----	1.21	.90	1.02	.68	.76	2.35	1.33
30	.74	.82	1.15	1.66	-----	1.16	.88	1.01	.68	.78	1.62	1.03
31	.75	-----	1.06	1.50	-----	1.14	-----	1.00	-----	.78	1.19	-----

CUYAHOGA RIVER AT OLD PORTAGE, OHIO

LOCATION.—At highway bridge at Old Portage, also known as Cranmer, Summit County, 4 miles northwest of Akron. Little Cuyahoga River enters on left $1\frac{1}{4}$ miles above station.

DRAINAGE AREA.—405 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 27, 1921, to September 30, 1923.

GAGE.—Chain gage on highway bridge; read by N. A. Bucklin.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight 300 feet above and below gage.

Banks fairly high, wooded. At extremely high stages water flows through second channel on right bank. Bed of stream composed of sand and gravel. Control for low water is riffle 50 feet below gage; control for high water is long stretch of channel below gage. Zero flow would occur at zero gage height.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.60 feet at 4 p. m. January 21 (discharge, 1,840 second-feet); minimum stage, 0.98 foot at 7.30 a. m. September 1 (discharge, 51 second-feet).

1921-1923: Maximum stage recorded, 7.2 feet on March 31, 1922 (discharge, 2,130 second-feet); minimum stage, that of September 1, 1923.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Municipal water supply for Akron is diverted from headwaters of this stream. A small amount of water is diverted into this stream from Tuscarawas River by the Ohio Canal.

REGULATION.—Flow regulated at reservoir above Akron.

ACCURACY.—Stage-discharge relation for low water changed during high water on January 21; not affected by ice. Rating curves well defined. Gage read to hundredths once daily up to November 9, twice daily thereafter. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Cuyahoga River at Old Portage, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 12	E. E. R. Dornbach	1.98	246	Aug. 29	L. L. Dickson	1.84	200
Nov. 10	Lasley Lee	1.10	76.2	Sept. 8	Morgan and Ansley	1.61	148
May 26	Covert, Lee, and Dornbach	2.09	279	10	Morgan and Byrnes	1.13	72.3
				16	Dornbach and Ansley	1.10	66.6

Daily discharge, in second-feet, of Cuyahoga River at Old Portage, Ohio, for the year ending September, 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	69		197	590	530	446	272	189	178	94	129	129
2	176		165	501	590	446	336	189	121	121	121	78
3	122		119	501	710	620	310	113	100	94	260	73
4	91	90	197	472	620	805	336	147	102	108	260	113
5	98		176	415	560	1,020	945	138	138	178	121	100
6	94		176	359	560	1,020	1,160	113	111	167	138	94
7	79	186	186	306	530	1,050	945	138	323	129	147	138
8	145	186	243	346	474	945	1,020	157	167	108	167	147
9		208	306	359	446	740	1,080	200	147	121	129	108
10		103	84	346	323	945	945	189	212	138	121	121
11		140	136	255	415	272	1,160	740	236	272	200	113
12			94	220	176	297	1,240	530	770	297	178	129
13			155	186	243	446	1,320	474	1,280	248	99	121
14		85	165	98	319	502	1,280	446	945	284	121	129
15		76	319	165	980	362	1,200	390	980	248	88	121
16			319	136	980	390	1,400	390	945	129	129	70
17			280	88	620	390	1,320	390	805	284	157	85
18		100	231	165	710	310	945	446	620	297	157	121
19			86	155	980	323	875	418	560	260	121	84
20			155	231	910	272	805	390	530	236	121	113
21												
22	82	136	208	1,760	272	680	336	560	100	121	121	284
23	119	94	136	1,600	284	740	362	502	94	68	138	147
24	280	122	145	1,320	272	875	323	390	99	108	129	113
25	280	136	155	1,200	260	770	310	362	82	138	129	167
26	186	124	98	1,160	138	710	362	336	103	129	113	167
27												
28	186	71	186	945	224	740	297	260	88	121	61	167
29	186	145	165	710	390	620	310	224	90	113	113	157
30	79	106	501	770	446	560	362	297	138	129	284	167
31	76	165	620	710		446	272	297	113	79	157	147
32	165	74	443	560		390	310	178	85	113	147	167
33	108		472	560		362		212		138	138	

NOTE.—Discharge Oct. 9-13, 16-20, and Nov. 1-6, estimated by comparison of record of combined flow of river and canal at Independence. Braced figures indicate mean discharge for periods indicated.

Monthly discharge, in second-feet, of Cuyahoga River at Old Portage, Ohio, for the year ending September 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October.....	280	69	128	May.....	1,280	113	415
November.....	319	71	145	June.....	323	82	172
December.....	620	84	215	July.....	200	68	125
January.....	1,760	176	704	August.....	284	61	139
February.....	710	138	400	September.....	310	70	136
March.....	1,400	362	854				
April.....	1,160	272	507	The year..	1,760	61	329

CUYAHOGA RIVER AT BRECKSVILLE, OHIO

LOCATION.—At highway bridge at Brecksville railroad station, 2 miles east of Brecksville, Cuyahoga County. Chippewa Creek enters on right 800 feet above gage.

DRAINAGE AREA.—584 square miles (measured on topographic maps).

RECORDS AVAILABLE.—March 1 to September 30, 1923.

GAGE.—Foxboro water-stage recorder of the pressure type and auxiliary vertical staff gage on highway bridge, read by Leonard Brown.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel slightly curved above and below gage. Left bank high; right bank fairly high; subject to overflow at extremely high stages. Control is timber dam with steel crest, 300 feet below gage. Leakage negligible.

EXTREMES OF DISCHARGE.—Maximum combined discharge of river and canal feeder during period of record, 3,070 second-feet April 5; minimum combined discharge, 92 second-feet August 20 and 21.

ICE.—Stage-discharge relation not affected by ice during period of record.

DIVERSIONS.—Water is diverted into the Ohio Canal feeder at the dam 300 feet below gage. For a record of this diversion see page 64. A small amount of water is diverted into this stream from Tuscarawas River by the Ohio Canal.

REGULATION.—Flow is regulated at reservoir above Akron.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

COOPERATION.—Gage-height record furnished by American Steel & Wire Co.

Discharge measurements of Cuyahoga River at Brecksville, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 12	E. E. R. Dornbach.....	2.05	2,380	Aug. 7	L. L. Dickson.....	0.25	203
13	do.....	1.80	1,800	30	do.....	.13	159
May 26	Lee and Covert.....	.57	377	Sept. 11	do.....	.05	146

Combined daily discharge, in second-feet, of Cuyahoga River and Ohio Canal feeder at Brecksville, Ohio, for the period March 1 to September 30, 1923

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1	737	340	271	220	122	169	144
2	793	391	225	174	122	144	115
3	1,080	393	312	150	145	361	122
4	1,460	616	169	150	210	299	100
5	1,260	3,070	193	169	197	221	219
6	1,220	1,940	193	178	205	188	158
7	1,230	1,460	186	304	201	240	152
8	1,110	1,320	271	272	183	221	225
9	911	1,270	325	238	156	162	132
10	2,090	1,110	287	302	178	132	120
11	1,730	898	354	306	244	131	123
12	1,980	737	2,470	316	205	134	120
13	1,830	538	1,740	293	148	141	129
14	1,650	585	1,180	289	145	142	113
15	1,470	674	1,240	266	136	141	113
16	2,300	582	1,040	215	132	108	113
17	1,710	531	926	159	149	113	122
18	1,400	631	784	232	142	104	122
19	1,220	518	646	349	147	108	122
20	1,060	477	772	282	142	92	209
21	873	457	885	201	129	92	416
22	1,620	413	645	192	116	138	268
23	1,490	403	506	170	100	116	174
24	1,080	380	455	137	134	125	192
25	937	373	409	170	141	113	183
26	716	312	386	183	148	104	183
27	640	296	357	187	138	104	202
28	650	277	401	192	157	302	223
29	544	290	371	165	122	174	160
30	470	351	283	138	147	132	174
31	422	-----	220	-----	167	140	-----

Combined monthly discharge, in second-feet, of Cuyahoga River and Ohio Canal feeder at Brecksville, Ohio, for the period March 1 to September 30, 1923

Month	Maximum (com- bined)	Minimum (com- bined)	Mean		
			River	Canal	Combined
March	2,300	422	1,150	68.0	1,220
April	3,070	277	649	71.6	721
May	2,470	169	522	75.2	597
June	349	137	121	99.2	220
July	244	100	29.5	126	155
August	361	92	41.1	117	158
September	416	100	53.9	114	168

CUYAHOGA RIVER AT INDEPENDENCE, OHIO

LOCATION.—In T. 6 N., R. 12 W., at highway bridge three-eighths mile north-west of Thornburg and 1 mile north of Independence, Cuyahoga County.

DRAINAGE AREA.—709 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 21, 1903, to July 21, 1906, and September 28, 1921, to May 31, 1923, when station was discontinued.

GAGE.—Chain gage on highway bridge, read by John Zimmerman.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 500 feet above and 3,000 feet below gage. Banks fairly high. One channel at all stages. Bed of stream composed of gravel and small boulders. Control for low water is riffle 700 feet below gage. Control for high water is long stretch of channel. Zero flow would occur at 0.00 foot gage height.

EXTREMES OF DISCHARGE.—Maximum combined daily discharge of river and canal during period, October 1, 1922, to May 31, 1923, 6,200 second-feet January 21; minimum combined daily discharge, 117 second-feet October 30.

1921–1923: Maximum combined daily discharge, that of January 21, 1923; minimum combined daily discharge, 116 second-feet on October 3, 1921.

ICE.—Stage-discharge relation affected by ice during severe winters.

DIVERSIONS.—Water is diverted into the Ohio Canal at Brecksville about 6 miles upstream and carried past station. For a record of this diversion, see page 65. A small amount of water is diverted into this stream from Tuscarawas River by the Ohio Canal.

REGULATION.—Flow is regulated at reservoir above Akron.

ACCURACY.—Stage-discharge relation for low water changed during high water of January 21, 1923; not affected by ice. Rating curve used prior to the change well defined up to 3,500 second-feet. Rating curve used thereafter fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Cuyahoga River at Independence, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
Oct. 13	E. E. R. Dornbach.....	<i>Feet</i> 1.96	<i>Sec.-ft.</i> 206	Mar. 13	E. E. R. Dornbach.....	<i>Feet</i> 5.88	<i>Sec.-ft.</i> 2,150
Nov. 9	Lasley Lee.....	1.76	140	May 27	Lasley Lee.....	2.30	354

Daily discharge, in second-feet, of Cuyahoga River at Independence, Ohio, for the period October 1, 1922, to May 31, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1.....	70	90	71	1,220	770	610	338	187
2.....	86	126	97	745	1,080	650	355	173
3.....	134	116	166	700	1,690	1,230	372	168
4.....	97	82	116	575	985	2,170	460	106
5.....	94	55	177	495	810	1,690	3,640	132
6.....	73	60	149	415	690	1,330	3,160	126
7.....	81	129	163	328	610	1,230	1,630	106
8.....	122	114	380	362	570	1,080	1,330	163
9.....	116	126	380	328	530	895	1,230	221
10.....	160	136	292	310	460	3,000	1,080	236
11.....	292	124	114	275	390	2,380	850	236
12.....	142	120	183	292	338	3,400	730	4,120
13.....	149	70	180	189	895	2,100	610	2,760
14.....	180	132	136	328	770	1,690	530	1,690
15.....	118	455	132	2,520	530	1,450	610	1,450
16.....	61	258	149	1,690	690	3,000	650	1,230
17.....	132	199	103	1,070	985	1,960	570	1,030
18.....	129	132	70	970	1,130	1,330	530	810
19.....	103	109	186	2,100	1,080	1,130	495	690
20.....	118	70	224	1,450	985	940	460	610
21.....	99	120	189	6,130	850	895	425	940
22.....	71	116	129	3,400	268	1,450	390	730
23.....	99	78	129	2,030	268	1,690	338	530
24.....	171	101	99	1,510	236	1,230	302	460
25.....	157	111	84	1,390	143	940	268	338
26.....	122	103	101	1,130	236	895	302	302
27.....	82	58	241	940	810	770	268	355
28.....	105	139	2,240	1,330	770	690	252	260
29.....	61	111	1,170	1,130	-----	530	268	
30.....	50	146	745	850	-----	460	302	
31.....	107	-----	655	770	-----	390	-----	

NOTE.—Mean discharge May 28–31 estimated by comparison with record of flow of Cuyahoga River at Brecksville. Braced figure gives mean discharge for period indicated.

Monthly discharge of Cuyahoga River and Ohio Canal at Independence, Ohio, for the period October 1, 1922, to May 31, 1923

Month	Discharge in second-feet				
	Maximum (com- bined)	Minimum (com- bined)	Mean		
			River	Canal	Combined
October.....	357	117	116	65.6	181
November.....	533	126	126	74.1	200
December.....	2,310	135	298	67.7	366
January.....	6,200	258	1,120	68.2	1,260
February.....	1,760	212	699	66.9	766
March.....	3,470	452	1,390	66.9	1,460
April.....	3,700	314	758	62.1	820
May.....	4,180	168	675	63.3	739

OHIO CANAL FEEDER AT BRECKSVILLE, OHIO

LOCATION.—300 feet below head gate at dam on Cuyahoga River at Brecksville railroad station, 2 miles east of Brecksville, Cuyahoga County.

RECORDS AVAILABLE.—March 1 to September 30, 1923.

GAGE.—Vertical staff on right bank 300 feet below head gate; read by Leonard Brown.

DISCHARGE MEASUREMENTS.—Made from footbridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 200 feet above and below gage. Control is stretch of channel below gage; shifting.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during period of record, 140 second-feet July 28 and 31; minimum mean daily discharge, 44 second-feet March 14 and 15.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice. Gage read to hundredths twice daily. Daily discharge ascertained by method for shifting control. Records fair.

COOPERATION.—Gage-height record furnished by American Steel & Wire Co.

The Ohio Canal feeder diverts water from Cuyahoga River at the dam at Brecksville. The water is used for industrial purposes at Cleveland by the American Steel & Wire Co.

Discharge measurements of Ohio Canal feeder at Brecksville, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis- charge	Date	Made by—	Gage height	Dis- charge
Mar. 12	E. E. R. Dornbach.....	<i>Feet</i> 0.99	<i>Sec.-ft.</i> 64.4	Aug. 7	L. L. Dickson.....	<i>Feet</i> 1.76	<i>Sec.-ft.</i> 116
13	do.....	.98	63.7	30	do.....	1.68	121
May 26	do.....	1.40	75.7	Sept. 11	do.....	1.80	129

Daily discharge, in second-feet, of Ohio Canal feeder at Brecksville, Ohio, for the period March 1 to September 30, 1923

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1	73	66	70	76	122	108	113
2	73	66	70	80	122	113	108
3	73	76	73	80	131	122	122
4	73	84	80	80	131	122	100
5	73	70	80	80	131	122	96
6	73	73	70	84	131	122	88
7	73	73	73	84	131	122	104
8	73	73	76	84	131	113	131
9	73	73	73	88	122	131	122
10	96	73	73	88	122	122	113
11	66	73	73	80	131	131	113
12	70	73	73	84	131	131	113
13	62	73	73	92	131	131	122
14	44	73	73	88	131	122	113
15	44	73	80	84	122	131	113
16	73	70	76	92	122	108	113
17	62	66	76	80	122	113	122
18	59	70	76	88	122	104	122
19	62	70	76	104	113	108	122
20	73	73	76	122	122	92	122
21	73	70	73	122	122	92	113
22	80	73	84	122	113	131	108
23	62	70	76	122	100	113	113
24	59	70	76	113	131	122	131
25	62	70	76	122	131	113	113
26	62	73	76	122	131	104	122
27	70	70	76	131	131	104	113
28	70	70	76	122	140	131	100
29	70	70	76	131	122	104	122
30	66	70	76	131	113	122	113
31	66	-----	76	-----	140	113	-----

NOTE.—Daily discharge Mar. 1-7 estimated by comparison with record of flow of Ohio Canal at Independence.

Monthly discharge, in second-feet, of Ohio Canal feeder at Brecksville, Ohio, for the period March 1 to September 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
March	96	44	68.0	July	140	100	126
April	84	66	71.6	August	131	92	117
May	84	70	75.2	September	131	88	114
June	131	76	99.2				

OHIO CANAL AT INDEPENDENCE, OHIO

LOCATION.—At highway bridge 1 mile north of Independence, Cuyahoga County, and 7 miles southeast of Cleveland.

RECORDS AVAILABLE.—September 28, 1921, to May 31, 1923, when station was discontinued.

GAGE.—Chain gage on highway bridge, read by John Zimmerman.

DISCHARGE MEASUREMENTS.—Made from bridge at gage.

CHANNEL AND CONTROL.—Channel straight for 600 feet above and 2,000 feet below gage. One channel at all stages. Bed of stream silt and fine gravel. Control is long stretch of channel below gage. Considerable aquatic growth in canal during summer. Zero flow would occur at gage height 0.3 foot.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during period October 1, 1922, to May 31, 1923, 83 second-feet January 17; minimum mean daily discharge, 60 second-feet several days in December, April, and May.

1921-1923: Maximum mean daily discharge, 92 second-feet June 13 and 15-17, 1922; minimum mean daily discharge, 54 second-feet October 9, 1921.
 ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation affected by aquatic growth during summer and by ice for short period. Rating curve fairly well defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used October 1 to November 9 and March 21 to May 27. Records fair.

Water is diverted into the canal from Cuyahoga River by the Ohio Canal feeder at the dam at Brecksville. The water is used for industrial purposes at Cleveland by the American Steel & Wire Co.

Discharge measurements of Ohio Canal at Independence, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 13	E. E. R. Dornbach	4.60	64.9	Mar. 13	E. E. R. Dornbach	3.88	66.4
Nov. 9	Lasley Lee	4.40	78.0	May 27	do	3.78	62.7

Daily discharge, in second-feet, of Ohio Canal at Independence, Ohio, for the period October 1, 1922, to May 31, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1	65	69	71	69	65	69	60	62
2	67	74	71	69	67	69	60	60
3	69	76	74	69	69	69	65	62
4	65	74	74	69	69	69	62	62
5	62	71	74	69	69	69	65	62
6	62	74	71	69	69	69	62	62
7	62	76	65	69	69	69	62	62
8	62	76	69	69	69	69	62	65
9	65	78	65	69	67	69	62	62
10	65	76	62	67	65	69	65	65
11	65	78	60	67	67	67	62	65
12	65	76	60	69	69	67	62	62
13	65	76	60	69	69	67	62	60
14	62	76	74	69	69	67	62	62
15	62	78	74	69		65	62	65
16	62	76	65	69		71	62	65
17	65	74	65	83		74	62	65
18	65	74	65	69		62	62	65
19	65	74	69	67	65	67	62	65
20	65	74	69	65		67	65	65
21	67	74	67	69		65	60	67
22	67	74	67	65		65	60	65
23	67	74	69	69		67	62	65
24	69	74	69	67		65	62	65
25	69	74	67	65	69	67	62	65
26	69	71	69	67	69	62	62	65
27	69	69	69	65	67	65	60	62
28	69	71	69	67	67	65	62	62
29	69	71	60	67		62	60	62
30	67	71	67	65		65	65	62
31	67		69	65		62		62

NOTE.—Mean discharge Feb. 15-24, estimated because of ice from observer's notes and weather records. Gage not read Apr. 13-18; discharge interpolated. Discharge May 28-31 estimated by comparison with record of Ohio Canal feeder at Brecksville.

Monthly discharge, in second-feet, of Ohio Canal at Independence, Ohio, for the period October 1, 1922, to May 31, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October-----	69	62	65.6	February-----	69	65	66.9
November-----	78	69	74.1	March-----	74	62	66.9
December-----	74	60	67.7	April-----	65	60	62.1
January-----	83	65	68.2	May-----	65	60	63.3

GRAND RIVER NEAR MADISON, OHIO

LOCATION.—At highway bridge 2 miles south of Madison, Lake County. Griswold Creek enters from left, half a mile below station.

DRAINAGE AREA.—587 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 7, 1922, to September 30, 1923.

GAGE.—Chain gage on highway bridge, read by G. C. Wenger and E. H. Horton.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 500 feet above and below gage.

Left bank high and clean; right bank fairly high and brushy. One channel at all stages. Control for low water is riffle 150 feet below gage; for high stages is long stretch of channel below gage; shifts during high water. Zero flow would occur at gage height 0.7 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 7.56 feet at 8.30 a. m. April 6, 1923 (discharge, 5,500 second-feet); minimum stage, 1.10 feet at 5.30 p. m. August 27, 1923 (discharge, 1.5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

ACCURACY.—Stage-discharge relation for low water changed during high water on April 6, 1923; affected by ice during December, February, and March. Rating curves fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except for periods of ice effect, for which they are fair.

Discharge measurements of Grand River near Madison, Ohio, during the years ending September 30, 1922 and 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
1922		<i>Feet</i>	<i>Sec.-ft.</i>	1923		<i>Feet</i>	<i>Sec.-ft.</i>
July 7	Lee and Sherman-----	1.89	41.4	Aug. 8	L. L. Dickson-----	1.41	7.2
July 26	E. E. R. Dornbach-----	1.66	22.0	Aug. 28	do-----	1.52	14.7
				Sept. 12	do-----	1.64	22.9
1923							
May 28	E. E. R. Dornbach----	1.96	59.5				

Daily discharge, in second-feet, of Grand River near Madison, Ohio, for the period July 7, 1922, to September 30, 1923

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1922				1922				1922			
1		24	10	11	30	28	26	21	156	7	6
2		471	17	12	24	17	26	22	130	7	6
3		213	68	13		20	49	23		8	8
4		106	17	14	83	15	20	24	64	9	8
5		61	33	15	66	13	20	25	37	13	9
6		39	15	16	39	9	35	26	33	9	8
7	38	22	10	17	33	21	25	27	28	10	8
8	47	88	16	18	98	9	10	28	18	8	11
9	61	41	10	19	150	9	13	29	10	8	8
10	49	18	15	20	138	7	7	30	18	8	10
								31	17	9	

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1922-23												
1	10	10	15	1,020	880	600	175	67	29	10	10	28
2	7	10	23	1,020	1,250	900	133	76	35	14	9	24
3	7	9	20	730	2,360	2,480	299	59	42	15	11	19
4	7	8	22	645	3,360	4,040	645	45	28	13	13	16
5	5	9	21	572	2,240	4,220	3,520	45	20	16	12	19
6	5	17	13	393	1,090	2,360	4,980	39	44	18	16	19
7	5	11	92	299	820	1,420	2,480	29	58	21	11	21
8	6	13	27	264	490	1,090	1,900	25	136	28	11	39
9	7	10	18	230	213	595	1,250	34	412	42	12	49
10	6	11	16	264	83	1,420	700	39	342	28	12	38
11	6	15	39	230	210	3,200	450	108	205	58	12	34
12	10	17	75	133	230	4,780	290	308	160	44	14	30
13	9	16		281	393	4,040	220	1,250	142	40	8	26
14	6	11		510	950	2,240	193	1,250	94	34	9	13
15	6	20		1,020	1,250	1,700	220	1,250	44	28	10	16
16	6	18		1,600	2,480	2,120	395	1,600	38	26	7	15
17	6	18		2,000		1,900	550	1,330	28	24	8	11
18	7	23		2,120		1,420	450	880	20	22	7	9
19	6	25	20	2,480		1,170	325	595	20	83	8	9
20	9	30		2,000		760	220	412	20	22	7	12
21	10	26		3,200		550	148	308	16	13	7	22
22	9	24		4,220		760	120	220	14	24	7	22
23	10	21		2,480	600	1,250	133	163	12	24	5	27
24	10	37		1,900		1,420	96	154	7	19	5	42
25	9	29	77	1,600		1,170	85	139	10	12	4	49
26	8	20	200	950		820	76	108	16	8	3	48
27	7	43	393	393		471	67	85	13	10	2	26
28	21	42	510	490		393	85	58	19	13	9	112
29	12	33	1,170	490		281	59	50	12	10	24	74
30	13	20	1,020	530		162	59	48	12	8	27	33
31	10		950	760		127		35		7	22	

NOTE.—Stage-discharge relation affected by ice Dec. 13-24 and Feb. 17 to Mar. 2; discharge estimated from study of observer's notes, weather records, and records of flow of near-by streams. Braced figures give mean discharge for periods indicated.

Monthly discharge of Grand River near Madison, Ohio, for the period July 7, 1922, to September 30, 1923

[Drainage area, 587 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
1922					
July 7-31.....	156	10	60.2	0.103	0.10
August.....	471	7	42.8	.073	.08
September.....	68	6	17.5	.030	.03
1922-23					
October.....	21	5	8.23	.014	.02
November.....	43	8	19.9	.034	.04
December.....	1,170	-----	159	.271	.31
January.....	4,220	133	1,120	1.91	2.20
February.....	3,360	-----	911	1.55	1.61
March.....	4,780	127	1,610	2.74	3.16
April.....	4,980	59	677	1.15	1.28
May.....	1,600	25	349	.595	.69
June.....	412	7	68.3	.116	.13
July.....	58	7	22.1	.038	.04
August.....	27	2	10.4	.018	.02
September.....	112	9	30.1	.051	.06
The year.....	4,980	2	414	.705	9.56

CONNENAUT CREEK AT AMBOY, OHIO

LOCATION.—At highway bridge half a mile east of Amboy, Ashtabula County, and 3 miles southwest of Conneaut.

DRAINAGE AREA.—178 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 1, 1922, to September 30, 1923.

GAGE.—Chain gage on highway bridge; read by J. L. Evans.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Channel straight for 300 feet above and 1,000 feet below gage. Left bank high and clean; right bank fairly high and brushy. The flood of March, 1913, flowed over right bank and across the road leading to bridge at a point some distance from bridge. Control for low-water is rock ledge 75 feet below gage. Control for high water is long stretch of channel below gage. Zero flow would occur at gage height 0.6 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 5.6 feet at 5 p. m. March 4, 1923 (discharge, 2,970 second-feet); minimum stage, 1.06 feet at 6 p. m. August 20, 1923 (discharge, 1.6 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined below 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except for periods of ice effect, for which they are fair.

Discharge measurements of Conneaut Creek at Amboy, Ohio, during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
May 28	E. E. R. Dornbach	<i>Feet</i> 1.48	<i>Sec-ft</i> 21.6	Aug. 28	L. L. Dickson	<i>Feet</i> 1.43	<i>Sec-ft</i> 10.2
Aug. 8	L. L. Dickson	1.25	4.3	Sept. 12	do	1.38	8.6

Daily discharge, in second-feet, of Conneaut Creek at Amboy, Ohio, for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5.7	10.6	43	655	224		122	43	11.6	5.2	2.8	3.7
2	5.2	8.9	64	1,130	352	300	110	38	22	6.2	3.5	3.2
3	4.5	24	132	590	400		102	35	18.9	3.3	2.9	4.2
4	5.7	40	88	475	1,310	2,530	231	20	6.2	20	2.8	3.9
5	5.7	16.2	91	400	655	2,310	1,600	40	13.7	6.2	3.2	11.6
6	3.9	36	75	231	330	800	1,800	36	22	12.6	2.9	8.2
7	3.9	32	77	132	1,130	352	690	33	88	5.2	2.5	4.5
8	5.2	38	77	159	955	231	375	50	148	6.8	3.2	6.2
9	10.6	32	75	210	530	220	249	70	105	4.5	3.9	20
10	14.9	32	168	132	425	352	198	150	62	5.2	2.9	8.2
11	16.2	28	159	140	352	1,220	153	198	40	6.8	2.5	16.2
12	9.7	54	95	148	285	1,700	183	308	45	6.2	2.4	8.2
13	12.6	40	62	148	502	2,000	138	1,130	33	6.8	2.3	3.9
14	9.7	56	70	145	875	655	128	530	27	3.7	2.3	5.2
15	6.8	58	50	400		330	112	308	27	11.6	2.0	3.7
16	6.2	47	98	1,410		352	115	655	8.2	6.2	2.0	3.0
17	7.4	52	115	2,420		875	120	998	8.2	4.8	2.2	3.9
18	24	48	95	1,900		375	142	425	10.6	4.5	2.2	3.5
19	6.8	50	86	2,200		261	138	261	18.9	3.5	1.8	3.9
20	14.9	40	108	2,640		201	125	162	18.9	2.9	1.7	6.8
21	6.8	38	102	1,500	250	150	91	128	8.2	2.7	1.8	9.7
22	8.9	50	140	2,420		207	77	135	6.2	2.9	2.2	8.9
23	16.2	50	145	1,310		450	73	110	5.2	2.5	2.4	5.7
24	25	54	128	622		655	64	79	7.4	2.4	2.2	10.6
25	14.9	52	108	352		308	62	66	4.5	2.0	2.2	22
26	7.4	54	159	277		217	56	45	6.2	2.2	2.0	10.6
27	5.2	47	257	238		156	64	54	5.2	2.2	1.8	7.4
28	6.2	58	590	189		128	66	30	6.2	7.4	14.9	10.6
29	12.6	47	838	220		112	50	11.6	8.2	4.5	8.2	6.8
30	17.5	38	530	257		95	48	17.5	8.9	3.9	5.2	4.5
31	12.6		352	220		75		24		8.2	3.9	

NOTE.—Stage-discharge relation affected by ice Jan. 16 and Feb. 15 to Mar. 3; discharge estimated from study of observer's notes, weather records, and records of flow of near-by streams. Braced figures give mean discharge for period indicated.

Monthly discharge of Conneaut Creek at Amboy, Ohio, for the year ending September 30, 1923

[Drainage area, 178 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	25	3.9	10.1	0.057	0.07
November	58	8.9	41	.230	.26
December	838	43	167	.938	1.08
January	2,640	132	751	4.22	4.86
February	1,310	-----	422	2.37	2.47
March	2,530	75	589	3.31	3.82
April	1,800	48	249	1.40	1.56
May	1,130	11.6	200	1.12	1.29
June	148	4.5	26.7	.150	.17
July	20	2.0	5.42	.030	.03
August	14.9	1.7	3.19	.018	.02
September	22	3.0	7.63	.043	.05
The year	2,640	1.7	206	1.16	15.68

CATTARAUGUS CREEK AT VERSAILLES, N. Y.

LOCATION.—At three-span highway bridge in Versailles, Cattaraugus County, 2¼ miles above mouth of Clear Creek, 6 miles below Gowanda, and 8 miles above mouth of stream.

DRAINAGE AREA.—467 square miles (measured on post-route map).

RECORDS AVAILABLE.—September 23, 1910, to September 30, 1923, when station was discontinued.

GAGE.—Chain on upstream side of right span of bridge; read by Charles Wilson.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of rocks and gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum open-water stage recorded during year, 9.20 feet at 5 p. m. March 4 (discharge, 11,700 second-feet); minimum discharge recorded, 39 second-feet several times in August.

1910-1923: Maximum open-water stage recorded, 12.3 feet during night of March 25, 1913 (discharge, about 30,000 second-feet); minimum discharge, that of August, 1923.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent; affected by ice from November to April. Gage read to half-tenths twice daily. Daily discharge throughout year ascertained by indirect method, applying mean daily effective gage height to rating table; corrections for obtaining effective gage heights determined from discharge measurements. Records below 500 second-feet fair; poor above.

Discharge measurements of Cattaraugus Creek at Versailles, N. Y., during the period October 1, 1922, to October 11, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 9	A. W. Harrington.....	5.46	513	Aug. 17	A. W. Harrington.....	4.63	51.7
Jan. 8	B. F. Howe.....	* 5.44	454	Oct. 11	Lamson and Johnson..	4.72	84.2
Feb. 1	-----do-----	5.45	509				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Cattaraugus Creek at Versailles, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	150	160	550	3,800	550	1,200	360	360	140	100	180	75
2.....	150	160	600	1,100	1,300	1,700	440	280	140	100	100	70
3.....	150	180	420	700	3,200	4,200	650	220	140	95	100	55
4.....	120	180	320	650	1,600	8,000	2,000	220	130	180	100	70
5.....	140	170	280	650	950	3,600	5,000	200	130	130	95	80
6.....	150	200	300	500	900	1,500	2,000	200	130	100	80	80
7.....	130	240	340	200	850	1,000	1,200	180	320	95	75	75
8.....	180	220	360	420	700	750	1,000	190	380	85	85	75
9.....	160	550	550	440	600	700	750	420	380	85	80	80
10.....	220	320	340	320	550	900	650	480	240	95	70	80
11.....	240	280	190	340	550	1,100	550	500	170	100	75	70
12.....	220	240	300	380	460	3,600	650	600	160	95	65	70
13.....	240	200	170	360	850	3,000	550	700	140	85	55	70
14.....	200	200	180	360	560	1,200	480	420	130	85	70	75
15.....	180	280	180	750	500	850	420	700	130	85	75	80
16.....	180	300	170	700	550	4,400	440	3,200	130	320	80	75
17.....	200	260	180	380	500	2,400	380	950	120	200	60	65
18.....	200	260	170	600	500	1,500	360	700	100	100	65	75
19.....	170	240	170	1,000	440	1,800	360	500	100	95	70	75
20.....	160	280	170	1,200	380	700	380	380	100	85	70	80
21.....	170	280	150	2,200	380	750	360	420	100	85	70	100
22.....	160	240	150	1,700	340	1,300	340	420	95	85	75	110
23.....	180	260	140	1,100	320	5,000	600	360	100	70	70	110
24.....	440	260	150	900	280	1,800	500	260	100	85	70	80
25.....	300	240	150	800	300	900	360	240	100	85	70	80
26.....	260	260	480	650	380	900	300	200	100	95	50	75
27.....	200	240	1,700	550	550	600	280	200	140	85	46	70
28.....	190	240	1,200	550	850	420	260	180	100	85	70	110
29.....	160	240	650	500	-----	380	240	180	170	75	85	90
30.....	150	240	600	500	-----	340	240	160	180	85	65	80
31.....	180	-----	600	500	-----	340	-----	150	-----	550	75	-----

NOTE.—Discharge, Nov. 27, Dec. 15 to Jan. 20, Feb. 6 to Mar. 3, and Mar. 29 to Apr. 2, determined from gage heights corrected for ice effect by means of two discharge measurements, study of weather records and gage-height graph, observer's notes, and comparison with record of Allegheny River at Red House.

Monthly discharge of Cattaraugus Creek at Versailles, N. Y., for the year ending September 30, 1923

[Drainage area, 467 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	440	120	191	0.409	0.47
November.....	550	160	247	.529	.59
December.....	1,700	140	384	.822	.95
January.....	3,800	200	800	1.71	1.97
February.....	3,200	280	710	1.52	1.58
March.....	8,000	340	1,830	3.92	4.52
April.....	5,500	240	753	1.61	1.80
May.....	3,200	150	457	.979	1.13
June.....	380	95	153	.328	.37
July.....	550	70	119	.255	.29
August.....	160	46	76.6	.164	.19
September.....	110	55	78.3	.170	.19
The year.....	8,000	46	484	1.04	14.05

STREAMS TRIBUTARY TO LAKE ONTARIO

LITTLE TONAWANDA CREEK AT LINDEN, N. Y.

LOCATION.—At stone-arch highway bridge in Linden, Genesee County, 3 miles about junction with Tonawanda Creek.

DRAINAGE AREA.—22 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 8, 1912, to September 30, 1923.

GAGE.—Vertical staff on upstream side of right abutment; read by C. L. Schenck.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—A standard Francis weir, 2.01 feet long and 8 inches high was reconstructed September 18, 1920, under the upstream side of the bridge. When the water overtops this weir it flows over a 2-inch plank about 13 feet long, including the 2 feet of weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.29 feet at 6 p. m. March 3 (discharge, 1,070 second-feet); minimum stage recorded, 0.23 foot at 6 p. m. October 5 and 9 a. m. October 7 (discharge, 0.6 second-foot).

1912–1923: Maximum stage, 14.6 feet during the flood of April 22, 1916, determined by leveling from floodmarks (discharge, 2,400 second-feet). The discharge (2,500 second-feet) published in previous water-supply papers for the flood of May 10, 1919, is too large; the revised determination of the maximum discharge for that date is 1,750 second-feet. Minimum discharge, 0.4 second-foot several times during September and October, 1921.

ICE.—Stage-discharge relation slightly affected by ice.

ACCURACY.—Stage-discharge relation changed at time of high water in March; affected by ice from December to March. Rating curves used before and after the change well defined below 800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Little Tonawanda Creek at Linden, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 8	A. W. Harrington-----	0.31	1.0	Apr. 3	E. B. Shupe-----	1.44	38.3
Jan. 7	B. F. Howe-----	*.91	7.4	Aug. 18	A. W. Harrington-----	.405	1.4
Feb. 3	----do-----	*2.37	109				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Little Tonawanda Creek at Linden, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	0.9	1.0	3.1	11	12	19	15	12	5.8	4.5	2.8	1.1
2.....	.8	1.0	4.5	16	48	22	23	10	5.2	4.0	2.7	1.2
3.....	.8	1.1	2.9	14	100	550	57	8.4	5.8	3.8	4.7	1.1
4.....	.7	1.0	2.6	11	65	637	135	8.4	6.8	4.9	2.9	1.1
5.....	.7	1.0	2.6	9	42	154	235	7.8	6.0	11	2.6	1.2
6.....	.7	1.1	2.4	8	32	90	112	7.2	6.2	12	2.3	1.1
7.....	.7	1.1	2.2	8	26	62	69	6.8	57	7.8	2.2	1.0
8.....	.9	1.1	3.3	7	20	46	69	6.8	135	6.2	2.3	1.2
9.....	1.0	1.1	7.2	7	16	39	41	9.2	116	5.3	2.1	1.4
10.....	1.8	1.1	4.2	7	14	58	34	9.2	36	5.0	2.0	1.2
11.....	1.4	1.1	3.8	7	14	74	42	8.8	22	4.8	1.9	1.1
12.....	1.1	1.0	2.8	7	10	436	61	9.2	14	4.3	1.8	1.1
13.....	1.0	1.0	2.3	6	14	135	42	10	11	4.0	1.7	1.1
14.....	1.0	1.1	2.3	6	7	70	29	7.5	8.8	3.6	1.7	1.0
15.....	1.0	1.4	2.4	8	8	58	27	18	8.4	4.0	1.7	1.0
16.....	1.1	1.2	2	7	8	516	27	77	7.2	36	1.7	.9
17.....	1.0	1.5	2	6	7	112	23	46	6.8	8.0	1.5	.9
18.....	.9	1.4	2	6	6	112	23	46	5.8	5.8	1.4	.9
19.....	.9	1.4	2	10	6	99	23	26	5.3	5.2	1.5	1.0
20.....	.9	2.0	2	11	5	58	34	19	5.0	4.7	1.4	1.3
21.....	1.0	2.4	2.2	20	5	74	23	34	4.7	4.3	1.6	1.4
22.....	1.0	2.2	2.2	34	5	108	21	26	4.3	3.8	1.9	1.1
23.....	1.2	2.0	2.3	32	5	274	34	17	4.3	3.6	1.5	1.1
24.....	1.3	2.5	2.4	24	5	78	23	13	4.0	3.8	1.5	1.1
25.....	1.1	2.3	2.6	19	5	50	18	11	4.3	3.8	1.4	.9
26.....	1.0	2.0	3.6	16	5	42	15	10	13	3.3	1.4	1.0
27.....	1.0	2.0	5.2	15	10	35	13	8.0	6.2	3.0	1.3	.9
28.....	1.0	1.9	3.5	13	12	24	14	7.2	5.3	3.0	1.4	.9
29.....	1.0	1.9	3.8	11	-----	24	14	6.8	6.8	3.0	1.4	.9
30.....	1.0	1.8	4.8	10	-----	22	12	6.2	5.2	3.6	1.3	.9
31.....	1.0	-----	4.8	10	-----	22	-----	5.8	-----	3.2	1.2	-----

NOTE.—Discharge, Dec. 16-20, Jan 1 to Mar. 3, and Mar. 28-31, determined from gage heights corrected for ice effect by means of two discharge measurements, study of gage-height graph and weather records, observer's notes, and comparison with records of near-by streams.

Monthly discharge of Little Tonawanda Creek at Linden, N. Y., for the year ending September 30, 1923

[Drainage area, 22 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	1.8	0.7	0.997	0.045	0.05
November.....	2.5	1.0	1.49	.068	.09
December.....	7.2	2	3.10	.141	.16
January.....	34	6	12.1	.550	.63
February.....	100	5	18.3	.832	.87
March.....	637	19	132	6.00	6.92
April.....	235	12	43.6	1.98	2.21
May.....	77	5.8	16.1	.732	.84
June.....	135	4.0	17.7	.805	.90
July.....	49	3.0	7.34	.334	.39
August.....	4.7	1.2	1.90	.086	.10
September.....	1.4	.9	1.07	.049	.05
The year.....	637	.7	21.4	.973	13.20

GENESEE RIVER AT SCIO, N. Y.

LOCATION.—At steel highway bridge a quarter of a mile above Vandermark Creek, half a mile above Scio, Allegany County, and 1 mile above Knight Creek.

DRAINAGE AREA.—288 square miles (measured on map issued by United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—June 12, 1916, to September 30, 1923.

GAGE.—Vertical staff attached to downstream face of left abutment; read by Mrs. Margaret Potter.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Coarse gravel; shifting occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.5 feet at 5.30 p. m. March 4 (discharge, 6,010 second-feet); minimum stage recorded, 0.10 foot several times during August and September (discharge, 16 second-feet).

1916-1923: Maximum stage recorded, 9.1 feet at noon May 22, 1919 (discharge, 10,600 second-feet); minimum stage recorded, that of August and September, 1923.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation changed presumably at time of high water March 3. Rating curve used before the change well defined between 20 and 2,000 second-feet; that used after the change fairly well defined between the same limits. Stage-discharge relation affected by ice from December to March. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height, corrected for back-water if necessary, to rating table. Records good except for estimated periods and for periods when stage-discharge relation was affected by ice or rubbish, for which they are fair.

Discharge measurements of Genesee River at Scio, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 10	A. W. Harrington-----	0.51	53.7	Mar. 29	E. B. Shupe-----	1.45	384
Jan. 10	B. F. Howe-----	1.00	135	Aug. 16	A. W. Harrington-----	.25	26.4
Feb. 2	-----do-----	1.50	366				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Genesee River at Scio, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	34	37	140	700	850	190	340	317	200	43	59	19
2.....	33	37		500	320	200	317	275	184	42	49	17
3.....	31	38		340	260	1,810	317	256	158	42	58	17
4.....	29	37		280	220	5,060	675	256	130	538	56	30
5.....		37	80	260	220	3,460	4,310	236	148	155	47	30
6.....	30	38	75	220	220	1,610	2,460	236	122	108	41	27
7.....		40	80	200	180	930	1,420	218	180	88	36	28
8.....		44	100	170	200	860	1,160	236	340	68	31	51
9.....		88	49	160	140	675	860	386	218	61	28	49
10.....	84	46	100	140	180	675	675	386	160	59	26	33
11.....	113	42	70	130	180	675	620	362	106	58	24	28
12.....	77	40	85	110	170	1,810	592	795	119	56	23	27
13.....	62	49	48	95	140	1,810	538	930	98	39	26	25
14.....	48	37	48	95	240	930	460	648	98	37	34	24
15.....	43	52	55	130	140	592	410	735	79	38	30	23
16.....	40	58	60	150	130	2,940	386	1,000	72	46	28	26
17.....	37	56	55	110	120	1,710	362	860	68	41	27	28
18.....	38	44	50	170	120	1,160	317	675	55	34	25	22
19.....	36	48	50	170	120	1,160	317	592		33	22	20
20.....	35	44	50	200	140	795	296	538		33	25	21
21.....	31	48	50	260	120	675	256	930		28	21	23
22.....	26	43	55	900	120	795	236	592		26	22	27
23.....	32	46	55	550	140	2,020	296	485		24	20	25
24.....	111	43	55	480	140	1,420	256	410	44	25	19	23
25.....	81	54	60	460	150	930	236	386	42	30	19	22
26.....	56	44	85	380	160	795	218	340	52	26	17	22
27.....	50	43	95	280	190	648	200	317	83	26	17	22
28.....	48	43	360	240	190	485	218	275	51	37	17	23
29.....	44	44	300	220		386	296	256	65	42	22	54
30.....	46	44	300	220		460	256	236	56	46	22	37
31.....	38		340	220		362		218		106	20	

NOTE.—Discharge for the following days estimated from comparison with records of flow of near-by streams: Oct. 5-8, Nov. 30, Dec. 1-3, 31, Feb. 3, 25, Mar. 21, June 10, 18-23, July 29, Aug. 9, 20, and Sept. 16. Discharge, Oct. 1-31, determined from gage heights corrected for backwater from rubbish by means of one discharge measurement and comparison with record of Genesee River at St. Helena. Discharge, Dec. 5 to Mar. 2, determined from gage heights corrected for ice effect by means of two discharge measurements, study of gage-height graph and weather records, observer's notes, and comparison with records of flow of near-by streams.

Monthly discharge of Genesee River at Scio, N. Y., for the year ending September 30, 1923

[Drainage area, 288 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	113	26	48.7	0.169	0.19
November.....	58	37	44.2	.153	.17
December.....	360	48	111	.385	.44
January.....	900	95	275	.955	1.10
February.....	850	120	199	.691	.72
March.....	5,060	190	1,230	4.27	4.92
April.....	4,310	200	643	2.23	2.49
May.....	1,000	218	464	1.61	1.86
June.....	340	42	107	.372	.42
July.....	538	24	65.6	.228	.26
August.....	59	17	29.4	.102	.12
September.....	54	17	27.4	.095	.11
The year.....	5,060	17	271	.941	12.80

GENESEE RIVER AT ST. HELENA, N. Y.

LOCATION.—At steel highway bridge in St. Helena, Wyoming County, $5\frac{1}{2}$ miles below Portageville and site of proposed storage dam of New York State Conservation Commission and $9\frac{1}{2}$ miles above mouth of Canaseraga Creek.

DRAINAGE AREA.—992 square miles.

RECORDS AVAILABLE.—August 14, 1908, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder on left bank below bridge, installed September 28, 1917, and a chain gage on upstream side of the highway bridge installed August 14, 1908. Water-stage recorder inspected and chain gage read by Glenn Streeter.

DISCHARGE MEASUREMENTS.—Made from upstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Gravel and rocks; shifting occasionally.

EXTREMES OF DISCHARGE.—Maximum open-water stage during year from water-stage recorder, 9.13 feet at 6 p. m. March 16 (discharge, 16,400 second-feet); minimum stage from water-stage recorder, 1.92 feet at 11 a. m. August 21 (discharge, 44 second-feet).

1908–1923: Maximum stage from water-stage recorder, 12.81 feet at 8 a. m. May 17, 1916 (discharge,² 44,400 second-feet); minimum stage recorded, 1.70 feet at 5 p. m. October 5 and 8 a. m. October 17, 1913 (discharge, about 18 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

ACCURACY.—Stage-discharge relation for medium and low stages changed presumably at time of high water April 5. Rating curve for chain gage used before the change fairly well defined between 150 and 2,500 second-feet. Rating curve for automatic gage used before the change and rating curve for automatic and chain gage used after the change fairly well defined between 30 and 30,000 second-feet. Stage-discharge relation affected by ice from December to March. Previous to June 19, when lower intake pipe was uncovered, chain-gage readings were used during periods when automatic gage was not functioning properly due to plugging of intake pipe. Daily discharge ascertained by applying to proper rating table mean daily gage height, determined by averaging the twice daily chain gage readings or by inspection of automatic record, except for days of considerable fluctuation, when the discharge is averaged for intervals of day. Records fair.

Discharge measurements of Genesee River at St. Helena, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 8	A. W. Harrington.....	2.56	201	Apr. 2	E. B. Shupe.....	3.47	987
Jan. 11	B. F. Howe.....	*3.33	419	Aug. 18	A. W. Harrington.....	1.94	46.3
Feb. 6	.....do.....	*4.41	1,840				

* Stage-discharge relation affected by ice.

NOTE.—Measurements of Nov. 8 and Apr. 2 referred to chain gage; other measurements referred to automatic gage.

² Previously published as 43,500 second-feet.

Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for the year ending September, 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	115	203	203	550	800	550	950	680	350	206	362	72
2	155	198	1,180	1,600	800	800	945	680	306	166	237	75
3	155	177	785	1,300	1,700	2,200	1,090	556	285	185	202	80
4	123	167	565	900	2,800	4,600	2,730	518	285	518	185	68
5	132	123	608	700	1,800	9,000	10,400	497	322	385	185	75
6	115	141	592	650	1,400	5,500	7,490	410	362	327	185	80
7	89	167	542	550	1,100	3,200	3,950	410	476	252	151	80
8	85	230	556	500	900	2,400	2,760	339	638	194	144	85
9	141	208	759	460	900	2,000	2,150	497	680	211	134	97
10	158	218	776	420	800	2,000	1,820	595	556	174	94	105
11	485	208	600	420	750	2,400	1,690	920	448	237	111	111
12	425	230	372	420	750	7,000	1,570	1,260	398	137	70	108
13	354	253	349	400	750	9,230	1,320	1,960	301	137	102	97
14	253	253	326	400	750	3,700	1,120	1,240	285	130	105	91
15	177	253	320	380	850	2,520	1,040	1,480	327	429	105	88
16	203	198	300	420	850	9,550	970	1,880	285	442	100	88
17	218	218	300	440	700	7,810	880	1,750	247	275	94	75
18	218	264	280	500	550	4,830	840	1,310	252	174	82	75
19	198	218	280	550	460	4,830	850	1,040	211	147	86	75
20	132	203	280	750	400	2,550	840	1,160	185	137	79	75
21	123	235	260	1,000	380	2,220	707	2,080	166	111	79	137
22	85	198	280	1,500	340	3,270	820	1,340	147	108	83	301
23	198	203	280	2,600	340	6,970	880	1,020	137	117	68	162
24	253	230	300	1,600	340	5,400	970	970	140	117	94	117
25	276	224	300	1,200	340	2,840	870	820	147	137	72	117
26	354	230	320	1,100	340	2,440	820	680	185	134	50	111
27	253	230	400	900	420	2,010	595	595	194	124	52	111
28	264	208	650	800	500	1,570	595	518	228	111	62	429
29	230	230	950	800	-----	1,140	556	476	194	88	65	233
30	208	198	650	800	-----	1,220	638	435	270	462	68	170
31	208	-----	550	800	-----	986	-----	385	-----	580	72	-----

NOTE.—Discharge for the following days when water-stage recorder not operating satisfactorily estimated from hydrograph and fragmentary automatic record: Oct. 1-4, Dec. 5, 26, 30, Jan. 7, Apr. 1, 2, 8, 9, 21, June 19-25, July 1-3, 7, 8, and Sept. 10-13. Chain-gage readings used Oct. 1 to Dec. 4, Feb. 19 to Mar. 3, April 24 to May 11, and May 24 to June 18; water-stage recorder not operating satisfactorily. Discharge Dec. 15 to Mar. 12, determined from gage heights corrected for ice effect by means of two discharge measurements, study of observer's notes, gage-height graph and weather records, and comparison with record of Genesee River at Scio.

Monthly discharge of Genesee River at St. Helena, N. Y., for the year ending September 30, 1923

[Drainage area, 992 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	485	85	206	0.208	0.24
November	264	123	211	.213	.24
December	1,180	203	481	.485	.56
January	2,600	380	820	.827	.95
February	2,800	340	815	.822	.86
March	9,550	550	3,770	3.80	4.38
April	10,400	556	1,760	1.77	1.98
May	2,080	339	919	.926	1.07
June	680	137	300	.302	.34
July	580	88	224	.226	.26
August	362	50	115	.116	.13
September	429	68	120	.121	.14
The year	10,400	50	814	.821	11.15

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

LOCATION.—At highway bridge known as Jones Bridge, $1\frac{1}{2}$ miles below mouth of Canaseraga Creek, $1\frac{3}{4}$ miles above mouth of Beards Creek, 5 miles below Mount Morris, Livingston County, and 6 miles above Geneseo.

DRAINAGE AREA.—1,400 square miles.

RECORDS AVAILABLE.—May 22, 1903, to April 30, 1906; August 12, 1908, to December 31, 1913; July 12, 1915, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder on right bank; inspected by Theron S. Trewer. Prior to 1915 a chain gage fastened to upstream side of highway bridge was used. Datum of water-stage recorder, 540 feet New York State Conservation Commission datum, and 2.73 feet higher than that of chain gage.

DISCHARGE MEASUREMENTS.—Made from footbridge erected on lower chord of upstream bridge truss or by wading.

CHANNEL AND CONTROL.—Sandy clay; fairly permanent in recent years.

EXTREMES OF DISCHARGE.—Maximum open-water stage during year from water-stage recorder, 19.47 feet at 8 p. m. April 5 (discharge, 12,200 second-feet); minimum stage from water-stage recorder, 0.20 foot from 7 to 9 p. m. September 14 and 1 to 3 p. m. September 18 (discharge, 45 second-feet).

1903–1906, 1908–1913, and 1915–1923: Maximum stage recorded, 25.44 feet at noon May 17, 1916 (discharge, 55,100 second-feet); minimum stage, 2.7 feet (old datum) at 6 p. m. August 29, 1909 (discharge, about 18 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—Operation of mills at Mount Morris causes considerable diurnal fluctuation during low-water period.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice from December to March. Rating curve well defined between 50 and 4,000 second-feet and fairly well defined between 4,000 and 20,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of gage-height graph or for days of considerable fluctuation, by averaging discharge for intervals of day. Records good, except during periods of estimate, for which they are fair.

Discharge measurements of Genesee River at Jones Bridge, near Mount Morris, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 6	A. W. Harrington	1.33	284	Mar. 27	E. B. Shupe	5.64	2,790
7	do.	1.33	283	Apr. 7	do.	12.73	7,800
Jan. 15	B. F. Howe	*4.63	564	Aug. 19	A. W. Harrington	.82	149
Feb. 6	do.	*6.96	1,640				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Genesee River at Jones Bridge, near Mount Morris, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	215	260					1,460	872	494	233	605	80
2.....	237	264					1,280	872	454	210	378	
3.....	241	270					1,460	762	398	224	286	
4.....	201	262					2,870	708	406	248	254	
5.....	196	221					9,350	630	427	469	218	
6.....	195	270					11,200	605	423	485	227	110
7.....	175	283					7,160	545	485	321	224	
8.....	207	294					4,860	545	580	254	210	
9.....	232	306				6,200	3,850	605	845	257	210	
10.....	310	334					2,800	790	790	230	145	114
11.....	503	362					2,390	1,040	605	233	142	130
12.....	605	321					2,320	1,040	521	218	170	130
13.....	476	321					2,130	2,200	427	221	122	170
14.....	406	300					1,880	2,010	390	227	103	74
15.....	358	293			1,110		1,580	1,460	358	196	148	130
16.....	314	293	640	1,120			1,460	2,000	347	686	138	134
17.....	310	321					1,460	2,460	293	710	121	101
18.....	293	336				7,520	1,370	1,940	307	394	106	95
19.....	280	304				6,500	1,280	1,520	286	304	153	96
20.....	264	321				4,060	1,230	1,280	267	260	108	125
21.....	254	314				3,010	1,230	1,490	257	239	105	126
22.....	224	293				3,360	1,090	2,390	242	196	106	104
23.....	239	310				5,300	1,120	1,580	230		106	314
24.....	304	310				7,700	1,260	1,200	186		110	254
25.....	432	314				5,300	1,060	1,040	216		117	188
26.....	436	270				3,710	928	928	260	190	158	169
27.....	370					2,800	818	790	254		66	152
28.....	332	320				2,260	790	680	284		98	236
29.....	286					1,520	790	655	314	196	93	368
30.....	286					1,700	845	570	293	135	79	224
31.....	270					1,760		521		461	105	

NOTE.—Discharge for the following periods when recorder did not operate estimated by comparison with records of flow at other stations in the basin: Nov. 26 to Mar. 17, Mar. 20–26, 31, July 7, 8, 22–29, Aug. 12, 26, and Sept. 2–10.

Monthly discharge of Genesee River at Jones Bridge, near Mount Morris, N. Y., for the year ending September 30, 1923

[Drainage area, 1,400 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	605	175	305	0.218	0.25
November.....	362	221	301	.215	.24
December.....			640	.457	.53
January.....			1,120	.800	.92
February.....			1,110	.793	.83
March.....		1,520	5,220	3.73	4.30
April.....	11,200	790	2,440	1.74	1.94
May.....	2,460	621	1,150	.821	.95
June.....	845	486	387	.276	.31
July.....	710	135	282	.201	.23
August.....	605	66	168	.120	.14
September.....	368	74	145	.104	.12
The year.....	11,200	66	1,110	.793	10.76

GENESEE RIVER AT DRIVING PARK AVENUE, ROCHESTER, N. Y.

LOCATION.—In station No. 5 of Rochester Gas & Electric Corporation, 400 feet above Driving Park Avenue Bridge, $1\frac{1}{2}$ miles northwest of center of city of Rochester, Monroe County, and 5 miles above mouth.

DRAINAGE AREA.—2,460 square miles.

RECORDS AVAILABLE.—December 17, 1919, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder in northwest corner of old power house; inspected by employee of the Rochester Gas & Electric Corporation.

DISCHARGE MEASUREMENTS.—Made from cable 2,000 feet below gage.

CHANNEL AND CONTROL.—Coarse gravel and large broken rock; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 11.20 feet at 3 p. m. March 13 (discharge, 19,300 second-feet); minimum stage is reached nearly every day during low-water period when power plant shuts down.

1919–1923: Maximum discharge recorded, about 26,000 second-feet at 2.30 p. m. March 17, 1920 (observed at Court Street dam).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—The Barge Canal crosses the river near the southern line of the city of Rochester. It discharges water into Genesee River from Lake Erie and diverts water to the east for canal purposes.

REGULATION.—Daily discharge affected by storage for power purposes at Rochester and points upstream.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 20 and 20,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by averaging the discharge for bihourly intervals of the day. Records fair.

Discharge measurements of Genesee River at Driving Park Avenue, Rochester, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 4	A. W. Harrington.....	2.84	993	Mar. 26	Shupe and Davidson *	5.81	5,150
5	do.....	2.76	887	Aug. 19	A. W. Harrington.....	2.76	928
Jan. 5	B. F. Howe.....	3.76	2,030				

* Engineer, Rochester Gas & Electric Corporation.

Daily discharge, in second-feet, of Genesee River at Driving Park Avenue, Rochester, N. Y., for the year ending September 30, 1923

Date	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	728	844	1,060	1,050	1,290	1,100	2,060	1,800	1,410	1,090	990	804
2	882	892	927	1,180	1,390	1,360	2,000	1,790	1,450	1,120	1,120	726
3	845	809	1,330	2,880	1,900	2,620	2,200	1,760	1,440	950	1,150	810
4	899	800	1,690	2,850	4,510	8,990	2,600	1,620	1,380	950	900	703
5	809	700	1,450	2,200	5,760	14,400	7,660	1,560	1,440	1,090	897	686
6	719	850	1,250	1,850	4,830	16,400	14,800	1,470	1,510	1,370	976	757
7	883	800	1,050	1,600	3,300	17,500	14,600	1,450	1,680	1,440	855	764
8	753	741	1,070	1,300	2,380	14,500	9,590	1,430	1,330	1,200	971	793
9	856	678	1,220	1,120	2,250	10,500	6,440	1,570	3,560	1,040	865	694
10	1,030	900	1,370	1,210	2,100	7,080	4,930	1,740	3,610	881	822	738
11	977	900	1,330	1,310	1,930	6,400	3,910	1,800	2,830	1,020	888	787
12	1,230	1,010	1,410	1,240	1,720	9,180	3,570	2,000	2,260	930	712	777
13	1,270	800	2,010	1,230	1,430	17,200	3,360	2,180	1,800	998	905	881
14	1,130	893	620	1,160	1,400	18,300	3,000	3,230	1,630	936	824	866
15	995	994	620	1,010	1,430	13,600	2,740	2,220	1,380	969	812	911
16	992	1,050	700	1,030	1,410	9,430	2,180	2,760	1,360	998	795	778
17	1,010	949	900	1,030	1,240	15,300	2,030	3,600	1,230	1,640	820	792
18	1,050	981	866	1,110	1,080	16,200	1,890	3,770	1,380	1,630	829	731
19	914	997	849	1,090	1,040	12,200	1,790	3,250	1,280	1,240	771	770
20	902	1,010	755	1,100	960	8,640	1,670	2,860	1,120	1,220	890	799
21	896	1,030	1,030	1,250	1,030	5,490	1,470	2,600	992	1,010	796	866
22	688	959	875	1,500	1,070	5,160	1,260		939	899	985	850
23	1,040	939	919	2,270	1,000	6,760	1,500		959	931	768	925
24	814	1,000	806	2,200	1,010	10,900	1,280		994	936	700	924
25	1,070	998	841	2,440	856	9,100	1,170		1,000	802	700	961
26	1,060	991	936	2,420	875	5,620	928	1,500	1,150	900	712	877
27	1,060	971	1,060	2,190	851	4,500	845		1,680		740	990
28	827	924	1,260	2,040	914	3,790	800		1,230		819	962
29	931	973	1,220	1,740	-----	3,200	389		1,610		879	880
30	897	1,000	1,380	1,400	-----	2,800	1,270		1,630		813	854
31	911	-----	1,430	1,330	-----	2,400	-----	1,500	-----	871	851	-----

NOTE.—Discharge for the following periods when water-stage recorder was not operating satisfactorily, estimated from fragmentary automatic record and comparison with record of Genesee River at Jones Bridge: Nov 6, 7, 10, 11, 13, Dec. 15, 16, Jan. 22, 24, Mar. 7, 8, 15, 29-31, Apr. 2-4, 14, 28, May 12, 21-26, June 2, July 3, 4, 26-28 Aug. 4, 24, 25, and Sept. 22.

Monthly discharge of Genesee River at Driving Park Avenue, Rochester, N. Y., for the year ending September 30, 1923

[Drainage area, 2,460 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,270	698	938	0.381	0.44
November	1,050	678	909	.370	.41
December	2,010	620	1,100	.447	.52
January	2,880	1,010	1,590	.646	.74
February	5,760	851	1,820	.740	.77
March	18,300	1,100	9,050	3.68	4.24
April	14,800	389	3,460	1.41	1.57
May	3,770	1,430	2,200	.894	1.05
June	3,610	939	1,580	.642	.72
July	1,640	802	1,050	.427	.49
August	1,150	700	857	.348	.40
September	990	686	822	.334	.37
The year	18,300	389	2,120	.862	11.70

Note.—The figures on discharge and run-off given above do not represent the natural flow from the drainage area on account of inflow and diversion at the crossing of the Barge Canal during the navigation season.

CANASERAGA CREEK NEAR DANSVILLE, N. Y.

LOCATION.—At highway bridge 1 mile west of Dansville, Livingston County, half a mile below mouth of Mill Brook and 22 miles above mouth.

DRAINAGE AREA.—158 square miles (furnished by New York State Conservation Commission).

RECORDS AVAILABLE.—July 21, 1910, to December 31, 1912; July 10, 1915, to June, 30, 1917; March 10, 1919, to June 16, 1919; March 17, 1920, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder installed October 19, 1920, on left abutment. During winter a vertical staff at the same location is used because of unsatisfactory operation of water-stage recorder. Recorder inspected and staff gage read by Frank S. Fox.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Sand and gravel; shifting frequently.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.20 feet (staff gage reading) at 4 p. m. March 4, (discharge, determined from logarithmic extension of rating curve, about 3,500 second-feet); minimum stage from water-stage recorder, 6.26 feet from 11 p. m. September 2 to 5 a. m. September 3 (discharge, 14 second-feet).

1910-1912; 1915-1917; 1919-1923: Maximum stage recorded, 13 feet at 9.30 p. m. May 16, 1916 (discharge, determined from logarithmic extension of rating curve, roughly 6,600 second-feet); minimum discharge, 14 second-feet September 10, 1921, and September 2 and 3, 1923.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent until after spring breakup when it became practically permanent for the remainder of the year; affected by ice from December to March. Rating curve used subsequent to March 3 fairly well defined between 10 and 1,000 second-feet. Daily discharge ascertained by applying to rating table mean daily gage height as observed or as determined by inspection of gage-height graph, or for days of considerable fluctuation, by averaging discharge for intervals of day; shifting-control method used October 1 to December 16. Records fair.

Discharge measurements of Canaseraga Creek near Dansville, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 10	A. W. Harrington-----	7.01	98.5	Feb. 7	B. F. Howe-----	* 7.26	114
Nov. 10	do-----	6.80	54.6	Mar. 28	E. B. Shupe-----	7.10	178
Jan. 12	B. F. Howe-----	* 6.89	65.8	Aug. 16	A. W. Harrington-----	6.35	21.8

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Canaseraga Creek near Dansville, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	52	46	72	240	95	90	155	94	59	37	27	18
2	52	46	95	160	280	120	155	89	59	33	24	17
3	52	46	65	120	650	1,400	164	83	50	30	25	17
4	50	47	58	110	340	3,300	320	78	50	43	25	19
5	50	46	60	95	220	1,110	1,260	78	50	36	23	21
6	49	50	50	85	120	440	695	78	59	34	22	22
7	52	52	47	75	100	342	440	78	59	33	21	19
8	60	52	56	70	95	270	365	68	94	30	22	37
9	70	56	80	70	80	239	286	118	135	27	22	28
10	92	55	60	65	70	221	239	126	78	25	20	22
11	92	52	95	70	70	299	232	126	64	27	19	21
12	68	50	65	65	80	1,180	221	164	68	26	19	21
13	63	47	65	60	80	792	196	170	50	25	18	21
14	55	46	65	64	95	365	170	135	50	24	18	21
15	52	50	65	60	95	247	155	113	54	43	19	20
16	53	50	53	75	90	1,980	155	196	50	316	20	19
17	52	49	42	70	80	760	140	203	50	99	19	19
18	49	47	36	100	75	520	140	140	50	68	19	18
19	49	46	36	100	70	492	140	140	50	52	18	19
20	47	46	36	130	60	320	140	113	43	42	18	20
21	46	45	36	160	55	286	135	221	36	36	18	23
22	45	46	36	440	50	342	126	164	36	30	20	46
23	55	45	36	200	46	825	137	140	30	28	19	26
24	78	47	38	160	34	492	124	108	30	30	18	25
25	63	45	42	110	48	320	111	101	27	48	19	23
26	58	43	55	95	46	258	103	89	54	35	19	23
27	53	46	90	90	55	203	99	78	43	30	19	22
28	52	45	180	85	55	170	103	68	59	33	20	22
29	49	43	110	80	-----	170	116	68	68	30	21	23
30	47	43	110	85	-----	170	101	68	50	29	19	23
31	46	-----	95	80	-----	155	-----	68	-----	30	18	-----

NOTE.—Discharge for the following days estimated or interpolated because of missing gage-height record: Dec. 11-13, Feb. 5, Apr. 30, May 1-6, and Sept. 20-25. Staff gage readings used Dec. 14 to Apr. 22, and May 7 to June 30, when there was no record from water-stage recorder. Discharge, Dec. 17 to Mar. 3 determined from gage heights corrected for ice effect by means of two discharge measurements, study of observer's notes, gage-height graph, and weather records.

Monthly discharge of Canaseraga Creek near Dansville, N. Y., for the year ending September 30, 1923

[Drainage area, 158 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	92	45	56.5	0.358	0.41
November	56	43	47.6	.301	.34
December	180	36	65.5	.415	.48
January	440	60	112	.709	.82
February	650	34	116	.734	.76
March	3,300	90	577	3.65	4.21
April	1,260	99	231	1.46	1.63
May	221	68	115	.728	.84
June	135	27	55.2	.349	.39
July	316	24	45.5	.288	.33
August	27	18	20.3	.128	.15
September	46	17	22.5	.142	.16
The year	3,300	17	122	.772	10.52

KESHEQUA CREEK AT CRAIG COLONY, SONYEA, N. Y.

LOCATION.—200 feet downstream from private bridge on grounds of Craig Colony at Sonyea, Livingston County, and $2\frac{1}{2}$ miles above mouth.

DRAINAGE AREA.—70 square miles (measured by New York State Conservation Commission).

RECORDS AVAILABLE.—October 31, 1917, to September 30, 1923, at present site; July 22, 1910, to December 31, 1912, at a site 200 feet upstream. August 29, 1915, to October 31, 1917, at a site 1 mile downstream.

GAGE.—Vertical staff in three sections on retaining wall on left bank just above the concrete dam for pumping plant of Craig Colony; read by A. J. Porter.

DISCHARGE MEASUREMENTS.—Made from downstream side of private bridge above gage or by wading.

CONTROL.—Concrete dam with two crests of equal elevation separated by a trough 18 inches wide which serves as an intake for the Craig Colony pumping plant; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.06 feet at 6 p. m. March 3 (discharge, 1,780 second-feet); minimum discharge, 0.7 second-foot at 5 p. m. August 24.

1917–1923: Maximum stage recorded, 5.9 feet at 10 a. m. May 22, 1919 (discharge not determined); minimum discharge, 0.7 second-foot August 20, 1918, and August 24, 1923.

ICE.—Stage-discharge relation slightly affected by ice.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice from December to March and by sandbag on dam during August and September. Rating curve fairly well defined between 1 and 1,500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Keshequa Creek at Craig Colony, Sonyea, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 10	A. W. Harrington.....	0.77	34.0	Feb. 6	B. F. Howe.....	^a .73	27.9
Nov. 7	do.....	.44	7.89	Aug. 18	A. W. Harrington.....	^b .21	1.31
Jan. 12	B. F. Howe.....	^a .64	18.8				

^a Stage-discharge relation affected by ice.

^b Stage-discharge relation affected by sand bag on control.

Daily discharge, in second-feet, of Keshequa Creek at Craig Colony, Sonyea, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	5.2	9.6	9.6	120	35	60	6.2	22	9.6	5.7	3.4	1.3
2.....	4.9	6.7	22	85	130	90	19	17	8.1	4.1	3.6	1.2
3.....	4.4	6.7	9.1	55	440	300	41	17	7.6	4.1	3.2	1.0
4.....	4.6	10	11	40	120	1,070	115	17	8.1	8.1	3.2	.9
5.....	4.6	7.2	12	30	55	303	730	14	9.1	6.2	2.8	1.5
6.....	4.1	6.2	8.6	22	36	100	258	13	7.2	7.2	3.0	1.9
7.....	4.1	9.1	5.9	11	28	72	132	12	10	4.1	2.4	3.2
8.....	5.2	8.1	12	11	19	58	110	12	14	4.6	1.7	2.5
9.....	12	9.6	22	11	17	60	66	18	15	3.6	2.6	2.0
10.....	23	9.1	14	13	14	86	58	27	11	3.9	2.1	1.7
11.....	21	8.1	9.1	14	14	150	60	25	10	3.6	1.7	1.7
12.....	11	7.2	12	19	16	1,010	50	31	7.6	3.4	1.0	1.7
13.....	11	7.2	7.2	14	22	391	47	44	6.2	3.0	1.0	1.5
14.....	8.1	9.6	7.6	10	24	105	40	28	6.2	3.0	1.2	1.1
15.....	7.2	9.1	8.1	11	17	68	36	37	6.2	13	1.5	1.5
16.....	7.2	10	6	14	14	780	36	46	6.2	236	1.2	1.7
17.....	9.6	7.2	4	17	10	227	31	31	5.7	29	1.9	1.9
18.....	7.6	7.2	4	22	9	126	29	29	5.2	12	1.6	1.3
19.....	8.1	7.2	4	24	7	150	27	22	5.2	9.1	1.3	2.1
20.....	5.7	6.2	4	36	7	51	27	19	4.1	7.2	1.0	2.1
21.....	11	8.6	4	65	5	68	28	34	4.4	4.6	1.0	2.5
22.....	5.9	8.1	4	170	5	100	26	39	3.4	3.9	1.5	25
23.....	7.2	8.1	5	120	4	298	31	27	3.2	3.6	1.2	7.6
24.....	18	10	7	70	3	132	27	20	3.4	3.6	.9	5.2
25.....	12	9.1	11	44	5	51	22	18	2.1	7.6	1.2	5.7
26.....	10	9.1	20	38	6	61	18	17	6.2	6.2	1.5	3.0
27.....	9.1	9.6	30	36	11	41	20	12	9.6	5.7	1.3	2.8
28.....	9.1	9.1	22	26	29	31	17	12	5.7	4.1	1.2	3.2
29.....	6.7	9.1	15	24	-----	36	25	11	12	3.9	1.4	4.1
30.....	6.7	8.1	11	19	-----	41	21	10	7.2	3.6	1.6	2.8
31.....	6.2	-----	34	22	-----	25	-----	10	-----	3.6	1.6	-----

NOTE.—Discharge for the following days when gage was not read, estimated, or interpolated: Dec. 10, 15, Jan. 1, 23-25, April 14, July 11, Aug. 7, 29, and Sept. 8 and 9. Discharge, Dec. 16 to Mar. 3, determined from gage heights corrected for ice effect by means of two discharge measurements, study of observer's notes, gage-height graph and weather records, and comparison with records of Canaseraga Creek near Dansville. Discharge, Aug. 12 to Sept. 30, determined from gage heights corrected for backwater effect from obstruction on dam by means of two discharge measurements.

Monthly discharge of Keshequa Creek at Craig Colony, Sonyea, N. Y., for the year ending September 30, 1923

[Drainage area, 70 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	23	4.1	8.73	0.125	0.14
November.....	10	6.2	8.34	.119	.13
December.....	34	4	11.5	.164	.19
January.....	170	10	39.1	.559	.64
February.....	440	3	39.4	.563	.59
March.....	1,070	25	198	2.83	3.26
April.....	730	6.2	71.8	1.03	1.15
May.....	46	10	22.3	.319	.37
June.....	15	2.1	7.32	.105	.12
July.....	236	3.0	13.6	.194	.22
August.....	3.6	.9	1.80	.026	.03
September.....	25	.9	3.19	.046	.05
The year.....	1,070	.9	35.5	.507	6.89

CONESUS CREEK NEAR LAKEVILLE, N. Y.

LOCATION.—At highway bridge known locally as Millville Bridge, $1\frac{1}{2}$ miles north of Lakeville, Livingston County, and outlet of Conesus Lake.

DRAINAGE AREA.—71 square miles (furnished by New York State Conservation Commission).

RECORDS AVAILABLE.—November 13, 1919, to September 30, 1923.

GAGE.—Vertical staff bolted to upstream side of right abutment of bridge; read by W. B. Milliman.

DISCHARGE MEASUREMENTS.—Made from highway bridge about a quarter of a mile downstream or by wading.

CHANNEL AND CONTROL.—A rectangular weir, 2.01 feet long and 0.67 foot high under upstream side of bridge. When the water overtops this weir it flows over a 2-inch plank 25.75 feet long, including the 2 feet of weir. The theoretical stage-discharge relation does not apply on account of leakage under the left abutment and around the right end of weir. During night of March 11, 1923, the weir was carried out by ice and débris from the lake; the control then became a 2 by 4 inch timber bolted to concrete apron under highway bridge.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during year, 202 second-feet at 10 a. m. March 20; minimum discharge, about 3 second-feet December 15–21.

1919–1923: Maximum discharge recorded, that of March 20, 1923; minimum discharge, about 2.5 second-feet several times during October and November, 1921.

ICE.—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—No water is diverted from Conesus Lake above the station.

ACCURACY.—Stage-discharge relation practically permanent, except as affected by ice from December to night of March 11, when weir was carried away by ice and débris. Rating curve for weir fairly well defined between 4 and 150 second-feet. Rating curve for temporary control fairly well defined between 3 and 150 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Conesus Creek near Lakeville, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Oct. 11	A. W. Harrington	<i>Feet</i> 0.85	<i>Sec.-ft.</i> 13.1	Jan. 31	B. F. Howe	<i>Feet</i> 0.11	<i>Sec.-ft.</i> 30.4
Nov. 5	do	.64	5.5	Apr. 4	E. B. Shupe	.72	118
Jan. 13	B. F. Howe	0.98	22.5	Aug. 19	A. W. Harrington	— .16	14.0

^a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Conesus Creek near Lakeville, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	14	4.4	9.7	7	36	36	145	74	36	22		12
2.....	15	4.5	6.0	9	34	50	122	71	34			11
3.....	14	5.2	4.2	16	36	65	122	69	35			12
4.....	15	5.6	4.0	18	36	80	115	69	38			11
5.....	15	5.4	6.8	18	38	88	152	66	39			10
6.....	14	6.0	4.0	18	40	94	152	64	38	22		11
7.....	14	6.8	3.7	17	38	101	152	62	47			12
8.....	14	7.6	3.9	18	34	101	145	62	55			13
9.....	15	7.6	4.4	17	32	94	152	64	50			11
10.....	17	8.8	4.2	18	30	101	152	61	45		16	11
11.....	16	8.5	4.0	20	28	108	138	61	40	24		10
12.....	16	8.5	4.0	24	30	176	138	61	35			9.7
13.....	15	7.6	3.6	28	28	140	130	61	33			9.7
14.....	15	7.6	3.4	18	32	138	122	59	30			9.1
15.....	14	7.0		16	36	130	115	62	28			9.7
16.....	13	6.6		13	32	168	108	60		24		9.7
17.....	13	7.6		13	28	168	108	61				9.1
18.....	12	6.6	3	13	28	176	108	59				8.4
19.....	12	4.9		16	26	184	108	56				9.1
20.....	11	4.8		16	24	176	101	56			13	9.7
21.....	10	4.7		22	18	160	101	56		30	12	9.7
22.....	11	4.8	3.5	24	16	168	94	54			9.7	11
23.....	12	4.8	3.5	26	15	168	94	53			9.7	12
24.....	11	4.3	3.7	28	15	168	94	54			10	11
25.....	11	4.8	3.9	26	15	168	94	54			9.7	11
26.....	12	4.9	4.5	24	18	160	87	56		24	11	10
27.....	7.3	7.6	4.9	22	24	160	82	47			12	9.7
28.....	5.6	4.7	4.5	24	34	152	79	44			13	9.7
29.....	5.0	4.7	4.1	28	-----	145	79	42			12	9.7
30.....	4.6	4.6	4	28	-----	145	75	41			13	9.1
31.....	4.5	-----	5	36	-----	138	-----	38	-----		12	-----

NOTE.—Discharge for the following periods when gage-height record was doubtful estimated by comparison with record of Keshequa Creek at Craig Colony Dec. 15–21, Mar. 13, June 15 to Aug. 18. Discharge, Dec. 30 to Mar. 4, determined from gage heights corrected for ice effect by means of two discharge measurements, study of observer's notes, gage-height graph and weather records and comparison with records of flow of near-by streams.

Monthly discharge of Conesus Creek near Lakeville, N. Y., for the year ending September 30, 1923

[Drainage area, 71 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	17	4.5	12.2	0.172	0.20
November.....	8.8	4.3	6.05	.085	.09
December.....	9.7	-----	4.15	.058	.07
January.....	36	7	20.0	.282	.33
February.....	40	15	28.6	.403	.42
March.....	184	36	132	1.86	2.14
April.....	152	75	115	1.62	1.81
May.....	74	38	58.0	.817	.94
June.....	55	-----	31.4	.442	.49
July.....	-----	-----	26.1	.368	.42
August.....	-----	9.7	14.1	.199	.23
September.....	13	8.4	10.4	.146	.16
The year.....	184	-----	38.3	.539	7.30

CANADICE LAKE OUTLET NEAR HEMLOCK, N. Y.

LOCATION.—At outlet of Canadice Lake, Livingston County. Outlet flows into Genesee River through Canadice Lake outlet and Honeoye Creek.

DRAINAGE AREA.—12.6 square miles, of which 1 square mile is lake surface.

RECORDS AVAILABLE.—April, 1903, to September 30, 1923.

GAGE.—Hook, in channel above weir.

CHANNEL AND CONTROL.—Outflow 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 feet. No end contractions during high water. The weir crest stands 3.14 feet above the stream channel, which is artificial with a plank bottom and vertical sides, and the crest is never submerged by backwater. Two additional rectangular gates, each 1 foot square with three complete contractions and a fourth incomplete contraction at the bottom.

ICE.—Stage-discharge relation not affected by ice as the pool above the weir is free from ice throughout the winter.

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

REGULATION.—Outflow of lake is regulated by bulkhead and gates at dam above weir.

ACCURACY.—Stage-discharge relation permanent. Rating curve used is expressed by Francis formula. Corrections are made for velocity of approach for high stages. Gage read to hundredths once daily. Records good.

COOPERATION.—Data collected, computed, and furnished for publication by the city engineer of Rochester.

Monthly discharge of Canadice Lake outlet near Hemlock, N. Y., for the year ending September 30, 1923

[Drainage area, 12.6 square miles]

Month	Mean discharge	Mean elevation of lake above low water mark	Month	Mean discharge	Mean elevation of lake above low water mark
	Sec.-ft.	Feet		Sec.-ft.	Feet
October	4. 143	1. 356	May	14. 588	0. 964
November .....	. 213	1. 204	June	6. 479	. 573
December	6. 516	. 943	July	3. 174	. 247
January	7. 290	. 768	August	2. 781	— . 510
February	10. 858	. 985	September	1. 600	—1. 251
March	27. 867	2. 321			
April	29. 988	2. 257	The year	9. 625	0. 821

NOTE.—Terminal water surface for the year was 3.14 feet lower than for the previous year, corresponding to a loss in storage of 89,483,164 cubic feet, or a discharge of 2.837 second-feet for the year. This correction applied to the above gives 6.788 second-feet, equivalent to 0.539 second-foot per square mile or a run-off of 7.298 inches from the drainage area.

OWASCO LAKE OUTLET NEAR AUBURN, N. Y.

LOCATION.—On farm of Charles H. Pearce, 2 miles below center of Auburn.

Cayuga County, and 3¾ miles below State dam at outlet of Owasco Lake,

DRAINAGE AREA.—206 square miles (measured on topographic maps.)

RECORDS AVAILABLE.—November 17, 1912, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder on left bank; inspected by Mrs. Charles H. Pearce.

DISCHARGE MEASUREMENTS.—Made from a cable directly opposite gage or by wading.

CHANNEL AND CONTROL.—The control is artificial and consists of a low concrete dam 100 feet long 25 feet below the gage. The elevation of crest of left half of dam is 1.28 feet gage datum; right half of dam is at elevation of 2.13 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.61 feet at 2 p. m. March 24 (discharge, 1,230 second-feet); minimum stage from water-stage recorder, 1.50 feet at 3.30 p. m. September 23 (discharge, 14 second-feet).

1912-1923: Maximum stage, 6.4 feet during period March 25-30, 1913, determined by leveling from floodmarks (discharge, 2,750 second-feet); minimum stage from water-stage recorder, 1.38 feet (effective) at 7 p. m. August 21, 1920 (discharge, 3.8 second-feet).

ICE.—Stage-discharge relation seldom affected by ice.

DIVERSIONS.—An average flow of about 10 second-feet is pumped from Owasco Lake for the municipal water supply of the city of Auburn. Proportion returning to stream above the gaging station is not known.

REGULATION.—Large diurnal fluctuation in flow during low-water periods due to operation of mills in the city of Auburn; seasonal flow regulated at the State dam.

ACCURACY.—Stage-discharge relation permanent except for possible slight back-water effect from ice during the winter and from aquatic growth during the late summer. Rating curve well defined below 1,700 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily discharge table. Daily discharge ascertained by averaging the discharge for bihourly intervals of the day. Records good except for periods of estimate, for which they are fair.

Discharge measurements of Owasco Lake outlet near Auburn, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 3	A. W. Harrington.....	2.25	181	Mar. 25	E. B. Shupe.....	3.52	1,070
Jan. 4	B. F. Howe.....	2.39	225	Aug. 20	A. W. Harrington.....	2.18	146
30	do.....	2.55	318				

Daily discharge, in second-feet, of Owasco Lake outlet near Auburn, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	157	142	146	140	291	225	788	253	196	167	193	124
2.....	192	144	164		299	223	750	235	188	193	189	107
3.....	180	136	79		347	268	640	236	188	189	204	120
4.....	181	145	146			324	596	239	206	168	237	133
5.....	187	118	131	160		383	764	247	191	190	143	121
6.....	169	144	133	140	330	427	973	230	199	188	206	89
7.....	175	135	141		449	1,020	254	189	196	212	90	
8.....	156	128	141		464	1,020	245	201	174	190		
9.....	182	133			341	465	965	236	219	210	204	
10.....	201	135		333	464	922	232	200	196	186		
11.....	184	125		140	324	450	877	228	255	193	188	100
12.....	175	116			325	523	803	233	416	200	148	
13.....	176	138			318	538	708	228	344	201	196	
14.....	178	135			304	548	644	253	290	210	185	
15.....	154	125		302	554	616	358	250	192	178	112	
16.....	173	130		130	302	668	553	470	246	222	186	106
17.....	174	115			317	790	528	540	239	222	181	109
18.....	170	134			299	879	499	538	262	209	182	99
19.....	179	76			266	931	442	465	229	215	156	56
20.....	174	121		218	944	367	416	183	220	180	96	
21.....	170	129		263	217	905	372	422	192	220	151	112
22.....	164	130		299	232	915	346	372	191	193	144	95
23.....	193	131			230	989	370	363	184	227	150	74
24.....	182	130			240	1,130	338	348	174	216	150	98
25.....	175	148			224	1,130	303	333	193	209	150	98
26.....	168	106		280	233	1,120	285	296	188	217	136	86
27.....	170	139			240	1,060	239	274	174	227	144	89
28.....	166	142			232	991	259	263	194	211	114	85
29.....	153	134				946	237	202	184	194	134	83
30.....	173	129		293		878	255	179	186	225	118	81
31.....	166					822		200		207	128	

NOTE.—Discharge estimated for the following periods when water-stage recorder was not operating satisfactorily: Dec. 9, to Jan. 4, Jan. 6-20, 23-30, Feb. 4-8, July 20, 21, Aug. 20, 24, 25, and Sept. 7-14.

Monthly discharge of Owasco Lake outlet near Auburn, N. Y., for the year ending September 30, 1923

[Drainage area, 206 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	201	153	174	0.845	0.97
November.....	148	76	130	.631	.70
December.....	164	79	131	.636	.73
January.....			191	.927	1.07
February.....	347	217	289	1.40	1.46
March.....	1,130	223	690	3.35	3.86
April.....	1,020	237	583	2.83	3.16
May.....	540	179	303	1.47	1.70
June.....	416	174	218	1.06	1.18
July.....	227	167	203	.985	1.14
August.....	237	114	170	.825	.95
September.....	133	56	98.8	.480	.54
The year.....	1,130	56	265	1.29	17.46

EAST BRANCH OF FISH CREEK AT TABERG, N. Y.

LOCATION.—At steel highway bridge in village of Taberg, Oneida County, just below mouth of Furnace Creek and $2\frac{3}{4}$ miles above confluence of East and West branches near Blossvale.

DRAINAGE AREA.—188 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 1 to September 30, 1923.

GAGE.—Vertical staff attached to downstream face of left abutment; read by Alvin Thorn.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Large and small boulders; shifting occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the period of record, 5.66 feet at 6.30 p. m. April 8 (discharge, about 5,180 second-feet); minimum stage, 0.57 foot at 11.40 a. m. August 21 (measured discharge, 19.8 second-feet).

ICE.—Stage-discharge relation slightly affected by ice during extremely cold weather.

REGULATION.—Operation of mills upstream causes some diurnal fluctuation of flow during extremely low water.

ACCURACY.—Stage-discharge relation permanent during period. Rating curve fairly well defined between 20 and 1,500 second-feet; extended above. Gage read to tenths twice daily; accuracy doubtful. Daily discharge ascertained by applying mean daily gage height to rating table. Records poor because of doubtful gage-height record.

Discharge measurements of East Branch of Fish Creek at Taberg, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Mar. 24	Shupe, White,* and Lamprecht *	Feet 3.54	Sec.-ft. 1,320	Aug. 7	Harrington and White.	Feet 0.67	Sec.-ft. 33.7
Apr. 17	Lamson and Harrington	2.99	868	21	A. W. Harrington.....	.57	19.8
25	do	3.74	1,490	27	do	.58	21.0
					do	.97	62.9

* Engineer, Utica Gas & Electric Co.

Daily discharge, in second-feet, of East Branch of Fish Creek at Taberg, N. Y., for the year ending September 30, 1923

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1	220	1,200	200	220	75	55	16	1,200	1,100	160	260	40	55
2	220	800	190	150	60	46	17	900	1,700	140	260	40	55
3	260	700	200	110	65	46	18	750	1,200	130	75	30	55
4	850	650	190	110	65	55	19	700	800	130	60	36	75
5	2,200	600	240	100	65	46	20	1,400	600	110	55	44	95
6	4,200	480	200	80	60	46	21	3,400	1,000	110	55	36	380
7	3,800	420	190	80	46	55	22	4,000	1,000	100	46	55	420
8	4,600	360	700	80	44	260	23	3,600	650	90	46	55	220
9	3,000	950	1,200	65	40	200	24	2,400	500	80	44	46	180
10	2,600	950	650	65	44	180	25	1,500	460	80	44	55	110
11	2,600	700	400	60	36	110	26	1,500	360	280	44	55	95
12	2,800	600	280	55	34	80	27	1,500	300	550	46	46	80
13	2,400	550	220	55	46	75	28	1,400	260	280	80	50	80
14	1,600	440	190	55	36	65	29	2,000	260	300	75	80	95
15	1,500	550	170	55	44	60	30	1,500	220	280	65	95	95
							31		200		75	75	

Monthly discharge of East Branch of Fish Creek at Taberg, N. Y., for the year ending September 30, 1923

[Drainage area, 188 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
April	4,600	220	2,020	10.74	11.98
May	1,700	200	663	3.53	4.07
June	1,200	80	268	1.43	1.60
July	260	44	86.1	.458	.53
August	95	30	51.5	.274	.32
September	420	46	116	.617	.69

BLACK RIVER NEAR BOONVILLE, N. Y.

LOCATION.—At highway bridge 1 mile above mouth of Sugar River, 2 miles northeast of Boonville, Oneida County, and 2 miles, by river, downstream from Hawkinsville.

DRAINAGE AREA.—303 square miles (measured on topographic maps).

RECORDS AVAILABLE.—February 16, 1911, to September 30, 1923.

GAGE.—Chain near center of left span, downstream side of bridge; staff gage on right abutment used for high-water readings; read by W. D. Charbonneau

DISCHARGE MEASUREMENTS.—Made from a cable half a mile above gage or by wading near gage.

CHANNEL AND CONTROL.—Rough and full of boulders; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.88 feet at 5 p. m. April 8 and 22 (discharge, 3,980 second-feet); minimum stage, 3.20 feet several times in August and September (discharge, 42 second-feet).

1911-1923: Maximum stage (determined by leveling from floodmark) about 12.5 feet during night of March 28, 1913 (discharge, about 10,000 second-feet); minimum stage, 2.40 feet at 5 p. m. August 26, 1918 (discharge, about 5 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Water is diverted at Forestport during the navigation season through the Forestport feeder, flowing west to a basin in Boonville. The Black River canal flows north from this basin, entering Black River at the foot of Lyons Falls. A spillway from the basin overflows into Mill Creek, a tributary of Black River. Water flowing through these two channels returns to the river below the gaging station, thus passing around it. The Black River canal also flows south from Boonville, passing out of the Black River drainage and entering the summit level of the Erie Canal (or Barge Canal) at Rome.

A continuous record of the amount of diversion through the Forestport feeder from Black River at Forestport during navigation season is published under "Forestport feeder near Boonville, N. Y." A continuous record of the amount of diversion out of the Black River drainage basin is published under "Black River canal (flowing south) near Boonville, N. Y." The difference in discharge between these two records doubtless indicates very nearly the amount of water diverted around this station and returned to Black River.

REGULATION.—The State Pond at Forestport, 8 miles upstream, impounds 13,068,000 cubic feet; another State dam $1\frac{1}{2}$ miles upstream from Forestport provides a reservoir with a capacity of 213,440,000 cubic feet and receives storage from headwater reservoirs with total capacity of about 1,800,000,000 cubic feet, from which 1,397,000,000 cubic feet may be drawn each year.

ACCURACY.—Stage-discharge relation practically permanent, except as affected by ice from December to April. Rating curve well defined between 35 and 2,800 second-feet and fairly well defined between 2,800 and 4,500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good, except for period of ice effect, for which they are fair.

Discharge measurements of Black River near Boonville, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 11	J. L. Lamson	5.50	413	June 2	J. L. Lamson	4.89	371
Feb. 8	A. W. Harrington	5.40	292	Aug. 2	Johnson and Lamson	4.00	134
Mar. 13	J. L. Lamson	5.40	309		do	4.00	138
Apr. 17	Lamson and Harrington	6.65	1,450				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	145	127	535	950	280	180	650	2,860	390	275	136	60
2	127	136	535	1,500	280	200	600	2,160	370	238	136	66
3	119	145	410	1,400	260	200	650	1,640	352	290	205	51
4	119	275	390	900	260	240	1,200	1,210	352	262	127	44
5	127	227	370	800	260	260	1,800	1,060	352	238	111	44
6	136	184	320	600	260	280	2,620	990	352	216	111	53
7	145	174	335	550	260	420	3,240	920	320	194	104	66
8	184	164	352	460	300	380	3,880	855	305	184	97	145
9	205	154	410	420	300	320	3,880	1,140	630	174	84	216
10	238	145	370	400	280	280	3,240	1,370	680	164	84	164
11	227	154	335	400	280	280	3,360	1,210	680	164	78	145
12	111	164	335	380	260	280	3,110	1,140	535	154	72	127
13	78	174	320	380	260	320	2,980	990	370	145	97	90
14	97	184	320	380	280	360	2,740	1,060	275	136	84	72
15	111	205	300	380	280	440	2,270	1,060	238	145	78	56
16	136	450	300	400	260	550	1,740	1,460	216	174	71	53
17	111	370	280	360	220	800	1,460	3,490	194	184	63	51
18	90	320	280	340	220	1,200	1,210	2,620	174	184	70	57
19	104	305	260	360	240	1,200	1,210	1,840	164	127	70	60
20	104	370	240	460	240	1,100	1,290	1,210	164	119	63	97
21	119	335	260	600	200	950	2,620	990	164	111	49	184
22	111	305	260	650	200	1,100	3,880	920	184	97	42	227
23	111	335	240	750	220	1,300	3,880	795	227	90	51	174
24	305	262	240	650	200	1,500	3,750	680	216	84	63	154
25	250	227	220	600	180	1,700	2,740	605	238	111	84	127
26	216	205	260	550	180	1,600	2,500	558	410	111	84	66
27	194	227	280	500	180	1,300	2,380	470	450	119	84	44
28	184	205	300	460	190	1,100	2,160	430	450	136	90	72
29	174	227	320	340	-----	1,000	3,490	410	470	127	97	65
30	154	470	300	300	-----	850	3,110	352	390	111	84	72
31	145	-----	360	280	-----	700	-----	370	-----	119	65	-----

NOTE.—Discharge, Dec. 13 to Apr. 5, determined from gage heights corrected for ice effect from three discharge measurements, study of weather records and gage-height graph, observer's notes, and comparison with records of flow of near-by streams.

Monthly discharge of Black River near Boonville, N. Y., for the year ending September 30, 1923

[Drainage area, 303 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	305	78	151	0.498	0.57
November.....	470	127	241	.795	.89
December.....	535	220	324	1.07	1.23
January.....	1,500	280	565	1.86	2.14
February.....	300	180	244	.805	.84
March.....	1,700	180	722	2.38	2.74
April.....	3,880	600	2,450	8.09	9.03
May.....	3,490	352	1,190	3.93	4.53
June.....	680	164	344	1.14	1.27
July.....	290	84	161	.531	.61
August.....	205	42	88.2	.291	.34
September.....	227	44	96.7	.319	.36
The year.....	3,880	42	548	1.81	24.55

NOTE.—Water diverted past this station by the Forestport feeder is not included in the above table.

BLACK RIVER AT WATERTOWN, N. Y.

LOCATION.—At Vanduzee Street Bridge in Watertown, Jefferson County, 8 miles above mouth. No important tributary enters the river below this point.

DRAINAGE AREA.—1,890 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 18, 1920, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder on downstream side of right abutment; inspected by employees of Black River regulating district. Prior to September 3, 1921, a vertical staff at same location and an inclined staff on right bank 150 feet below, were used.

DISCHARGE MEASUREMENTS.—Made from cable 150 feet below gage.

CHANNEL AND CONTROL.—Rocky and rough; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.50 feet (staff gage reading) at 8.30 a. m. April 9 (discharge, 22,000 second-feet); minimum stage from water-stage recorder, 0.30 foot from 1 to 5 a. m. August 6, (discharge, 155 second-feet).

1920-1923: Maximum stage recorded, 9.45 feet (staff gage reading) at 6 p. m. April 13, 1922 (discharge, 26,200 second-feet); minimum stage from water-stage recorder, that of August 6, 1923.

ICE.—Stage-discharge relation probably not affected by ice.

DIVERSIONS.—Water is diverted from Black River into the Forestport feeder at Forestport. A part of this water returns to the river through various spillways and through the Black River canal (flowing north); the rest passes out of the drainage basin through the Black River canal (flowing south), the record at the station on Black River canal (flowing south) near Boonville indicates the amount of this diversion. See also "Regulation" and "Diversions" in description of station on Black River near Boonville.

REGULATION.—Seasonal distribution of flow is regulated by Beaver River flow, Fulton Chain Lakes, Forestport reservoir, and other storage reservoirs in the upper part of the drainage basin. During medium and low water periods there is considerable diurnal fluctuation in flow, caused by mills and power plants at Watertown and above.

ACCURACY.—Stage-discharge relation practically permanent; probably not affected by ice. Rating curve well defined between 200 and 25,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of gage-height graph, or for days of considerable fluctuation, by averaging discharge for intervals of day. Records excellent, except for periods of estimate, for which they are fair.

Discharge measurements of Black River at Watertown, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Dec. 4	A. W. Harrington-----	1.92	1,590	July 29	Lamson and Johnson--	0.83	554
Jan. 8	J. L. Lamson-----	2.58	2,850	Aug. 6	A. W. Harrington-----	1.19	822
Feb. 10	A. W. Harrington-----	1.91	1,730	6	do-----	.47	243
Apr. 20	do-----	4.50	7,840				

Daily discharge, in second-feet, of Black River at Watertown, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	1,000	1,360	1,310	1,550	1,750	1,210	3,600	11,200	2,480	1,630	848	741
2-----	902	1,260	1,780	2,760	1,520	1,290	3,250	11,200	2,220	1,750	883	564
3-----	1,090	1,560	2,050	3,990	1,840	1,440	3,460	10,200	1,890	1,440	799	681
4-----	1,160	1,210	1,860	4,660	1,810	1,640	6,930	8,640	1,780	1,430	843	454
5-----	1,100	1,270	1,860	4,540	2,050	2,300	9,250	7,210	1,720	1,340	622	692
6-----	933	1,550	1,320	4,320	1,800	2,950	10,900	6,390	1,970	1,420	657	862
7-----		1,190	1,830	4,100		2,950	13,600	5,740	2,050	1,550	992	790
8-----		1,450	1,540	2,950		2,760	19,600	5,250	2,050	1,400	859	776
9-----		1,350	1,450	2,390		2,390	21,600	4,540	3,280	1,060	790	784
10-----	1,400	1,450	1,560	2,390		2,390	20,800	5,740	4,100	1,340	796	834
11-----		1,550	1,680	2,480	1,440	2,290	17,600	6,660	4,430	1,080	786	1,360
12-----		1,190	1,380	2,220	1,470	2,220	16,000	6,660	3,990	1,130	557	1,120
13-----	1,700	1,170	1,690	2,140	1,510	1,890	15,600	6,000	2,950	1,160	410	1,080
14-----	1,540	1,340	1,220	1,780	1,430	1,970	14,800	5,250	2,390	1,080	772	812
15-----	1,070	1,230	1,120	1,600	1,380	1,970	13,600	5,010	2,140	967	673	825
16-----	1,120	1,720	1,400	1,760	1,340	2,570	12,200	4,890	1,890	878	805	756
17-----	889	2,140	1,170	2,050	1,330	3,660	10,900	6,000	1,560	1,160	726	700
18-----	1,080	2,050	1,040	1,870	1,360	5,500	9,560	7,490	1,320	1,080	629	788
19-----	920	1,890	1,540	1,570	1,280		8,340	8,940	1,760	1,050	515	781
20-----	922	1,810	1,240	1,540	1,390		7,490	9,560	1,310	1,020	504	768
21-----	948	2,050	1,140	1,810	1,270	5,620	8,050	8,940	1,570	980	604	861
22-----	921	2,220	1,240	1,970	1,170	5,500	9,250	8,340	1,470	752	923	878
23-----	1,130	2,140	1,810	2,950	1,230	7,490	11,500	7,770	1,380	637	794	1,160
24-----	1,130	1,970	1,050	3,050	1,240	9,250	14,800	6,660	1,260	944	622	1,450
25-----	1,970	1,970	1,100	2,950	1,070	8,340	15,600	5,620	1,220	861	778	1,350
26-----	1,890	1,320	1,320	2,760	1,050	7,770	13,600	4,780	1,350	875	650	1,246
27-----	1,970	1,370	1,330	2,480	1,250	6,930	11,900	3,770	1,380	782	550	1,440
28-----	1,720	1,390	1,410	2,390	1,230	6,390	10,900	3,150	1,890	865	795	1,060
29-----	1,300	1,540	1,390	2,140	-----	5,500	10,500	3,150	1,750	659	818	1,080
30-----	1,450	1,410	1,220	1,890	-----	4,890	10,500	2,570	1,840	606	786	808
31-----	1,430	-----	948	1,890	-----	4,320	-----	2,390	-----	917	839	-----

NOTE.—Discharge for the following periods when water-stage recorder was not operating satisfactorily estimated by comparison with records of flow of several tributary streams: Oct. 1, 7-13, 29, Nov. 12, Feb. 6-10, Mar. 18-21, Aug. 26 and 27.

Monthly discharge of Black River at Watertown, N. Y., for the year ending September 30, 1923

[Drainage area, 1,890 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	1,970	920	1,280	0.677	0.78
November.....	2,220	1,170	1,560	.825	.92
December.....	2,050	948	1,400	.741	.85
January.....	4,660	1,540	2,540	1.34	1.54
February.....	2,050	1,050	1,470	.778	.81
March.....	9,250	1,210	4,080	2.16	2.49
April.....	21,000	3,250	11,900	6.30	7.03
May.....	11,200	2,390	6,440	3.41	3.93
June.....	4,430	1,220	2,080	1.10	1.23
July.....	1,750	606	1,090	.577	.67
August.....	992	410	730	.386	.44
September.....	1,450	484	919	.486	.54
The year.....	21,600	410	2,950	1.56	21.23

NOTE.—See "Regulation" and "Diversions" in station description.

FORESTPORT FEEDER NEAR BOONVILLE, N. Y.

LOCATION.—Slope station at lower end of feeder, above point where it enters basin at Boonville, Oneida County.

RECORDS AVAILABLE.—Occasional discharge measurements 1900 and 1905-1915 continuous record, October 30, 1915, to September 30, 1923.

GAGES.—Two Gurley seven-day graph water-stage recorders, with natural scale for gage height. Gage No. 1 is at downstream end of left abutment of steel highway bridge in village of Hawkinsville; gage No. 2 is on left bank; just below a farm bridge 1 mile above the basin at Boonville; they are 2.53 miles apart. These gages and the two in Black River canal (flowing south) near Boonville are set to the same datum. Recorders inspected by Fred Kesauer.

DISCHARGE MEASUREMENTS.—Made from the steel highway bridge at gage No. 1 in Hawkinsville.

DETERMINATION OF DISCHARGE.—Daily discharge determined by use of Chezy formula. The coefficient "C," computed from each current-meter measurement, is plotted on a curve showing the variation of "C" through the season. A smooth curve drawn through the plotted points shows the coefficients for intervening days. The other factors in the Chezy formula are obtained from gage-height records and cross section of the canal.

DIVERIONS.—One spillway takes water from the Forestport feeder just below gage No. 2 and a second spillway takes water from the basin in Boonville. Both discharge into Mill Creek, which enters Black River below the Boonville gaging station. No spillway between gage No. 1 and gage No. 2. Other spillways in the feeder above gage No. 1 discharge into Black River above the gaging station. The sum of this record and the record for Black River near Boonville indicates the total run-off of the Black River basin above these gaging stations.

REGULATION.—Flow in the feeder is regulated at the outlet of Forestport reservoir.

ICE.—There is usually some flow in the canal during the winter, and occasional current-meter measurements of the discharge have been made.

ACCURACY.—Operation of water-stage recorders satisfactory except as indicated in footnote to daily-discharge table. Records good except when either recorder was not operating, when estimates of missing gage heights were made from comparison with other recorder or from a study of the slope relation. Records for such periods, fair.

Discharge measurements of Forestport feeder near Boonville, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height (feet)		Dis-charge	Date	Made by—	Gage height (feet)		Dis-charge
		Gage No. 1	Gage No. 2				Gage No. 1	Gage No. 2	
Oct. 1	A. W. Harrington.	2.775	1.565	Sec.-ft. 182	Aug. 2	Lamson and John-	1.760		Sec.-ft. 109
15	Harrington and					son	1.585	-.280	
	Lamson	2.570	1.335		2	do	1.585	-.280	
Nov. 3	J. L. Lamson	2.495	1.355		3	A. W. Harrington	1.035	-.750	
Jan. 11	do				4	Lamson and John-	1.765	.645	
June 20	A. W. Harrington.	1.900	.640	58.0	23	A. W. Harrington	2.170	.345	157
21	do	1.840	.440	142					
28	do	2.165	.925	159					

Daily discharge, in second-feet, of Forestport feeder near Boonville, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	June	July	Aug.	Sept.	Day	Oct.	Nov.	June	July	Aug.	Sept.
1	177	169	-----	150	111	153	16	173	-----	113	131	157	162
2	176	171	-----	130	105	156	17	176	-----	131	135	157	152
3	177	170	-----	76	78	154	18	180	-----	166	125	155	164
4	176	142	-----	130	108	152	19	175	-----	165	129	158	171
5	178	155	-----	130	124	153	20	178	-----	148	133	157	170
6	177	188	-----	130	123	156	21	179	-----	144	132	156	175
7	181	165	-----	128	122	167	22	178	-----	146	132	156	173
8	186	170	-----	122	122	169	23	184	-----	149	133	157	170
9	189	196	138	120	131	158	24	191	-----	155	134	152	167
10	190	194	127	118	154	161	25	188	-----	162	120	150	168
11	184	198	120	124	143	152	26	188	-----	160	125	150	168
12	166	194	114	129	147	151	27	184	-----	153	121	142	169
13	175	192	112	134	147	153	28	174	-----	154	128	154	168
14	175	170	112	131	156	153	29	166	-----	165	125	151	166
15	174	-----	112	132	157	152	30	169	-----	147	124	151	165
							31	169	-----	-----	124	152	-----

NOTE.—Discharge for the following periods when only one water-stage recorder was operating satisfactorily determined from gage heights estimated by comparison with other recorder graph or from a study of the slope relation: June 12-19 and June 21 to Aug. 2.

Monthly discharge, in second-feet, of Forestport feeder near Boonville, N. Y., for the year ending September 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
October	191	166	178	July	150	76	127
November 1-14	198	142	177	August	158	78	141
June 9-30	166	112	141	September	175	151	161

BLACK RIVER CANAL (FLOWING SOUTH) NEAR BOONVILLE, N. Y.

LOCATION.—Slope station in summit level of Black River canal, near Boonville, Oneida County.

RECORDS AVAILABLE.—Occasional discharge measurements 1900 and 1905–1915; continuous record, September 16, 1915, to September 30, 1923.

GAGES.—Two Gurley seven-day graph water-stage recorders, 1.81 miles apart, with natural scale for gage heights. Gage No. 1 is on right bank (opposite towpath) about 50 feet downstream from collector's office in Boonville; gage No. 2 is on right bank (opposite towpath) about 300 yards above Lock 70 and 50 yards above spillway from the canal into Lansing Kill. These gages and the two gages in the Forestport feeder near Boonville are set to the same datum. Recorders inspected by Fred Kesauer.

DISCHARGE MEASUREMENTS.—Made from the steel and concrete highway bridge in the village of Boonville, a short distance below gage No. 1.

DETERMINATION OF DISCHARGE.—Daily discharge determined by use of Chezy formula. The coefficient "C," computed from each current meter measurement, is plotted on a curve showing the variation of "C" through the season. A smooth curve drawn through the plotted points shows the coefficients for intervening days. The other factors in the Chezy formula are obtained from gage-height records and cross section of canal.

DIVERSIONS.—No diversion between gage No. 1 and gage No. 2. Records obtained at this station indicate the quantity of water diverted from the Black River basin into the Mohawk River basin.

REGULATION.—Flow in canal is regulated by operation of spillway and sluice gates at Lock 70 and also by discharge of Forestport feeder into the basin at Boonville.

ICE.—No flow in canal during winter.

ACCURACY.—Operation of water-stage recorders satisfactory except as indicated in footnote to daily-discharge table. Records good, except when either recorder is not operating, when estimates for missing gage heights are made from comparison with other recorder or from a study of the slope relation. Records for such periods, fair.

Discharge measurements of Black River canal (flowing south) near Boonville, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height (feet)		Dis- charge	Date	Made by—	Gage height (feet)		Dis- charge
		Gage No. 1	Gage No. 2				Gage No. 1	Gage No. 2	
				<i>Sec.-ft.</i>					<i>Sec.-ft.</i>
Oct. 1	A. W. Harrington.	1.230	0.770	145	Aug. 3	Lamson and			
15	Lamson and Har- rington.....	1.035	.625	145	4	Johnson.....			42.0
Nov. 3	J. L. Lamson....	1.160	.930	129	23	Harrington and	0.735	0.555	97.2
June 20	A. W. Harrington..	.410	.220	117	Sept. 27	Johnson and			
21	do.....	.180	— .020	100		Lamson.....	.295	.060	80.7
28	do.....	.790	.580	112		A. W. Harrington.	— .420	— 1.810	100
						do.....	.030	— 1.420	146

*Daily discharge, in second-feet, of Black River canal (flowing south) near Boonville
N. Y., for the year ending September 30, 1923*

Day	Oct.	Nov.	June	July	Aug.	Sept.	Day	Oct.	Nov.	June	July	Aug.	Sept.
1	146	128		122	66	120	16	147			80	113	116
2	148	130		98	60	129	17	145			90	113	114
3	149	126		40	40	126	18	144		95	85	113	121
4	150	123		80	62	127	19	147			81	110	131
5	150	125			83	125	20	151		117	92	112	128
6	150	130			84		21	152		114	96	115	
7	155	126			82	130	22	153		119	93	112	
8	146	127			81		23	148		117	96	109	
9	150	126		85	104	114	24	142		115	81	106	135
10	147	125			108	114	25	144		109	78	104	
11	149	122			96	110	26	150		122	84	103	
12	135	125	95		99	121	27	147		125	82	104	140
13	139	124			97	129	28	136		103	80	107	130
14	148	110		79	107	124	29	127		104	79	108	118
15	145			80	112	120	30	127		106	83	109	114
							31	128			79	111	

NOTE.—Discharge for the following periods when only one water-stage recorder was operating satisfactorily determined from gage heights estimated by comparison with other recorder graph or from a study of the slope relation: Oct. 11-14, 19-21, 24-27, Nov. 10, 11, 13, 14, June 9-19, July 2-13, 15, Aug. 2-4, 10-13, 15, 16, 23, and Sept. 6-8, 14, and 19-26.

Monthly discharge of Black River canal (flowing south) near Boonville, N. Y., for the year ending September 30, 1923

Month	Discharge in second-feet			Month	Discharge in second-feet		
	Maximum	Minimum	Mean		Maximum	Minimum	Mean
October	155	127	145	July	122	40	84.6
November 1-14	130	110	125	August	115	40	97.7
June 9-30	125		104	September	140	110	129

MOOSE RIVER AT McKEEVER, N. Y.

LOCATION.—Half a mile west of village of McKeever, Herkimer County, 2 miles below mouth of South Branch of Moose River, and 16 miles above junction of Black and Moose rivers at Lyons Falls.

DRAINAGE AREA.—366 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 28, 1922, to September 30, 1923. Comparable record from station at Moose River, 3 miles below, from June 5, 1900, to December 31, 1922.

GAGE.—Gurley seven-day graph water-stage recorder on left bank, just above Moose Head Inn and half a mile below dam of Iroquois Pulp & Paper Co.; installed November 2, 1922. Prior to this date gage was a vertical staff at same location. Gage read and recorder inspected by R. D. Nash.

DISCHARGE MEASUREMENTS.—Made from cable 250 feet above gage or by wading.

CHANNEL AND CONTROL.—Low-water control consists principally of coarse gravel and boulders; probably permanent.

EXTREMES OF DISCHARGE.—1922-1923: Maximum stage recorded, 12.9 feet about 10 p. m. June 22, 1922 (discharge, about 10,000 second-feet); minimum stage from water-stage recorder, 1.49 feet from 9 p. m. to midnight July 27, 1923 (discharge, 83 second-feet).

ICE.—Stage-discharge relation considerably affected by ice.

REGULATION.—Flow regulated to a considerable extent for short periods at dam of Iroquois Pulp & Paper Co., half a mile above. Seasonal distribution of flow affected by operation of State dam at Old Forge. This regulation indicated by record at station on Middle Branch of Moose River at Old Forge.

ACCURACY.—Stage-discharge relation permanent except as affected by ice from December to April. Rating curve well defined between 100 and 5,500 second-feet. Operation of recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean of twice daily staff gage readings or mean daily gage height determined by inspection of recorder graph. For days of considerable fluctuation, mean discharge is ascertained from recorder graph by averaging discharge for intervals of day. Records prior to November 2, good; open-water records after that date excellent except those for estimated periods which are fair; records for period of ice effect, fair.

Discharge measurements of Moose River at McKeever, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 2	A. W. Harrington	1.62	111	Apr. 18	Lamson and Harrington	4.52	1,360
17	J. L. Lamson	1.95	177	19	A. W. Harrington	4.39	1,340
17	do	1.77	158	23	Lamson and Harrington	8.55	5,060
19	do	1.97	195	24	do	7.27	3,630
22	do	2.34	322	26	A. W. Harrington	6.34	2,870
29	do	1.91	215	27	do	6.48	3,010
29	do	1.98	220	May 29	J. L. Lamson	3.10	656
Dec. 5	A. W. Harrington	2.60	462	30	do	2.73	507
Jan. 12	J. L. Lamson	*2.00	154	June 21	A. W. Harrington	1.73	143
Feb. 13	A. W. Harrington	*2.97	319	Aug. 3	Johnson and Lamson	1.77	134
Mar. 23	J. L. Lamson	*4.26	823				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Moose River at McKeever, N. Y., for the year ending September 30, 1923

Day	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	387	203	447	480	240	190	460	2,650	515	300	158	131
2	482	235	407	1,400	300	170	700	2,230	494		171	117
3	124	447	336	1,500	500	160	500	1,710	349		161	115
4	149	415	528	1,300	340	170	700	1,870	524		142	136
5	246	216	448	1,000	550	380	1,400	1,830	494		147	134
6	283	413	490	900	200	240	3,800	1,560	477	500	161	111
7	290	395	254	400	260	170	4,800	1,340	465		171	111
8	313	461	144	700	340	260	4,400	1,470	527		193	122
9	440	486	461	600	320	260	4,600	1,480	710		152	144
10	575	399	352	550	320	240	4,200	2,390			186	432
11	642	367	511	500	320	260	3,500	1,530	469	221	136	263
12	432	255	217	240	300	260	3,400	1,310		221	106	155
13	351	383	275	360	220	240	3,200	1,130		207	117	168
14	158	223	320	420	340	220	2,560	1,130		217	122	183
15	359	323	340	600	340	200	2,310	1,020		177	122	174
16	190	469	351	460	380	400	1,830	1,220	346	210	142	142
17	239	584	340	190	380	700	1,500	3,960	226	228	126	183
18	177	532	340	380	360	650	1,400	2,560	356	268	124	168
19	207	326	300	400	340	1,100	1,250	1,630	345	239	100	168
20	313	511	300	600	360	850	1,130	1,470	330	217	115	161
21	340	498	280	500	300	800	2,310	1,440	317	228	115	183
22	363	503	260	650	280	800	5,000	1,250	230	174	102	574
23	432	436	240	700	220	800	4,900	1,220	270	183	104	558
24	423	359	240	550	240	1,000	3,800	1,020	280	147	104	350
25	755	296	220	550	180	1,300	3,010	950	390	155	111	174
26	549	216	220	500	240	1,100	2,830	825	390	152	104	207
27	448	399	200	460	240	240	950	2,920	696	400	142	217
28	432	395	220	180	220	850	3,010	834	550	122	108	235
29	158	189	240	420		750	3,660	732	550	119	111	742
30	407	139	320	420		650	3,900	608	360	164	115	601
31	264		300	140		600				161	122	

NOTE.—Discharge estimated for following periods when water-stage recorder was not operating satisfactorily: Jan. 7, 13, Feb. 17, June 9–15, 17–19, and June 23 to July 7. Discharge, Dec. 17 to April 7, determined from gage heights corrected for ice effect from three discharge measurements and study of weather records.

Monthly discharge of Moose River at McKeever, N. Y., for the year ending September 30, 1923

[Drainage area, 366 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	755	124	353	0.964	1.11
November	584	139	369	1.01	1.13
December	528	144	319	.872	1.01
January	1,500	140	582	1.59	1.83
February	550	180	312	.852	.89
March	1,300	160	539	1.47	1.70
April	5,000	460	2,770	7.57	8.45
May	3,960	580	1,470	4.02	4.64
June	550	226	429	1.17	1.30
July .....	.....	119	208	.568	.65
August	171	100	126	.344	.40
September	574	111	240	.656	.73
The year	5,000	100	642	1.75	23.84

NOTE.—See "Regulation" in station description.

MOOSE RIVER AT MOOSE RIVER, N. Y.

LOCATION.—In Moose River, Lewis County, 3 miles downstream from McKeever, 5 miles below mouth of South Branch of Moose River and 13 miles above junction of Black and Moose rivers at Lyons Falls.

DRAINAGE AREA.—370 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 5, 1900, to December 31, 1922, when station was discontinued. Comparable record from station at McKeever, 3 miles above, beginning May 28, 1922.

GAGE.—Staff in two sections on left bank; read by W. D. Rinkle. Gage datum was lowered 0.17 foot February 28, 1903, and again 5.00 feet on January 1, 1913.

DISCHARGE MEASUREMENTS.—Made from cable a short distance below gage or by wading.

CHANNEL AND CONTROL.—Cobblestones and boulders; fairly permanent. Current smooth; depth comparatively uniform. Ice and logs occasionally jam above the station on a small island.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, October 1 to December 31, 1922, 7.3 feet at 8.30 a. m. December 11 (discharge, 810 second-feet); minimum stage recorded, 5.39 feet at 9 a. m. October 4 (discharge, 124 second-feet).

1900–1922: Maximum stage recorded, 16.3 feet during the afternoon of March 27, 1913, determined by leveling from floodmarks (discharge, about 16,500 second-feet); minimum stage, 4.94 feet July 21, 23, and 25–27, 1913 (discharge, about 42 second-feet).

ICE.—Stage-discharge relation affected by ice.

REGULATION.—A dam at McKeever, 3 miles upstream, is used for power and for the regulation of flow during log driving. Seasonal distribution of flow affected by operation of the State dam at Old Forge. This regulation is indicated by the record at station on Middle Branch of Moose River at Old Forge.

ACCURACY.—Stage-discharge relation permanent except as affected by ice December 16-31. Rating curve well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair except during period of ice effect and for low stages when one daily reading of gage may not indicate the correct mean daily gage height, owing to fluctuations in stage. During such periods records are poor.

The following discharge measurement was made by A. W. Harrington:
October 1, 1922: Gage-height, 5.88 feet; discharge, 263 second-feet.

Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for the period October 1 to December 31, 1922

Day	Oct.	Nov.	Dec.	Day	Oct.	Nov.	Dec.	Day	Oct.	Nov.	Dec.
1 -----	216	422	320	11 -----	386	352	810	21 -----	336	500	260
2 -----	540	189	625	12 -----	441	216	369	22 -----	352	500	240
3 -----	259	320	}	13 -----	422	400	202	23 -----	460	500	240
4 -----	124	422		14 -----	404	304	304	24 -----	441	369	220
5 -----	202	369		15 -----	176	164	386	25 -----	670	369	220
6 -----	259	216	}	16 -----	422	422	360	26 -----	540	136	220
7 -----	259	422		17 -----	148	625	340	27 -----	500	500	220
8 -----	259	520		18 -----	164	500	320	28 -----	460	386	220
9 -----	336	520	}	19 -----	189	176	320	29 -----	230	369	220
10 -----	670	440		20 -----	289	540	300	30 -----	422	136	260
								31 -----	280	-----	240

NOTE.—Discharge Oct. 31, Nov. 10 and 13, and Dec. 3-9, estimated by comparison with record at McKeev; no gage-height record. Discharge, Dec. 16-31, determined from gage heights corrected for ice effect from study of weather records, observer's notes, and comparison with record at McKeev.

Monthly discharge of Moose River at Moose River, N. Y., for the period October 1 to December 31, 1922

[Drainage area, 370 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October -----	670	124	350	0.946	1.09
November -----	625	136	377	1.02	1.14
December -----	810	164	324	.876	1.01

NOTE.—See "Regulation" in station description.

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

LOCATION.—300 feet below highway bridge and 400 feet below State dam at Old Forge, Herkimer County.

DRAINAGE AREA.—51.5 square miles (measured on topographic maps).

RECORDS AVAILABLE.—November 9, 1911, to September 30, 1923.

GAGE.—Vertical staff on left bank 300 feet below highway bridge; read by Joseph Otis.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading near gage.

CHANNEL AND CONTROL.—Bed near gage composed of stone and gravel. Control is rock ledge about 200 feet below gage; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.6 feet April 25 and 26 and May 1 (discharge, 225 second-feet); minimum stage, 0.82 foot from 5 p. m. October 14 to 8 a. m. October 18 (discharge, 22 second-feet).

1911-1923: Maximum discharge recorded, 862 second-feet morning and afternoon March 23, 1921; minimum discharge, 16 second-feet several times in October and November, 1919.

ICE.—Stage-discharge relation not affected by ice.

REGULATION.—Flow controlled by gates at dam.

ACCURACY.—Stage-discharge relation practically permanent except as affected by backwater from landslide near control from June to September. Rating curve well defined between 20 and 300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying to rating table mean daily gage height corrected for backwater effect when necessary. Records good.

Discharge measurements of Middle Branch of Moose River at Old Forge, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 2	A. W. Harrington	2.11	139	Apr. 23	Lamson and Harrington	2.43	208
16	Lamson and Harrington	.82	22.4	24	do	2.52	199
31	J. L. Lamson	1.71	92.0	26	A. W. Harrington	2.50	200
Dec. 5	A. W. Harrington	1.26	48.3	May 29	J. L. Lamson	2.24	168
Jan. 13	J. L. Lamson	1.08	34.3	June 2	do	1.50	71.1
Feb. 12	A. W. Harrington	1.85	105	20	A. W. Harrington	1.48	69.9
Mar. 22	J. L. Lamson	1.35	55.8	Aug. 3	Lamson and Johnson	1.39	53.2
Apr. 18	A. W. Harrington	2.18	149				

* Backwater from landslide near control.

Daily discharge, in second-feet, of Middle Branch of Moose River at Old Forge, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	150	129	50	50	64	28	57	225	71	65	55	33
2	143	116	50	50	116	28	57	207	71	65	55	33
3	143	122	50	52	116	65	57	207	71	65	55	35
4	143	116	50	43	116	65	57	198	71	60	55	35
5	143	116	50	36	116	47	58	190	71	60	55	55
6	143	116	50	36	116	33	59	190	71	60	55	55
7	143	116	50	36	116	33	67	143	71	60	50	55
8	143	81	50	36	116	33	76	92	71	60	50	55
9	143	67	50	86	110	33	76	71	71	60	50	55
10	143	67	50	36	110	33	81	71	71	60	50	55
11	143	60	50	36	110	33	81	71	71	60	50	55
12	143	48	50	36	110	33	92	71	71	55	50	75
13	68	50	50	36	110	33	98	71	71	55	50	75
14	22	47	50	36	110	33	104	71	71	55	46	75
15	22	49	50	36	110	33	104	98	71	55	42	75
16	22	47	50	36	110	47	136	150	71	55	42	75
17	22	48	50	36	110	57	158	190	71	55	42	75
18	76	49	50	76	110	56	168	190	71	55	38	75
19	166	49	50	129	104	57	156	190	71	55	34	75
20	166	49	49	129	60	59	150	190	70	55	32	75
21	166	49	50	129	29	59	150	190	69	55	31	80
22	166	49	50	69	28	57	166	190	69	55	31	80
23	158	49	50	29	28	57	190	190	70	55	31	90
24	150	49	50	29	28	57	207	190	65	55	31	90
25	143	49	50	29	28	57	225	182	65	55	31	80
26	136	49	50	29	28	58	225	182	65	55	31	75
27	136	49	50	29	28	57	207	174	65	55	31	80
28	129	49	50	29	28	59	190	174	65	55	31	80
29	98	49	50	29	-----	59	207	166	65	55	31	80
30	92	49	50	29	-----	59	207	166	65	55	31	80
31	92	-----	50	29	-----	57	-----	110	-----	55	33	-----

NOTE.—Discharge June 23 to Aug. 19, and Sept. 5 to 30 determined from gage heights corrected for backwater effect from landslide near control, by means of two discharge measurements and study of water surface elevations above Old Forge dam.

Monthly discharge of Middle Branch of Moose River at Old Forge, N. Y., for the year ending September 30, 1923

[Drainage area 51.5 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	166	22	121	2.35	2.71
November	129	47	67.7	1.31	1.46
December	50	49	50.0	.971	1.12
January	129	29	47.0	.913	1.05
February	116	28	84.5	1.64	1.71
March	65	28	47.6	.924	1.07
April	225	57	128	2.49	2.78
May	225	71	155	3.01	3.47
June	71	65	69.4	1.35	1.51
July	65	55	57.3	1.11	1.28
August	55	31	41.9	.814	.94
September	90	33	67.4	1.31	1.46
The year	225	22	78.0	1.51	20.56

NOTE.—The above figures do not necessarily represent the natural flow from the basin, because of artificial storage in Fulton Chain of Lakes.

BEAVER RIVER AT STATE DAM, NEAR BEAVER RIVER, N. Y.

LOCATION.—At concrete storage dam at outlet of Beaver River Flow, $7\frac{1}{2}$ miles west of Beaver River post office, Herkimer County, and 7 miles above Beaver Lake at Number Four.

DRAINAGE AREA.—176 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 11, 1908, to September 30, 1923.

GAGE.—Elevation of water surface in the reservoir is determined by a staff gage in two sections on the west corner of the gate house; read by James C. Dunbar, gate tender. The mean elevation of the crest of the spillway is at gage height 16.96 feet. Width of sluice gate openings determined by measuring on the gate stems the distance they have been raised.

DISCHARGE MEASUREMENTS.—Made from a temporary footbridge at the mouth of the outlet tunnel, below the gates. Discharge over the spillway has not been measured.

DETERMINATION OF DISCHARGE.—Records include the discharge through one or more of four 4-foot circular sluice gates, when opened, the discharge over the spillway, and the discharge through the logway at the west end of the spillway. The sluice gates have been rated by current-meter measurements made at different lake elevations, but no measurements have been made of the discharge over the spillway or through the logway. Theoretic coefficients based on the Cornell experiments³ have been used to compute ratings for the spillway and logway.

EXTREMES OF STAGE.—Maximum elevation of water surface in reservoir recorded during year, 19.0 feet May 18 and 19; minimum elevation recorded, 1.1 feet, several times October 13 to 22.

1908–1923: Maximum elevation of water surface in reservoir, 19.85 feet at 3.15 p. m. June 23, 1922; minimum elevation, that of October, 1922.

EXTREMES OF DISCHARGE.—Maximum daily discharge during year, 2,400 second-feet April 23 and 24; minimum daily discharge, practically zero April 9 and 10.

³U. S. Geol. Survey Water-Supply Paper 200.

1908-1923: Maximum discharge, 3,380 second-feet April 12, 1922; minimum discharge, practically zero during periods when gates were closed and there was no discharge over spillway.

REGULATION.—At ordinary stages the discharge of Beaver River is completely regulated by the operation of the sluice gates.

ACCURACY.—Stage-discharge relation permanent; probably not affected by ice. Rating curves for sluice gates fairly well defined. Lake gage read to half-tenths once daily. The accuracy of computations depends to a large extent on the care with which the gates were set to the recorded openings. Records fair.

Discharge measurements of Beaver River at State dam, near Beaver River, N. Y., during the year ending September 30, 1923

[Made by Johnson and Lamson]

Date	Gate		Lake gage height	Discharge	Date	Gate		Lake gage height	Discharge
	No.	Opening				No.	Opening		
		<i>Inches</i>	<i>Feet</i>	<i>Sec.-ft.</i>			<i>Inches</i>	<i>Feet</i>	<i>Sec.-ft.</i>
July 31-----	1	12	13.80	79.2	July 31-----	2	12	13.75	77.8
31-----	1	24	13.80	147	Aug. 1-----	2	24	13.70	145
31-----	1	36	13.80	217	1-----	3	24	13.70	146
31-----	1	48	13.75	264	1-----	4	24	13.70	149

Monthly discharge of Beaver River at State dam, near Beaver River, N. Y., for the year ending September 30, 1923

[Drainage area, 176 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October -----	130	80	94.5	0.537	0.62
November-----	180	95	128	.727	.81
December-----	140	100	125	.710	.82
January-----	200	100	168	.955	1.10
February-----	140	90	106	.602	.63
March-----	240	90	156	.886	1.02
April-----	2,400	-----	1,100	6.25	6.97
May-----	1,600	100	625	3.55	4.09
June-----	460	160	267	1.52	1.70
July-----	260	180	205	1.16	1.34
August-----	200	170	175	.994	1.15
September-----	240	100	179	1.02	1.14
The year-----	2,400	-----	278	1.58	21.39

NOTE—The above figures do not represent the natural flow of the river on account of regulation at the dam.

BEAVER RIVER AT EAGLE FALLS, NEAR NUMBER FOUR, N. Y.

LOCATION.—500 feet below Eagle Falls power plant of Northern New York Utilities (Inc.) $2\frac{1}{2}$ miles below Beaver Lake, 4 miles north of Number Four, Lewis County, and 9 miles below State dam at outlet of Beaver River Flow.

DRAINAGE AREA.—230 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 21, 1921, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder on left bank; inspected by employees of Northern New York Utilities (Inc.).

DISCHARGE MEASUREMENTS.—Made from a cable over tailrace and river channel, 300 feet above gage or by wading.

CHANNEL AND CONTROL.—Boulders and large broken rock; shifts occasionally.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 5.70 feet from 6 to 9 p.m. April 23 (discharge, 3,090 second-feet); minimum stage from water-stage recorder, 0.22 foot at noon December 17 (discharge, 5.8 second-feet).

1921-1923: Maximum stage from water-stage recorder, 7.30 feet at 3.30 p.m. April 13, 1922 (discharge, 4,980 second-feet); minimum stage from water-stage recorder, that of December 17, 1922.

ICE.—Stage-discharge relation not affected by ice.

REGULATION.—Seasonal flow is regulated by storage in Beaver River Flow 9 miles above. Diurnal flow regulated at dam at foot of Beaver Lake according to needs of power plant. Some regulation in other ponds and lakes in drainage area.

ACCURACY.—Stage-discharge relation changed presumably at time of high water April 23. Rating curve used October 1 to April 23 fairly well defined between 10 and 3,500 second-feet; curve used subsequent to April 23 well defined between 100 and 1,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of gage-height graph, or for days of considerable fluctuation, by averaging discharge for intervals of day. Records good.

Discharge measurements of Beaver River at Eagle Falls, near Number Four, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 17	A. W. Harrington.....	1.40	128	July 30	Lamson and Johnson..	1.96	276
Jan. 9	J. L. Lamson.....	2.08	291	Aug. 1do.....	1.69	194
Apr. 22do.....	4.89	2,150				

Daily discharge, in second-feet, of Beaver River at Eagle Falls, near Number Four, N. Y., for the year ending September 30, 1923

Date	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	19	176	218	103	211	129	185	1,920	400	202	184	286
2	160	169	200	303	213	133	406	1,680	344	381	184	148
3	167	133	24	323	205	159	315	1,460	126	333	233	319
4	156	124	194	323	23	26	354	1,010	373	171	248	323
5	141	17	218	315	223	181	532	1,500	330	358	40	312
6	90	137	226	296	216	196	835	670	309	330	219	295
7	109	124	218	135	194	199	990	1,070	340	312	230	251
8	15	92	189	326	185	201	910	828	491	169	202	186
9	88	120	192	277	140	206	800	522	675	316	199	41
10	99	160	26	301	112	196	518	764	780	326	192	233
11	96	160	213	282	24	20	399	685	798	316	169	263
12	105	16	201	282	185	174	604	590	461	289	40	266
13	105	153	208	251	139	204	1,210	270	362	242	199	263
14	97	167	185	23	121	206	1,440	900	340	202	202	213
15	11	167	167	252	116	204	1,300	894	330	41	205	72
16	89	178	172	259	125	199	1,440	758	254	216	205	33
17	125	201	15	274	128	221	1,300	1,060	118	227	219	51
18	129	218	170	264	21	58	1,120	1,410	457	230	273	52
19	129	34	158	218	144	301	950	1,450	444	230	37	50
20	120	251	153	196	137	277	1,080	1,250	412	266	208	114
21	96	248	135	26	133	280	1,590	1,360	404	242	224	192
22	12	243	135	220	131	272	2,210	1,770	333	38	230	227
23	105	246	150	240	135	285	2,980	1,640	286	242	236	120
24	103	259	15	246	148	380	2,810	1,460	236	233	197	299
25	118	269	14	243	20	373	2,420	1,250	373	233	260	263
26	125	26	147	299	150	437	2,070	764	326	257	45	181
27	129	248	180	276	139	357	1,920	428	306	263	208	164
28	129	264	178	24	127	323	1,770	537	316	236	286	169
29	17	266	176	206	-----	315	1,640	469	295	37	279	152
30	160	218	128	220	-----	288	2,070	420	292	219	102	29
31	176	-----	17	228	-----	272	-----	400	-----	210	248	-----

NOTE.—Discharge estimated for the following days when water-stage recorder was not operating satisfactorily: Oct. 22, 23, 29, 30, Nov. 18, 24, 25, Dec. 20, 22–24, Jan. 4–6, 19, Mar. 7, 8, May 31, June 1, and Aug. 25 and 26.

Monthly discharge of Beaver River at Eagle Falls, near Number Four, N. Y., for the year ending September 30, 1923

[Drainage area, 230 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	176	11	104	0.452	0.52
November	269	16	169	.735	.82
December	226	14	149	.648	.75
January	326	23	233	1.01	1.16
February	223	20	137	.596	.62
March	437	20	228	.991	1.14
April	2,980	185	1,270	5.52	6.16
May	1,920	270	1,010	4.39	5.06
June	798	118	377	1.64	1.83
July	381	37	238	1.03	1.19
August	286	37	194	.843	.97
September	323	29	186	.809	.90
The year	2,980	11	358	1.56	21.12

NOTE.—The above figures do not necessarily represent the natural flow from the basin because of artificial storage, mainly in Stillwater reservoir and Beaver Lake.

STREAMS TRIBUTARY TO ST. LAWRENCE RIVER

EAST BRANCH OF OSWEGATCHIE RIVER AT CRANBERRY LAKE, N. Y.

LOCATION.—In village of Cranberry Lake, St. Lawrence County, 500 feet below concrete dam at outlet of Cranberry Lake, and $10\frac{1}{2}$ miles above Newton Falls.

DRAINAGE AREA.—144 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 5 to September 30, 1923. Comparable records at station at Newton Falls, $10\frac{1}{2}$ miles below, October 6, 1912, to May 4, 1923.

GAGE.—Slope gage on left bank; read by Herbert Dean.

DISCHARGE MEASUREMENTS.—Made from cable about 200 feet below gage or by wading.

CHANNEL AND CONTROL.—Large boulders and gravel; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the period May 5 to September 30, 1923, 6.63 feet at 8 a. m. June 11 (discharge, 1,030 second-feet). The minimum stage is reached when gates in dam are closed and when there is no discharge over the spillway (discharge, practically zero).

ICE.—Stage-discharge relation probably not affected by ice.

REGULATION.—Discharge is regulated by operation of sluice gates at Cranberry Lake dam.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 40 and 350 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except on days when sluice gates in dam above are operated, when one gage reading a day may not give the true mean daily gage height.

Discharge measurements of East Branch of Oswegatchie River at Cranberry Lake, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 15	Lamson and Johnson ^a	3.58	51.2	Mar. 16	Lamson and Johnson ^a	4.24	126
15	do	4.00	92.8	June 26	A. W. Harrington	4.18	124
15	do	4.20	119	26	do	4.74	217
16	do	3.65	57.8	26	do	4.75	225
16	do	4.04	93.1	27	do	5.15	328
16	do	4.22	123	27	do	4.23	124
16	do	4.28	131	July 27	J. L. Lamson	4.96	284

^aEngineer, Board of Black River Regulating District.

Daily discharge, in second-feet, of East Branch of Oswegatchie River at Cranberry Lake, N. Y., for the period May 5 to September 30, 1923

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1		201	190	287	301	16	119	224	301	301	301
2		180	190	274	301	17	127	119	301	301	301
3		180	190	274	301	18	127	119	301	301	301
4		161	190	274	301	19	127	119	287	301	301
5	119	161	200	315	301	20	127	119	287	301	287
6	119	161	212	315	301	21	390	119	287	301	287
7	119	180	212	315	301	22	390	119	287	301	287
8	119	201	212	315	301	23	301	119	287	301	287
9	119	511	212	315	301	24	390	144	287	301	287
10	119	700	212	301	301	25	301	144	287	301	287
11	119	1,010	301	301	301	26	301	180	287	287	287
12	119	330	301	301	301	27	301	224	274	301	287
13	119	330	301	301	301	28	105	201	287	301	287
14	119	224	301	301	301	29	201	190	287	301	287
15	119	224	301	301	301	30	201	190	287	301	287
						31	201		287	301	

NOTE.—Discharge, June 10 and July 5, estimated because of doubtful gage-height record.

Monthly discharge of East Branch of Oswegatchie River at Cranberry Lake, N. Y., for the period May 5 to September 30, 1923

[Drainage area, 144 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
May 5-31	390	105	186	1.29	1.30
June	1,010	119	236	1.64	1.83
July	301	190	263	1.83	2.11
August	315	274	300	2.08	2.40
September	301	287	296	2.06	2.30

NOTE.—The monthly discharge does not necessarily represent the natural flow from the basin because of artificial storage in Cranberry Lake.

EAST BRANCH OF OSWEGATCHIE RIVER AT NEWTON FALLS, N. Y.

LOCATION.—In village of Newton Falls, St. Lawrence County, 600 feet below lower dam of Newton Falls Paper Co., 4 miles above mouth of Little River, and $10\frac{1}{2}$ miles below outlet of Cranberry Lake.

DRAINAGE AREA.—170 square miles (measured on topographic maps); previously published as 166 square miles.

RECORDS AVAILABLE.—October 6, 1912, to May 4, 1923, when station was discontinued because of backwater from Browns Falls dam.

GAGE.—Vertical staff on left bank; read by Henry Van Waldick. Datum lowered 1 foot on July 28, 1920.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet above gage or by wading.

CHANNEL AND CONTROL.—Small boulders and rock; covered with waste from pulp mill; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the period October 1, 1922, to May 4, 1923, 4.28 feet at 4.30 p.m. November 6 (discharge, 737 second-feet); minimum stage is reached nearly every Sunday in low-water period, when paper mills shut down.

1912–1923: Maximum stage recorded, 6.1 feet (old datum) at 5.15 p.m. March 28, 1913 (discharge, 2,200 second-feet).

ICE.—Stage-discharge relation affected by ice only for a short time during extremely cold weather.

REGULATION.—Considerable diurnal fluctuation in flow caused by operation of paper mills at Newton Falls. Seasonal flow largely controlled by storage at Cranberry Lake.

ACCURACY.—Stage-discharge relation practically permanent; probably not affected by ice. Rating curve well defined between 40 and 1,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except for days of great fluctuation due to closing down of power plant, when discharge is averaged for intervals of day. Records only fair, as mean daily gage height is obtained from only two readings and may be considerably in error on account of artificial regulation.

Discharge measurements of East Branch of Oswegatchie River at Newton Falls, N. Y., during the period October 1, 1922, to May 4, 1923

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 18	A. W. Harrington.....	3.17	364
Jan. 28	J. L. Lamson.....	1.36	42.4
Mar. 17	Lamson and Johnson.....	2.41	205

*Engineer, Board of Black River Regulating District

Daily discharge, in second-feet, of East Branch of Oswegatchie River at Newton Falls, N. Y., for the period October 1, 1922, to May 4, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1.....	286	411	321	357	274	55	64	321
2.....	309	357	274	263	298	168	168	333
3.....	286	383	298	286	263	198	188	357
4.....	263	321	321	298	110	44	383	309
5.....	309	298	333	263	69	55	321	-----
6.....	286	563	298	357	208	198	263	-----
7.....	333	499	321	159	219	116	219	-----
8.....	263	411	263	286	219	58	188	-----
9.....	357	357	309	309	168	39	357	-----
10.....	321	383	159	286	208	58	357	-----
11.....	309	321	321	39	168	44	321	-----
12.....	298	150	357	55	75	141	357	-----
13.....	298	274	298	150	132	188	321	-----
14.....	263	274	321	49	168	159	208	-----
15.....	309	321	333	150	124	178	116	-----
16.....	298	357	263	168	159	188	208	-----
17.....	263	357	150	178	49	188	298	-----
18.....	357	263	230	178	58	55	309	-----
19.....	411	333	241	178	44	88	298	-----
20.....	309	309	357	168	178	150	321	-----
21.....	357	274	357	58	69	219	321	-----
22.....	333	357	274	81	168	219	81	-----
23.....	309	469	150	132	188	274	333	-----
24.....	321	321	150	168	108	263	298	-----
25.....	321	383	262	298	150	69	286	-----
26.....	357	263	309	263	168	88	321	-----
27.....	357	274	321	241	178	81	298	-----
28.....	298	263	333	100	188	132	357	-----
29.....	321	321	333	120	-----	241	141	-----
30.....	411	309	298	263	-----	178	298	-----
31.....	411	-----	298	263	-----	168	-----	-----

NOTE.—Discharge Jan. 28, 29, and Feb. 4 determined by averaging discharge for intervals of day; paper mills shut down, causing large diurnal fluctuation in flow.

Monthly discharge of East Branch of Oswegatchie River at Newton Falls, N. Y., for the period October 1, 1922, to May 4, 1923

[Drainage area, 170 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	411	263	320	1.88	2.17
November.....	563	150	339	1.99	2.22
December.....	357	150	285	1.68	1.94
January.....	357	39	199	1.17	1.35
February.....	298	44	157	.924	.96
March.....	274	39	139	.818	.94
April.....	383	64	267	1.57	1.75
May 1-4.....	357	309	330	1.94	.29

NOTE.—The above figures do not necessarily represent the natural flow from the basin because of artificial storage, mainly in Cranberry Lake.

OSWEGATCHIE RIVER NEAR HEUVELTON, N. Y.

LOCATION.— $2\frac{1}{2}$ miles above Heuvelton, St. Lawrence County, 3 miles below Rensselaer Falls, and 7 miles above mouth of Indian River (outlet of Black Lake).

DRAINAGE AREA.—967 square miles (measured on topographic maps); previously published as 961 square miles.

RECORDS AVAILABLE.—June 23, 1916, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder on right bank; inspected by George B. Todd.

DISCHARGE MEASUREMENTS.—Made from cable 20 feet below gage or by wading

CHANNEL AND CONTROL.—Solid rock; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 6.89 feet at 5.30 p. m. April 10 (discharge, 9,920 second-feet); minimum stage from water-stage recorder, 0.82 foot at noon August 8 (discharge, 280 second-feet).

1916-1923: Maximum stage from water-stage recorder, 7.6 feet from 9 a. m. to noon March 30, 1917 (discharge, 11,700 second-feet); minimum stage from water-stage recorder, 0.81 foot from 2 to 4 a. m. September 30, 1921 (discharge, 274 second-feet).

ICE.—Stage-discharge relation slightly affected by ice during extremely cold periods.

REGULATION.—During low water there is some diurnal fluctuation due to operation of mills at Rensselaer Falls and above. Seasonal flow regulated by storage in Cranberry Lake.

ACCURACY.—Stage-discharge relation practically permanent; probably not affected by ice. Rating curve well defined between 400 and 12,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of recorder graph, or for days of considerable fluctuation, by averaging discharge for intervals of day. Records good, except for periods of estimate, for which they are fair.

Discharge measurements of Oswegatchie River near Heuvelton, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 27	J. L. Lamson.....	1.72	937
Apr. 21	A. W. Harrington.....	2.68	2,090
July 24	Lamson and Johnson.....	1.02	388

Daily discharge, in second-feet, of Oswegatchie River near Hewelton, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	393	502	667	700	550	460	1, 670	2, 360	1, 020	494	365	517
2	399	435	667	1, 400	560	480	1, 400	2, 360	901	562	328	502
3	399	416	650	1, 550	650	509	1, 440	2, 290	816	555	365	454
4	405	481	718	1, 380	650	555	3, 540	2, 020	771	502	387	411
5	360	532	825	1, 290	610		5, 290	1, 760	825	494	376	454
6	318	509		1, 200	570		6, 450	1, 590	844	487	382	411
7	344	494	750	1, 120	634	1, 200	7, 470	1, 380	1, 120	468	370	399
8	481	502		996	626		8, 320	1, 210	1, 410	547	308	354
9	517	494	602	930	618		8, 990	1, 120	2, 500	578	382	428
10	626	618	626	789	610		9, 460	1, 140	2, 930	441	405	468
11	562	726		700	610	1, 060	9, 220	1, 370	3, 230	382	416	416
12	594	658		692	630	939	8, 320	1, 720	3, 160	349	370	405
13	547	642		602	630	882	7, 050	1, 880	2, 570	376	365	399
14	602		600	490	520	892	6, 050	1, 880	2, 020	416		468
15	642			470	510		5, 100	1, 760	1, 700	487		570
16	586	700		460	520	2, 200	4, 210	1, 770	1, 410	540	375	594
17	532		578	470	530		2, 260	2, 220	1, 160	468		594
18	441	735	570	490	520	3, 350	2, 860	2, 500	996	382		540
19		825		500	520	3, 150	2, 500	2, 860	834	339	382	487
20		825		520	520		2, 220	2, 780	667	468	416	481
21	500	825	500		540	3, 400	2, 080	2, 780	610	555	448	578
22		882		530	550		2, 080	3, 080	692	509	399	610
23	555	930	502	490	490		2, 360	2, 860	658	428	428	802
24	509	958	547	800	490	6, 250	2, 780	2, 570	618	370	509	726
25	502	977	517		460	6, 250	3, 080	2, 290	618	360	540	709
26	618	892	422		450		3, 080	2, 080	517	370		692
27	684	762	382	958	450		2, 710	1, 880	454	399		667
28	650	684	349	988	460	4, 200	2, 360	1, 680	448	376	470	650
29	642	667	420	910			2, 220	1, 380	481	370		634
30	610	618	550	753		2, 220	2, 360	1, 230	481	344		585
31	578		610	600		1, 820		1, 100		370		

NOTE.—Discharge for following periods when water-stage recorder was not operating satisfactorily estimated by comparison with records of flow of nearby streams: Oct. 19-22, Nov. 13-18, 26, 27, Dec. 6-16, 19-22, 28-31, Jan. 4-6, 14-26, 31, Feb. 1-4, 9, 10, 12-28, Mar. 1, 2, 5-10, 12, 13, 15-23, 26-29, May 18, 19, Jul. 1, Aug. 12-19, Aug. 26 to Sept. 1.

Monthly discharge of Oswegatchie River near Hewelton, N. Y., for the year ending September 30, 1923

[Drainage area, 967 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	684	318	519	0.537	0.62
November	977	416	680	.703	.78
December	825	349	582	.602	.66
January	1, 550	460	822	.850	.98
February	650	450	553	.572	.60
March	6, 250	460	2, 360	2.44	2.81
April	9, 460	1, 400	4, 340	4.49	5.01
May	3, 080	1, 100	1, 960	2.03	2.34
June	3, 230	448	1, 220	1.26	1.41
July	578	339	445	.460	.53
August	540	308	408	.422	.49
September	726	354	527	.545	.61
The year	9, 460	308	1, 200	1.24	16.87

NOTE.—The above figures do not necessarily represent the natural flow from the basin because of artificial storage mainly in Cranberry Lake.

WEST BRANCH OF OSWEGATCHIE RIVER NEAR HARRISVILLE, N. Y.

LOCATION.—At highway bridge near Geers Corners, 4 miles downstream from Harrisville, Lewis County, and 16 miles above confluence of east and west branches near Talcville.

DRAINAGE AREA.—256 square miles (measured on topographic maps); previously published as 245 square miles.

RECORDS AVAILABLE.—July 1, 1916, to September 30, 1923.

GAGE.—Vertical staff in three sections on right bank; section graduated from 0.0 to 3.3 feet 25 feet below bridge, and two sections graduated from 3.3 to 10.1 feet on downstream side of bridge abutment. Gage read by Frank Osborne.

DISCHARGE MEASUREMENTS.—Made from cable 200 feet above gage from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Rocky and rough; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.2 feet at 6 p. m. April 7 (discharge, 3,740 second-feet); minimum stage, 0.90 foot several times during period August 10–19 (discharge, 27 second-feet).

1916–1923: Maximum stage recorded, 8.1 feet at 6.30 a. m. and 6 p. m. March 28, 1917 (discharge, 4,880 second-feet); minimum discharge, that of August 10–19, 1923.

ICE.—Stage-discharge relation only slightly affected by ice during extremely cold periods.

REGULATION.—During low water there is some diurnal fluctuation in flow caused by operation of pulp mill at Harrisville.

ACCURACY.—Stage-discharge relation practically permanent; not seriously affected by ice. Rating curve fairly well defined between 50 and 4,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except those for low stages, which, owing to diurnal fluctuation, are only fair.

Discharge measurements of West Branch of Oswegatchie River near Harrisville N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 18	A. W. Harrington.....	1.41	76.3	June 27	A. W. Harrington	1.57	100
Mar. 18	J. L. Lamson	^a 3.70	739	July 28	Lamson and Johnson ..	1.52	101
Apr. 20	.....do	3.34	637				

^a Stage-discharge relation slightly affected by ice.

Daily discharge, in second-feet, of West Branch of Oswegatchie River near Harrisville, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	48	106	142	222	174	114	438	1,090	290	210	56	72
2	48	106	163	438	186	123	384	970	262	163	56	75
3	52	98	163	535	186	142	456	860	248	152	60	65
4	45	106	210	535	222	235	915	665	210	142	60	60
5	40	114	235	495	222	351	1,640	575	210	106	72	56
6	40	142	123	438	198	384	2,790	495	210	98	42	62
7	40	180	186	384	198	290	3,740	456	222	78	39	68
8	68	186	163	351	174	351	3,520	402	276	82	36	72
9	90	186	186	290	152	351	3,300	456	575	82	40	82
10	106	186	186	262	186	305	2,890	665	970	65	36	163
11	106	174	174	248	163	290	2,130	760	970	65	34	132
12	106	152	163	210	163	276	1,960	760	760	62	36	142
13	123	142	186	210	123	290	1,800	760	575	65	45	123
14	123	142	186	186	106	290	1,640	710	419	72	42	106
15	82	152	163	152	123	290	1,490	620	305	106	48	90
16	123	262	163	152	123	438	1,210	665	248	65	45	90
17	90	320	123	152	132	665	1,030	810	222	62	40	65
18	87	276	123	163	142	810	810	1,030	198	114	33	50
19	90	262	123	142	123	860	710	1,150	163	82	30	62
20	90	248	106	152	123	860	665	1,090	163	78	45	65
21	98	305	123	235	114	760	665	1,030	142	78	42	163
22	98	351	90	290	123	760	915	1,030	142	98	48	320
23	98	305	90	336	123	1,030	1,420	970	123	50	62	305
24	186	262	98	305	123	1,490	1,640	915	106	62	68	235
25	248	235	106	351	132	1,560	1,490	760	123	65	68	198
26	186	186	123	351	123	1,350	1,280	665	114	62	75	123
27	174	186	114	305	123	1,090	970	535	132	68	60	106
28	174	186	123	262	123	860	860	456	123	68	62	106
29	152	174	132	210	-----	760	915	351	142	98	87	98
30	123	163	123	210	-----	575	1,030	320	22	56	87	90
31	106	-----	106	186	-----	535	-----	290	-----	60	82	-----

NOTE.—Discharge estimated Nov. 7; no gage-height record.

Monthly discharge of West Branch of Oswegatchie River near Harrisville, N. Y., for the year ending September 30, 1923

[Drainage area, 256 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	248	40	105	0.410	0.47
November	351	98	196	.766	.85
December	235	90	145	.566	.65
January	535	142	283	1.10	1.27
February	222	106	150	.586	.61
March	1,560	114	596	2.33	2.69
April	3,740	384	1,490	5.82	6.49
May	1,150	290	720	2.81	3.24
June	970	106	296	1.16	1.29
July	210	50	87.5	.342	.39
August	87	30	52.8	.206	.24
September	320	50	115	.449	.50
The year	3,740	30	353	1.38	18.69

RAQUETTE RIVER AT PIERCEFIELD, N. Y.

LOCATION.—Half a mile below dam of International Paper Co. at Piercefield, St. Lawrence County, and three-quarters of a mile above head of Black Rapids.

DRAINAGE AREA.—723 square miles (all but 16 square miles measured on topographic maps).

RECORDS AVAILABLE.—August 20, 1908, to September 30, 1923.

GAGE.—Stevens continuous water-stage recorder installed October 22, 1912, on left bank; inspected by employee of International Paper Co.

DISCHARGE MEASUREMENTS.—Made from a cable three-quarters of a mile below gage.

CHANNEL AND CONTROL.—Channel opposite gage is a deep pond with no perceptible velocity. Control is at head of Black Rapids.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 9.63 feet at 9.30 a. m. April 30 (discharge, 4,600 second-feet); minimum stage from water-stage recorder, 1.50 feet from 4 to 10 a. m. October 8 (discharge 36 second-feet).

1908–1923: Maximum stage from water-stage recorder, 11.82 feet from 6 to 8 p. m. April 17, 1922 (discharge, 7,580 second-feet); minimum stage from water-stage recorder, 0.85 foot at 11 a. m. September 2, 1913 (discharge, about 10 second-feet).

ICE.—Stage-discharge relation slightly affected by ice.

REGULATION.—Large diurnal fluctuation in flow during low and medium stages caused by operation of paper mill. Numerous lakes in upper part of drainage basin afford considerable storage, most of which is so controlled that the effect on the seasonal distribution of flow is large.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice from December to April. Rating curve well defined between 50 and 5,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of recorder graph, or for days of considerable fluctuation, by averaging discharge for intervals of day. Records good except for period of ice effect for which they are fair.

Discharge measurements of Raquette River at Piercefield, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 31	J. L. Lamson.....	4.00	471	May 30	J. L. Lamson.....	6.92	1,980
Mar. 22	do.....	4.50	557	May 31	do.....	7.40	2,440
April 19	do.....	8.49	3,250	July 14	A. E. Johnson.....	4.45	648
April 26	do.....	9.28	4,070	July 15	Lamson and Johnson..	2.45	132

*Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	175	425	470	500	550	420	420	4,450	2,170	469	394	354
2.....	284	221	470	550	550	420	650	4,450	2,050	724	435	182
3.....	398	84	247	550	500	300	850	4,340	1,670	1,130	485	75
4.....	311	258	367	600	280	150	950	4,230	1,870	299	330	289
5.....	203	198	485	700	440	340	1,200	4,120	1,800	416	142	290
6.....	323	320	470	900	550	480	1,100	3,800	1,870	565	287	146
7.....	140	425	470		550	500	1,300	3,800	1,870	840	326	85
8.....	60	410	485		550	480	1,500	3,700	1,800	265	230	69
9.....	324	306	547		550	460	2,000	3,600	1,550	430	230	65
10.....	455	358	300		500	300	2,200	3,500	1,700	600	222	75
11.....	403	434	420		280	170	2,600	3,400	1,950	582	166	69
12.....	226	205	550	650	420	320	2,800	3,300	1,940	582	73	163
13.....	243	297	600		500	440	3,000	3,110	1,900	582	285	372
14.....	331	433	550		550	480	3,300	3,200	1,780	565	372	398
15.....	127	440	500		500	500	3,500	3,110	1,760	269	210	197
16.....	307	440	480		500	550	3,600	3,110	1,700	397	58	72
17.....	351	308	240		480	550	3,500	3,110	1,070	548	67	68
18.....	89	371	400		200	280	3,500	3,200	1,700	548	69	62
19.....	70	231	550	700	200	360	3,300	3,200	1,660	530	75	68
20.....	316	383	460	650	380	500	3,200	3,110	1,400	515	298	302
21.....	410	455	480	300	440	500	3,300	3,200	1,250	515	425	425
22.....	204	440	500	550	440	550	3,400	3,200	1,130	227	123	398
23.....	182	455	420	700	420	550	3,700	3,110	1,130	362	56	143
24.....	357	455	130	550	300	550	4,010	3,020	439	515	69	75
25.....	372	440	160	550	150	280	4,120	2,930	462	515	66	295
26.....	207	236	460	600	280	400	4,230	2,840	582	530	76	398
27.....	199	390	550	600	360	550	4,230	2,570	815	530	71	410
28.....	91	582	550	300	420	650	4,230	2,750	600	500	66	341
29.....	86	530	550	440		650	4,230	2,570	1,000	236	70	220
30.....	336	470	550	550		800	4,450	2,410	1,190	392	70	126
31.....	433		180	600		900		2,410		500	162	

NOTE.—Discharge estimated for following days when water-stage recorder was not operating satisfactorily: Jan. 7–18, 26–28, 30, 31, Feb. 1–7, Mar. 9 and 10. Discharge, Dec. 10 to Apr. 13, determined from gage heights corrected for ice effect by means of one discharge measurement, study of gage-height graph, and weather records.

Monthly discharge of Raquette River at Piercefield, N. Y., for the year ending September 30, 1923

[Drainage area, 723 square miles]

Month	Discharge in second-feet				Run off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	455	60	258	0.357	0.41
November.....	582	84	365	.505	.56
December.....	600	130	438	.606	.70
January.....	900	300	603	.834	.96
February.....	550	150	423	.585	.61
March.....	900	150	464	.642	.74
April.....	4,450	420	2,810	3.89	4.34
May.....	4,450	2,410	3,320	4.59	5.29
June.....	2,170	439	1,460	2.02	2.25
July.....	1,130	227	507	.701	.81
August.....	485	56	194	.268	.31
September.....	425	62	208	.288	.32
The year.....	4,450	56	921	1.27	17.30

NOTE.—See paragraph on "Regulation"

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

LOCATION.—600 feet above steel highway bridge in Brasher Center, St. Lawrence County, 6 miles below junction of East and West branches of St. Regis River at Winthrop, 7 miles above mouth of Deer River, and 15 miles above mouth.

DRAINAGE AREA.—621 square miles (measured on post-route map).

RECORDS AVAILABLE.—August 22, 1910, to November 10, 1917, and January 1, 1919, to September 30, 1923.

GAGE.—Gurley seven-day water-stage recorder installed August 14, 1920, on left bank; inspected by Alfred Berry. Datum same as that of staff gage with inclined and vertical sections used June 24, 1916, to August 14, 1920. A chain gage on downstream side of bridge, at independent datum, was used August 22, 1910, to June 23, 1916.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading.

CHANNEL AND CONTROL.—Rock ledge, small boulders, and coarse gravel; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 9.75 feet at 6 a. m. April 9 (discharge, 6,430 second-feet); minimum stage from water-stage recorder, 5.72 feet at midnight August 16 (discharge, 138 second-feet).

1910-1923: Maximum stage recorded, 9.1 feet (old datum) at 7 a. m. March 27, 1914 (discharge, 16,200 second-feet); minimum stage recorded, 5.25 feet at 5 p. m. August 8, 1917 (discharge, about 34 second-feet).

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation practically permanent, except as affected by ice. Rating curve well defined between 200 and 6,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of recorder graph, or for days of considerable fluctuation, by averaging discharge for intervals of day. Records good except for periods of ice effect or estimate, for which they are fair.

Discharge measurements of St. Regis River at Brasher Center, N.Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 19	A. W. Harrington-----	5.90	210	Apr. 21	A. W. Harrington-----	7.57	2,140
Jan. 5	J. L. Lamson-----	6.46	651	June 25	do-----	6.55	818
28	do-----	6.44	427	July 23	A. E. Johnson-----	5.92	207
Mar. 20	do-----	7.33	1,010				

^a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of St. Regis River at Brasher Center, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	184	412	605	700	380	280	950	2,920	492	858	195	202
2	184	372	800	1,200	400	280	900	2,500	474		190	192
3	179	326	894	800	440	300	1,110	2,100	456		185	188
4	184	388	870	700	460	440	2,400	1,820	538		179	179
5	179	465	850	600	420		3,200	1,650	2,470		170	197
6	184	675	800	600	420		3,600	1,520	2,920		174	166
7	202	685	750	550	400		4,000	1,380	3,260	520	170	192
8	270	576	650	500	400		4,400	1,240	4,640		162	170
9	492	615	550	480	400		5,180	1,210	5,400		154	170
10	567	705	500	400	360		3,820	1,240	3,720		158	215
11	529	695	420	400	340	700	3,820	1,280	2,740		150	284
12	412	625	420	380	340		4,330	1,490	2,180		150	284
13	326	576	320	360	320		4,120	1,580	1,730		154	243
14	284	447	300	340			3,530	1,460	1,390	319	150	226
15	259	483	280	280			3,260	1,280	1,140	298	146	215
16	242	605	280	280			3,000	1,390	978	291	146	210
17	232	665	280	280		2,200	2,500	1,980	822	284	146	202
18	215	625	300	300		1,800	2,030	2,100	685	270	154	202
19	220	586	280	300		1,500	1,820	2,020	510	259	158	197
20	232	635	260	300		1,100	1,480	1,760	429	248	162	202
21	237	846	300	320	300	1,100	2,260	2,000	372	237	170	226
22	259	870	320	550		1,300	3,820	2,260	340	237	188	264
23	277	705	340	600		3,600	5,290	1,900	380	232	206	438
24	364	615	340	500		2,800	4,860	1,560	558	215	232	465
25	456	615	320	500		1,800	3,920	1,270	685	215	226	429
26	538	529	320	420		1,600	3,170	1,100	625	215	192	356
27	548	492	320	420		1,300	2,740	950	766	220	188	305
28	529	520	280	420		1,200	2,500	834	954	215	174	277
29	474	483	240	400		1,100	2,660	766	1,080	210	215	264
30	429	510	240	400		1,000	3,000	655	1,090	205	202	254
31	404		260	380		950		567		200	202	

NOTE.—Discharge for the following periods when water-stage recorder was not operating satisfactorily estimated by comparison with records of flow of near-by streams: Jan. 3-5, 7, 18, 19, 21, 22, Feb. 1, 2, 14-28, Mar. 1, 2, 5-16, 23, 26-30, Apr. 1, 2, 4-6, May 25, 29-31, June 1, 4, 6-8, 11-15, 21, 22, 24, 25, 29, July 1-13, 17-20, and July 28 to Aug. 3. Discharge, Dec. 5 to Apr. 8, determined from gage heights corrected for ice effect by means of three discharge measurements, study of gage-height graph and weather records, and comparison with records of flow of near-by streams.

Monthly discharge of St. Regis River at Brasher Center, N. Y., for the year ending September 30, 1923

[Drainage area, 621 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	567	179	326	0.525	0.61
November	870	326	578	.931	1.04
December	894	240	442	.712	.82
January	1,200	280	473	.762	.88
February	460		342	.551	.57
March	3,600	280	1,100	1.77	2.04
April	5,290	900	3,120	5.02	5.60
May	2,920	567	1,540	2.48	2.86
June	5,400	340	1,460	2.35	2.62
July	858	200	370	.596	.69
August	232	146	176	.283	.33
September	465	166	247	.398	.44
The year	5,400	146	847	1.36	18.50

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

LOCATION.—Inside fort, three-eighths of a mile south of international boundary, half a mile above head of Richelieu River, outlet of Lake Champlain, and 1 mile northeast of Rouses Point, Clinton County.

DRAINAGE AREA.—7,870 square miles, including 436 square miles of water surface (from annual report of New York State Engineer and Surveyor).

RECORDS AVAILABLE.—1875 to September 30, 1923.

GAGE.—Distance to water surface from reference point on curb of well inside the fort measured by a staff, graduated to feet and tenths, during portion of year. At other times a temporary staff gage, set by water level, fastened to a pile just below the Rutland railroad bridge, and about 25 feet from shore, was read, and readings reduced to datum of gage at the fort. Gages read by Thomas Bourke. Elevation of gage zero, 92.50 feet above mean sea level.

EXTREMES OF STAGE.—Maximum elevation recorded during year, 98.7 feet at 10 a. m. May 3; minimum elevation recorded, 92.9 feet at 10 a. m. September 21.

1869–1923: Maximum elevation recorded, 103.28 feet April, 1869; minimum elevation recorded, 91.9 feet November 13, 1908.

COOPERATION.—Gage heights observed under direction of the Corps of Engineers of the United States Army and reported monthly to the United States Geological Survey.

Daily gage height, in feet, of Richelieu River at Fort Montgomery, Rouses Point, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	1.15	0.55	0.9	0.6	1.2	1.05	2.35	6.1	4.55	3.05	1.75	0.8
2-----	1.15	.65	.4	.65	1.2	1.1	2.35	6.15	4.4	3.0	1.65	.9
3-----	1.05	.6	.7	.85	1.15	1.1	2.4	6.2	4.3	2.95	1.65	.85
4-----	1.1	.6	.6	.95	1.15	1.15	2.85	6.15	4.25	2.95	1.55	.8
5-----	.95	.6	1.05	1.1	1.15	1.15	3.1	6.05	4.2	2.85	1.5	.9
6-----	.95	.55	.85	1.05	1.1	1.15	3.6	6.0	4.15	2.75	1.45	.8
7-----	1.0	.8	.8	1.05	1.1	1.15	4.15	5.95	4.25	2.65	1.65	.95
8-----	1.1	.65	.6	1.05	1.1	1.15	4.6	5.95	4.4	2.65	1.35	.9
9-----	1.0	.65	.5	1.05	1.1	1.15	4.85	5.9	4.25	2.7	1.35	.7
10-----	.95	.75	.5	1.05	1.05	1.15	5.15	5.8	4.45	2.6	1.35	.65
11-----	1.0	.85	.45	1.1	1.05	1.15	5.3	5.7	4.55	2.55	1.3	.7
12-----	1.3	.45	.55	1.1	1.05	1.15	5.35	5.5	4.4	2.4	1.25	.75
13-----	.95	.5	.5	1.15	1.05	1.2	5.45	5.5	4.45	2.35	1.2	.7
14-----	1.3	.8	.5	1.2	1.1	1.2	5.45	5.4	4.25	2.3	1.35	.7
15-----	1.35	.5	.5	1.3	1.1	1.2	5.6	5.4	4.3	2.25	1.15	.65
16-----	.95	.5	.5	1.3	1.1	1.2	5.6	5.45	4.25	2.15	1.2	.6
17-----	1.05	.85	.45	1.3	1.1	1.25	5.5	5.3	4.1	2.15	1.2	.55
18-----	.95	.6	.45	1.3	1.1	1.4	5.5	5.35	4.1	2.15	1.2	.6
19-----	.95	.5	.45	1.3	1.1	1.45	5.45	5.35	4.1	2.15	1.6	.4
20-----	.85	.6	.45	1.3	1.1	1.5	5.4	5.4	3.9	2.1	1.05	.5
21-----	.8	.6	.45	1.3	1.1	1.6	5.35	5.4	3.7	2.15	1.15	.4
22-----	.8	.6	.5	1.3	1.1	1.65	5.4	5.4	3.6	1.95	.95	.5
23-----	1.3	.7	.5	1.35	1.1	1.7	5.35	5.35	3.55	1.9	.95	.65
24-----	.75	.55	.5	1.4	1.1	1.95	5.55	5.25	3.5	2.05	.95	.65
25-----	1.1	.45	.5	1.4	1.1	2.1	5.55	5.2	3.4	1.9	.95	.6
26-----	.55	.45	.5	1.35	1.05	2.15	5.85	5.05	3.4	1.8	.95	.65
27-----	.5	.85	.5	1.3	1.05	2.3	5.75	4.95	3.3	1.95	.95	.75
28-----	.5	.6	.5	1.3	1.05	2.4	5.75	4.85	3.2	1.7	1.25	.65
29-----	.55	.55	.55	1.25	-----	2.4	5.85	4.7	3.15	1.7	.85	.5
30-----	.55	.5	.6	1.25	-----	2.35	6.0	4.65	3.1	1.7	.9	.55
31-----	.55	-----	.6	1.2	-----	2.35	-----	4.55	-----	1.85	.9	-----

¹Hoyt, J. C., U. S. Geol. Supply Water-Supply Paper 97, p. 340.

LAKE CHAMPLAIN AT BURLINGTON, VT.

LOCATION.—On south side of roadway leading to dock of Champlain Transportation Co., at foot of King Street, Burlington, Chittenden County.

RECORDS AVAILABLE.—May 1, 1907, to September 30, 1923.

GAGE.—Staff. Comparisons of gage readings indicate that zero of gage at Burlington is at practically the same elevation as that of gage at Fort Montgomery, 92.5 feet above mean sea level. Gage read by employee of the Champlain Transportation Co.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.53 feet May 3; minimum stage recorded, 0.74 foot December 23.

1907-1923: Maximum stage recorded, 8.22 feet April 19, 1922; minimum stage, -0.25 foot December 4, 1908.

ICE.—Wider parts of Lake Champlain not usually frozen over until the latter part of January. Occasionally closure does not occur until February, and in some years it lasts only for a few days. The northern end of the lake above the outlet is usually covered with ice from the middle of December to the middle of April.

ACCURACY.—Gage read to hundredths at irregular intervals. Gage readings made when the lake is rough subject to inaccuracies due to wave action.

COOPERATION.—Gage-height record furnished by D. A. Loomis, general manager of the Champlain Transportation Co.

Daily gage height, in feet, of Lake Champlain at Burlington, Vt., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1								6.45	4.77	3.35		
2	1.42				1.44		3.06	4.70				
3	1.39						3.08	6.53		3.20		
4	1.38	0.88					3.16	6.50	4.57			0.97
5					1.46	1.44	3.40	6.42	4.47	3.10		
6	1.34	.90		1.16			3.76		4.47	3.04	1.75	.86
7	1.32		0.88		1.40		4.28	6.26	4.49	3.00		.94
8		.86							4.49			
9			.88			1.54	5.15	6.14	4.64	2.90		
10		.84					5.46	6.04	4.73	2.85	1.65	.98
11	1.28						5.60		4.73		1.58	.93
12					1.44	1.56	5.73	5.95		2.72		
13	1.24	.90	.86			1.56				2.66	1.60	.90
14		.86					5.90	5.88	4.64	2.62	1.55	.86
15			.86	1.35				5.65				
16	1.15					1.64		5.52	4.45	2.54	1.46	
17						1.64		5.75		2.50	1.45	.82
18		.86					5.80	5.76	4.26	2.46		.78
19	1.06				1.44	1.74	5.73					.76
20	1.06	.90				1.88				2.32	1.28	
21	1.02		.75			1.95		5.76	4.05			.84
22		.92		1.36		1.98		6.65	3.98			.86
23	1.00	.94	.74			2.10		5.62	3.90	2.26		
24	.96							5.55		2.22	1.20	.86
25	.90						6.15	5.44	3.70	2.20	1.14	.86
26				1.41	1.40	2.78			3.65			.86
27		.88				2.86	6.05	5.24	3.60		1.14	
28	.90	.88				2.94	5.95	5.18				
29						3.00		5.05			1.05	.90
30	.88		.78			3.04	6.25	5.00	3.40		1.08	
31	.88					3.06		4.92		1.90	1.08	

SARANAC RIVER NEAR PLATTSBURG, N. Y.

LOCATION.—At Indian Rapids power plant (formerly known as Lozier dam) of Plattsburg Gas & Electric Co., 6 miles above mouth at Plattsburg, Clinton County.

DRAINAGE AREA.—607 square miles (measured on topographic maps).

RECORDS AVAILABLE.—March 27, 1903, to September 30, 1923.

GAGES.—Gage showing elevation of water surface above intake to power plant is a Gurley seven-day graph water-stage recorder installed November 12, 1919, on retaining wall above power house on right side of river. Before that date the crest gage was a vertical staff on the angle of the wing wall at the end of the racks. Datum raised 0.76 foot August 20, 1906. Tailrace gage, a vertical staff spiked to timber-work dike between tailrace and river and about 50 feet below power house. Records of kilowatt output are obtained at half hour intervals. Inclined staff gage at cable station, a quarter of a mile below dam. Gages and watt meters read by power-house operators.

DISCHARGE MEASUREMENTS.—Made from a cable at head of Indian Rapids, a quarter of a mile below dam, or by wading under cable or in tailrace.

DETERMINATION OF DISCHARGE.—Records include the discharge over concrete spillway which has been rated by current-meter measurements; the discharge through two power units equipped with 300-kilowatt generators which have also been rated by current-meter measurements; and the discharge through two 5-foot waste gates when open, the rating for which is theoretical.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 3,250 second-feet June 9; minimum mean daily discharge, 65 second-feet January 7, 1903–1923: Maximum mean daily discharge recorded, 6,410 second-feet April 20, 1914; minimum mean daily discharge recorded, 15 second-feet August 4, 1908.

ICE.—The crest of the spillway is kept free from ice so that the stage-discharge relation is not affected.

REGULATION.—The lakes and ponds on the main stream and tributaries above the station comprise a water surface area of about 25.5 square miles. The actual storage afforded by these reservoirs has been largely increased by the State dam at lower Saranac Lake, the operation of which affects distribution of flow during the year.

ACCURACY.—Stage-discharge relation permanent. Spillway rating curve fairly well defined between 100 and 5,000 second-feet; turbine rating fairly well defined throughout. Operation of water-stage recorder satisfactory. Discharge over the spillway ascertained by averaging discharge for intervals of day. Discharge through the turbines ascertained by applying to their ratings the mean kilowatt output and head for periods of run. Records fair.

COOPERATION.—Record of power-plant operation furnished by Plattsburg Gas & Electric Co.

Discharge measurements of Saranac River near Plattsburg, N. Y., during the year ending September 30, 1923

[Made by Lamson and Johnson]

Date	Gage height	Unit No.	Output	Head	Dis-charge
	<i>Feet</i>		<i>Kilo-watts</i>	<i>Feet</i>	<i>Sec.-ft.</i>
July 18.....	0.78				^a 388
18.....	.42				^a 158
18.....		2	200	15.32	^b 288
19.....		2	150	15.21	^b 248
19.....		2	100	15.40	^b 220
19.....		2	50	15.54	^b 182
19.....		1	150	15.24	^b 250
19.....		1	100	15.37	^b 229
19.....		1	50	15.72	^b 190

^a Discharge over spillway only.^b Measurement made in tailrace; spillway excluded.*Daily discharge, in second-feet, of Saranac River near Plattsburg, N. Y., for the year ending September 30, 1923*

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....		395	204	350	310	300	234	1,960	830	530	390	350
2.....		395	194	570	315	300	440	1,800	600	590	370	350
3.....		335	295	455	315	380	495	1,640	355	660	460	315
4.....		340	560	440	142	325	920	1,420	660	610	345	305
5.....	200	248	485	470	335	395	1,400	1,340	690	610	405	335
6.....		360	380	280	148	265	2,320	1,280	1,240	510	495	325
7.....		230	290	65	196	510	2,650	1,200	1,960	530	500	300
8.....		250	380	380	300	345	1,980	1,120	2,400	370	490	365
9.....		305	500	190	290	305	2,280	1,060	3,250	580	465	310
10.....	248	265	370	244	290	186	2,260	1,040	2,750	480	370	180
11.....	345	228	470	275	250	345	2,320	990	2,400	550	300	246
12.....	400	194	385	315	500	500	2,950	930	2,100	420	242	290
13.....	365	330	400	265	410	485	2,850	1,060	1,640	415	305	238
14.....	370	182	280	144	415	460	2,180	980	1,440	285	420	206
15.....	265	246	390	275	300	430	1,900	1,040	1,220	415	320	168
16.....	440	172	360	216	290	510	1,720	1,320	1,120	340	320	208
17.....	350	270	196	192	315	630	1,520	1,700	830	385	280	218
18.....	355	244	360	260	420	540	1,300	1,740	850	435	265	204
19.....	325	164	265	325	335	590	1,080	1,560	710	410	228	280
20.....	370	154	265	280	465	390	1,100	1,380	700	485	325	400
21.....	375	164	375	170	440	510	2,200	1,460	650	385	370	450
22.....	355	200	290	440	430	510	3,050	1,440	630	315	248	550
23.....	345	190	196	400	390	750	3,000	1,360	560	440	246	280
24.....	170	164	90	275	320	1,680	2,550	1,180	485	390	226	206
25.....	340	102	186	295	285	920	2,200	1,140	560	455	192	335
26.....	380	110	370	320	300	670	2,060	1,080	560	460	285	260
27.....	255	220	380	270	385	440	1,960	760	630	380	220	285
28.....	310	204	188	178	285	375	1,820	980	620	410	280	260
29.....	83	192	198	400	-----	440	2,100	910	610	228	275	255
30.....	206	214	246	375	-----	485	2,140	940	650	570	400	222
31.....	320	-----	224	305	-----	445	-----	950	-----	430	415	-----

NOTE.—Mean discharge, Oct. 1-9, estimated by comparison with record of Ausable River at Ausable Forks; power plant shut down for repairs, pond drained and total discharge passed through waste gates. ^o

Monthly discharge of Saranac River near Plattsburg, N. Y., for the year ending September 30, 1923

[Drainage area, 607 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	440	83	283	0.466	0.54
November	395	110	239	.394	.44
December	560	90	315	.519	.60
January	570	65	302	.498	.57
February	500	142	328	.540	.55
March	1,680	186	491	.809	.93
April	3,050	234	1,900	3.13	3.49
May	1,960	760	1,250	2.06	2.38
June	3,250	355	1,120	1.85	2.06
July	660	228	454	.748	.86
August	500	192	337	.555	.64
September	550	168	290	.478	.53
The year	3,250	65	609	1.00	13.60

NOTE.—See paragraph on "Regulation."

WEST BRANCH OF AUSABLE RIVER NEAR NEWMAN, N. Y.

LOCATION.—On farm formerly owned by James Dudley, 4 miles northeast of Newman, Essex County, and 4 miles below Lake Placid.

DRAINAGE AREA.—116 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 7, 1916, to December 31, 1917, and July 15, 1919; to September 30, 1923.

GAGE.—Staff, in two sections, on right bank; lower section, inclined, graduated from 1.4 to 8.65 feet; upper section, vertical, graduated from 8.7 to 11 feet; read by Mrs. Ethel Fuller.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet above gage or by wading.

CHANNEL AND CONTROL.—Solid rock; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.41 feet at 8 a. m. April 22 (discharge, 2,750 second-feet); minimum stage recorded, 1.90 feet at 2 p. m. February 4 (discharge, 8 second-feet).

1916–17; 1919–1923: Maximum open-water stage recorded, 8.22 feet at 7 a. m. April 12, 1922 (discharge, about 6,300 second-feet); minimum stage recorded, 1.60 feet at 7.30 p. m. September 13, 1920, caused by closing gates in dam (discharge, practically zero).

ICE.—Stage-discharge relation usually affected by ice.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice from December to April. Rating curve fairly well defined between 30 and 1,000 second-feet; extended beyond these limits. Gage read to quarter-tenths twice daily, except December 10 to April 21, when it was read only once a day. Daily discharge ascertained by applying mean daily gage height to rating table. Records only fair, as mean daily gage height, determined from one or two gage readings, is subject to error owing to fluctuations in stage caused by operation of dams upstream.

Discharge measurements of West Branch of Ausable River near Newman, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 20	A. W. Harrington	2.52	46.7	May 2	E. B. Shupe	3.84	396
Nov. 17	J. L. Lamson	2.79	98.7	2	do	3.79	380
Jan. 4	do	* 2.96	87.7	26	A. W. Harrington	3.25	197
25	do	* 2.86	44.4	July 16	J. L. Lamson	2.55	52.6
Mar. 21	do	* 3.08	71.9				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of West Branch of Ausable River near Newman, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	37	44	73	90	30	50	110	534	100	142	36	37
2	34	46	130	260	38	38	130	395	67	100	37	34
3	33	61	82	160	30	48	400	395	67	87	38	36
4	34	61	100	140	8	110	480	395	100	94	35	34
5	34	73	76	70	15	85	700	534	208	87	31	35
6	46	64	44	36	20	50	1,300	395	1,230	80	28	31
7	39	76	66	32	15	50	1,060	333	1,020	90	29	31
8	46	113	76	32	13	36	1,140	353	1,140	80	34	40
9	94	130	87	32	11	40	830	732	975	56	40	208
10	67	87	66	32	10	36	485	700	763	66	29	130
11	90	78	46	32	11	40	586	353	439	66	28	100
12	78	67	58	32	18	24	700	240	353	48	29	76
13	61	90	46	32	19	65	417	258	313	42	30	57
14	54	64	40	32	22	36	353	294	240	41	35	52
15	64	75	34	30	26	40	333	224	179	44	31	47
16	72	166	28	28	26	120	275	865	100	52	31	44
17	67	87	24	26	22	280	130	1,520	109	70	29	45
18	54	82	26	24	24	260	120	641	120	58	29	42
19	54	98	28	22	20	70	179	534	94	44	30	36
20	51	142	28	28	24	60	153	374	83	42	28	38
21	48	153	32	50	20	75	1,630	395	58	38	35	179
22	44	90	36	40	24	90	2,210	374	61	38	57	130
23	58	90	40	60	20	440	1,630	313	67	38	56	94
24	130	73	46	40	15	480	763	240	111	35	46	73
25	105	56	60	46	15	200	510	208	130	45	33	76
26	94	56	50	40	30	200	439	208	92	42	30	61
27	90	61	40	36	60	190	417	179	130	42	34	46
28	61	46	36	24	55	150	670	153	120	45	47	46
29	48	58	28	22	-----	130	1,740	142	240	38	90	48
30	54	56	28	20	-----	110	900	100	258	37	60	38
31	51	-----	40	24	-----	110	-----	101	-----	38	48	-----

NOTE.—Discharge interpolated Jan. 29 and Feb. 14; no gage-height record. Discharge Dec. 14 to April 6 determined from gage heights corrected for ice effect by means of three discharge measurements; study of observer's notes, gage-height graph, and weather records; and comparison with records of Ausable River at Ausable Forks, N. Y.

Monthly discharge of West Branch of Ausable River near Newman, N. Y., for the year ending September 30, 1923

[Drainage area, 116 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	130	33	61.0	0.526	0.61
November.....	166	44	81.4	.702	.78
December.....	130	24	51.4	.443	.51
January.....	260	20	50.7	.437	.50
February.....	60	8	22.9	.197	.21
March.....	480	24	120	1.03	1.19
April.....	2,210	110	693	5.97	6.66
May.....	1,520	100	403	3.47	4.00
June.....	1,230	58	299	2.58	2.88
July.....	142	35	58.9	.508	.59
August.....	90	28	37.8	.326	.38
September.....	208	31	64.8	.559	.62
The year.....	2,210	8	162	1.40	18.93

AUSABLE RIVER AT AUSABLE FORKS, N. Y.

LOCATION.—In Ausable Forks, Clinton County, immediately below junction of East and West branches and 15 miles above mouth of river.

DRAINAGE AREA.—444 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 17, 1910, to September 30, 1923.

GAGE.—Chain on left bank 1,000 feet below junction of East and West branches; read by A. S. Baker.

DISCHARGE MEASUREMENTS.—Made from a cable $1\frac{1}{2}$ miles below gage or by wading either near cable or a short distance above gage.

CHANNEL AND CONTROL.—Stone and gravel; occasionally shifting. Channel divided by an island opposite the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.60 feet at 8 a. m. April 29 (discharge, 6,490 second-feet); minimum stage recorded, 3.12 feet at 5 p. m. July 27 and August 12 (discharge, 24 second-feet).

1910–1923: Maximum stage recorded, 10.2 feet in the evening of March 27, 1913 (discharge, roughly 25,000 second-feet); minimum stage, 3 feet at 7 a. m. July 21, 1912 (discharge, practically zero).

ICE.—Stage-discharge relation slightly affected by ice.

ACCURACY.—Stage-discharge relation practically permanent after October 19 except as affected by ice from December to March. Rating curve fairly well defined between 175 and 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used October 1–19. Records only fair as mean daily gage height, determined from two gage readings, is subject to error owing to fluctuations in stage caused by operation of power plants upstream.

Discharge measurements of Ausable River at Ausable Forks, N. Y., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		Feet	Sec.-ft.			Feet	Sec.-ft.
Oct. 20	A. W. Harrington.....	3.64	247	Jan. 24	J. L. Lamson.....	3.59	192
21	do.....	3.53	193	May 1	E. B. Shupe.....	4.76	1,810
Nov. 18	J. L. Lamson.....	3.68	302	26	A. W. Harrington.....	4.08	670
Jan. 3	do.....	3.82	333	July 17	Lamson and Johnson..	3.56	207

• Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Ausable River at Ausable Forks, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	88	170	257	150	170	130	264	1,530	371	362	102	153
2	134	164	257	140	160	120	272	1,160	362	280	102	142
3	150	189	250	340	130	110	388	1,060	336	189	102	132
4	144	170	354	240	150	240	864	1,070	280	227	94	94
5	143	177	294	200	150	500	2,050	1,260	751	242	82	102
6	148	264	242	150	140	480	5,030	1,230	2,950	227	78	46
7	158	250	98	140	140	220	2,720	970	2,490	208	110	64
8	102	264	153	150	160	260	3,440	955	3,190	177	102	70
9	372	336	148	150	120	260	2,950	2,270	3,320	177	86	702
10	302	294	153	150	130	180	1,620	2,720	2,050	170	46	336
11	316	272	142	150	150	110	1,260	1,260	1,350	142	55	257
12	331	257	150	160	120	140	1,940	1,040	984	137	28	188
13	281	242	180	150	130	170	1,440	984	800	126	90	164
14	249	250	170	150	130	190	1,070	851	588	106	94	153
15	248	319	150	150	120	240	998	764	526	86	115	132
16	225	280	160	150	140	950	800	1,830	371	148	78	94
17	224	336	150	150	130	650	1,070	4,750	379	202	90	121
18	244	302	150	140	46	550	890	2,270	336	170	106	94
19	251	371	150	150	120	480	588	1,440	302	153	115	126
20	221	407	150	140	150	480	679	1,090	242	126	49	94
21	227	426	140	180	140	260	4,750	1,070	250	106	90	446
22	221	371	130	200	130	300	4,750	1,130	208	102	78	567
23	234	272	110	200	130	1,300	4,480	903	189	102	102	371
24	257	257	120	160	150	1,500	2,160	679	242	94	102	257
25	319	214	120	180	160	851	1,440	727	319	121	126	202
26	328	221	150	170	160	727	1,070	691	272	70	153	142
27	287	242	150	160	130	622	1,130	567	227	58	121	132
28	227	242	140	190	150	546	1,530	505	302	137	153	110
29	189	250	130	300	-----	407	5,030	446	398	110	153	137
30	183	242	140	180	-----	336	3,320	379	588	110	132	153
31	177	-----	160	200	-----	484	-----	407	-----	102	148	-----

NOTE.—Discharge Dec. 12 to Mar. 24 determined from gage heights corrected for ice effect by means of two discharge measurements and study of gage-height graph, weather records, and observer's notes.

Monthly discharge of Ausable River at Ausable Forks, N. Y., for the year ending September 30, 1923

[Drainage area, 444 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	372	88	225	0.507	0.58
November	426	164	268	.604	.67
December	354	98	169	.381	.44
January	340	140	175	.394	.45
February	170	46	137	.309	.32
March	1,500	110	445	1.00	1.15
April	5,030	264	2,000	4.50	5.02
May	4,750	379	1,230	2.77	3.19
June	3,320	189	833	1.88	2.10
July	362	58	154	.347	.40
August	153	28	90.4	.224	.26
September	702	46	193	.435	.49
The year	5,030	28	493	1.11	15.07

LAKE GEORGE AT ROGERS ROCK, N. Y.

LOCATION.—At boathouse in a small bay on north side of steamboat landing at Rogers Rock, Essex County.

RECORDS AVAILABLE.—July 10, 1913, to September 30, 1923.

GAGE.—Vertical staff gage fastened to a pile in the back end of the boathouse. Datum 3.15 feet below crest of dam at outlet of lake. During the winter a temporary vertical staff gage located at Hoopers dock is used. Gage read once daily to hundredths by an employee of the International Paper Co. A study of gage heights at Rogers Rock and Glen Island stations indicates that the datum of the Rogers Rock gage is about 4.9 feet above that of the gage at Glen Island.

EXTREMES OF STAGE.—Maximum stage recorded during year, 4.20 feet May 17 and 22; minimum stage recorded, 1.06 feet December 29.

1913-1923: Maximum stage recorded, 5.07 feet April 18, 1922; minimum stage recorded, that of December 29, 1922.

REGULATION.—The elevation of lake surface is regulated by the operation of gates and wheels at the dam at the outlet of the lake at Ticonderoga.

COOPERATION.—Gage-height record furnished by Mr. C. S. Colson, hydraulic engineer, International Paper Co.

Daily gage height, in feet, of Lake George at Rogers Rock, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.48	1.88	1.46	1.42	1.60	1.56	2.06	4.00	3.98	3.62	3.25	2.72
2	2.46	1.84	1.46	1.44	1.58	1.58	2.08	3.98	3.98	3.60	3.25	2.70
3	2.42	1.82	1.44	1.46	1.60	1.58	2.10	3.92	3.95	3.52	3.28	2.72
4	2.38	1.80	1.42	1.48	1.62	1.60	2.08	3.88	3.98	3.55	3.25	2.70
5	2.32	1.78	1.40	1.52	1.64	1.62	2.16	3.98	3.95	3.55	3.22	2.68
6	2.40	1.74	1.38	1.60	1.62	1.64	2.64	3.90	3.80	3.48	3.22	2.68
7	2.36	1.72	1.36	1.54	1.60	1.68	2.80	4.00	3.85	3.40	3.20	2.66
8	2.34	1.72	1.36	1.50	1.62	1.68	2.90	3.98	3.92	3.45	3.15	2.64
9	2.32	1.76	1.34	1.54	1.62	1.66	3.10	3.95	4.00	3.45	3.10	2.66
10	2.38	1.78	1.28	1.52	1.60	1.66	3.20	4.05	3.98	3.42	3.18	2.64
11	2.44	1.76	1.26	1.54	1.62	1.68	3.28	4.02	3.95	3.40	3.15	2.62
12	2.40	1.74	1.28	1.56	1.60	1.66	3.30	4.00	3.92	3.42	3.18	2.60
13	2.38	1.72	1.26	1.58	1.62	1.66	3.32	4.02	3.90	3.45	3.10	2.58
14	2.38	1.70	1.28	1.60	1.64	1.68	3.34	4.05	3.85	3.42	3.08	2.54
15	2.30	1.74	1.24	1.62	1.62	1.70	3.36	4.02	3.78	3.40	2.98	2.54
16	2.34	1.72	1.26	1.64	1.64	1.78	3.40	4.10	3.80	3.42	3.02	2.52
17	2.38	1.70	1.26	1.64	1.62	1.80	3.42	4.20	3.80	3.45	3.00	2.50
18	2.20	1.68	1.28	1.66	1.64	1.82	3.46	4.18	3.78	3.50	2.98	2.48
19	2.18	1.64	1.27	1.68	1.64	1.84	3.46	4.12	3.75	3.52	2.95	2.48
20	2.12	1.60	1.28	1.70	1.62	1.82	3.48	4.12	3.70	3.50	2.92	2.42
21	2.12	1.60	1.26	1.68	1.62	1.84	3.50	4.15	3.72	3.48	2.90	2.48
22	2.10	1.58	1.24	1.66	1.60	1.88	3.55	4.20	3.70	3.38	2.85	2.50
23	2.20	1.56	1.22	1.64	1.60	1.90	3.55	4.12	3.72	3.40	2.80	2.52
24	2.08	1.54	1.24	1.62	1.58	1.96	3.52	4.15	3.70	3.40	2.82	2.52
25	2.04	1.54	1.24	1.60	1.60	2.00	3.50	4.15	3.68	3.38	2.80	2.50
26	2.00	1.52	1.22	1.64	1.60	2.08	3.55	4.10	3.68	3.38	2.78	2.52
27	1.98	1.50	1.16	1.62	1.58	2.10	3.58	4.10	3.70	3.35	2.76	2.50
28	1.94	1.52	1.10	1.60	1.56	2.04	3.60	4.00	3.70	3.30	2.78	2.46
29	1.92	1.50	1.06	1.60	-----	2.01	3.80	3.98	3.68	3.28	2.78	2.44
30	1.88	1.48	1.18	1.58	-----	2.02	4.00	3.95	3.65	3.30	2.76	2.40
31	1.90	-----	1.28	1.62	-----	2.04	-----	3.90	-----	3.28	2.74	-----

LAKE GEORGE AT GLEN ISLAND, NEAR BOLTON LANDING, N. Y.

LOCATION.—100 feet east of dock on northeast side of Glen Island, 2 miles north-east of Bolton Landing; reached by boat from Bolton Landing.

RECORDS AVAILABLE.—September 4, 1919, to September 30, 1923.

GAGE.—Slope gage, anchored to solid rock ledge, graduated to half-tenths from 6 to 10.4 feet, installed November 21, 1922; previous to this, a vertical cast-iron staff gage, reading from 6 to 10 feet, fastened to a 2 by 8 inch oak plank, spiked to the dock 100 feet west, was used. During winter a temporary vertical staff gage, attached to dock at Bolton Landing, has been used. Gage read twice daily to quarter-tenths by Jay Taylor, ranger. A comparative study of gage heights at the Glen Island and Rogers Rock stations indicates that the datum of the Glen Island gage is about 4.9 feet below that of the gage at Rogers Rock.

EXTREMES OF STAGE.—Maximum stage recorded during year, 9.1 feet May 21-24; minimum stage recorded, 6 feet December 24-27.

1919-1923: Maximum stage recorded, 9.9 feet April 15-18, 1922; minimum stage recorded, that of December 24-27, 1922.

REGULATION.—The elevation of lake surface is regulated by the operation of gates and wheels at the dam at the outlet of the lake at Ticonderoga.

COOPERATION.—Gage-height record furnished by State of New York Conservation Commission.

Daily gage height, in feet, of Lake George at Glen Island, near Bolton Landing, N. Y., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.45	6.75	6.35	6.25	6.6	6.55	7.1	8.9	8.9	8.55	8.25	7.65
2	7.4	6.75	6.35	6.3	6.6	6.6	7.15	8.9	8.85	8.5	8.25	7.65
3	7.4	6.75	6.35	6.35	6.6	6.6	7.3	8.9	8.85	8.5	8.25	7.65
4	7.4	6.75	6.35	6.4	6.65	6.6	7.35	8.9	8.85	8.5	8.25	7.65
5	7.35	6.75	6.35	6.4	6.65	6.6	7.4	8.9	8.8	8.5	8.25	7.6
6	7.35	6.75	6.35	6.45	6.7	6.6	7.45	8.9	8.8	8.5	8.2	7.6
7	7.3	6.75	6.35	6.45	6.7	6.65	7.55	8.9	8.8	8.45	8.15	7.55
8	7.3	6.75	6.25	6.5	6.7	6.65	7.65	8.9	8.85	8.45	8.1	7.55
9	7.3	6.7	6.25	6.5	6.7	6.65	7.75	8.95	8.85	8.45	8.1	7.6
10	7.25	6.7	6.25	6.5	6.7	6.65	7.85	8.95	8.85	8.45	8.1	7.6
11	7.25	6.7	6.25	6.55	6.7	6.65	8.05	9.0	8.85	8.4	8.05	7.6
12	7.2	6.7	6.25	6.6	6.7	6.65	8.35	9.0	8.8	8.4	8.05	7.55
13	7.2	6.7	6.25	6.6	6.7	6.65	8.4	8.9	8.8	8.4	8.0	7.55
14	7.2	6.65	6.25	6.6	6.7	6.7	8.4	8.9	8.8	8.35	8.0	7.5
15	7.1	6.65	6.2	6.6	6.7	6.75	8.4	8.95	8.75	8.35	8.0	7.5
16	7.1	6.65	6.2	6.6	6.7	6.75	8.45	9.0	8.75	8.35	8.0	7.4
17	7.05	6.65	6.2	6.5	6.7	6.8	8.5	9.0	8.75	8.35	7.9	7.4
18	7.0	6.65	6.2	6.5	6.7	6.8	8.5	9.0	8.75	8.35	7.9	7.4
19	7.0	6.65	6.2	6.5	6.7	6.8	8.5	9.05	8.75	8.35	7.9	7.35
20	6.95	6.65	6.2	6.5	6.7	6.85	8.45	9.05	8.7	8.35	7.85	7.45
21	6.95	6.6	6.1	6.5	6.7	6.85	8.45	9.1	8.7	8.35	7.8	7.45
22	6.95	6.55	6.05	6.5	6.7	6.9	8.45	9.1	8.65	8.35	7.75	7.45
23	6.95	6.55	6.05	6.55	6.7	6.95	8.45	9.1	8.65	8.35	7.75	-----
24	7.0	6.55	6.0	6.55	6.7	7.0	8.45	9.1	8.65	8.35	7.75	-----
25	6.95	6.5	6.0	6.6	6.65	7.0	8.5	9.05	8.65	8.35	7.7	-----
26	6.9	6.5	6.0	6.6	6.65	7.0	8.55	9.0	8.65	8.3	7.65	-----
27	6.9	6.45	6.0	6.6	6.6	7.05	8.6	8.95	8.6	8.3	7.6	-----
28	6.85	6.45	6.25	6.6	6.55	7.05	8.75	8.95	8.6	8.25	7.75	-----
29	6.8	6.45	6.25	6.6	-----	7.05	8.8	8.95	8.6	8.25	7.75	-----
30	6.75	6.4	6.25	6.6	-----	7.1	8.85	8.95	8.55	8.25	7.7	-----
31	6.75	-----	6.25	6.6	-----	7.1	-----	8.9	-----	8.25	7.7	-----

NOTE.—Mean daily gage heights Apr. 28 and Aug. 2-4 estimated by hydrograph comparison with record of Lake George at Rogers Rock; gage-height record either faulty or missing. No gage-height record Sept. 23-30. Readings from Oct. 22 to Apr. 27 made on temporary staff gage at Bolton Landing reduced to datum of Glen Island gage.

WINOOSKI RIVER AT MONTPELIER, VT.

LOCATION.—1 mile downstream from Central Vermont Railway station in Montpelier, Washington County, three-eighths mile above mouth of Dog River, and $1\frac{1}{4}$ miles below mouth of North Branch.

DRAINAGE AREA.—420 square miles.

RECORDS AVAILABLE.—May 19, 1909, to September 30, 1923, when station was discontinued.

GAGE.—Water-stage recorder on right bank, installed July 4, 1914; gage height referred to datum by means of a hook gage inside well; outside staff gage is used for auxiliary readings. Recorder inspected by L. D. Smith.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Channel deep and fairly uniform in section at the gage. Control is formed by sharply defined rock outcrop 500 feet below gage.

EXTREMES OF DISCHARGE.—Maximum open-water stage during year from water-stage recorder, 11.43 feet at 11 a. m. April 30 (discharge, by extension of rating curve, 9,100 second-feet); minimum stage during year from water-stage recorder, 2.82 feet at 7 a. m. June 27 (discharge, from extension of rating curve, 53 second-feet).

1909-1923: Maximum stage determined by leveling from floodmarks preserved on building near present gage, 17.31 feet, April 7, 1912 (discharge, estimated 20,200 second-feet); minimum stage from water-stage recorder, 2.58 feet, September 30, 1921 (discharge, from extension of rating curve, 6 second-feet).

ICE.—Stage-discharge relation affected by ice during winter. Daily discharge ascertained by means of gage heights, current-meter measurements, observer's notes, and climatic records.

REGULATION.—Operation of power plants on main stream and tributaries above station causes diurnal fluctuation in stage.

ACCURACY.—Stage-discharge relation changed March 20, probably due to use of dynamite in breaking up ice on control. Rating curve used prior to March 20 well defined between 30 and 7,500 second-feet; curve used after that date fairly well defined between 200 and 2,500 second-feet. Operation of water-stage recorder satisfactory except for periods indicated in footnote to daily-discharge table. Daily discharge December 19 to April 5 determined by applying to rating table mean daily gage height corrected for effect of ice; daily discharge during remainder of year ascertained by use of discharge integrator. Records good.

Discharge measurements of Winooski River at Montpelier, Vt., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Feb. 5	H. F. Hill, Jr.-----	<i>Feet</i> 4.85	<i>Sec.-ft.</i> 319	June 22	W. E. Armstrong-----	<i>Feet</i> 3.90	<i>Sec.-ft.</i> 334
Apr. 24	-----do-----	5.96	1,910	22	-----do-----	3.98	380
June 20	W. E. Armstrong-----	3.70	261				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	72	136	220	600	220	210	440	3, 210	292	150	150	105
2	110	142	360	1, 050	240	200	390	1, 890	278	210	140	65
3	108	140	200	880	220	195	370	1, 460	248	150	130	85
4	106	134	235	740	210	220	1, 720	1, 240	274	110	120	130
5	110	124	255	620	240	260	4, 350	1, 010	494	190	80	90
6	110	136	188	500	240	240	7, 430	960	1, 060	185	120	215
7	112	138	188	420	230	230	4, 610	850	720	145	115	185
8	114	154	205	420	220	210	4, 420	770	1, 040	110	120	105
9	290	340	205	440	220	190	3, 690	840	1, 450	170	125	100
10	320	320	162	420	210	170	2, 440	1, 200	1, 120	140	100	120
11	345	200	205	380	220	180	2, 360	1, 010	675	135	110	110
12	245	170	200	370	230	180	3, 060	845	488	120	85	110
13	186	182	190	350	230	190	2, 280	960	400	110	304	110
14	150	162	205	350	240	190	1, 670	745	340	100	242	105
15	100	172	198	360	230	180	1, 440	700	304	200	205	110
16	156	260	210	350	230	240	1, 290	1, 160	278	440	170	110
17	150	225	170	310	230	380	1, 180	1, 670	260	274	150	120
18	154	188	205	260	220	400	1, 120	920	288	210	110	140
19	150	198	220	260	240	380	1, 080	800	242	185	90	120
20	142	280	230	260	260	330	1, 230	675	220	140	130	145
21	130	450	230	260	220	295	3, 140	780	205	130	125	215
22	104	315	200	320	220	295	3, 230	1, 130	210	100	120	290
23	148	235	190	330	210	1, 050	2, 810	795	185	160	115	215
24	425	205	155	270	200	2, 400	1, 790	610	115	130	115	190
25	285	176	155	300	200	1, 700	1, 340	560	180	120	115	145
26	235	164	170	260	220	1, 200	1, 340	500	190	160	85	120
27	210	205	165	240	220	960	1, 100	440	160	160	135	125
28	178	180	165	220	210	760	1, 230	430	160	140	130	185
29	148	205	175	240	-----	620	5, 130	380	160	215	110	270
30	162	150	195	240	-----	560	6, 230	340	190	242	140	100
31	152	-----	260	250	-----	500	-----	335	-----	180	125	-----

NOTE.—Operation of water-stage recorder unsatisfactory Nov. 27–29, Dec. 30 to Jan. 2, July 18, and Sept. 6–30; discharge during these periods estimated from observer's readings and by comparison with records of flow of tributary streams.

Monthly discharge of Winooski River at Montpelier, Vt., for the year ending September 30, 1923

[Drainage area, 420 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	425	72	174	0.414	0.48
November	450	124	203	.483	.54
December	360	155	204	.486	.56
January	1, 050	220	396	.943	1.09
February	260	200	224	.533	.56
March	2, 400	170	488	1.16	1.34
April	7, 430	370	2, 460	5.86	6.54
May	3, 210	335	942	2.24	2.58
June	1, 450	115	408	.971	1.08
July	440	100	168	.400	.46
August	304	80	133	.317	.36
September	290	65	141	.336	.37
The year	7, 430	65	494	1.18	15.96

MOLLYS BROOK NEAR MARSHFIELD, VT.

LOCATION.—At head of Mollys Falls, one-fourth mile above confluence with Winoski River, and 1 mile from Marshfield, Washington County.

DRAINAGE AREA.—24 square miles (from surveys by engineers of Montpelier & Barre Light & Power Co.).

RECORDS AVAILABLE.—August 11, 1920, to September 30, 1923, when station was discontinued.

GAGE.—Inclined staff on right bank; vertical high-water section on left bank; read by Carroll George.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed covered with gravel and alluvial deposits. Control is well defined at head of Mollys Falls; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.3 feet at 4.30 p. m. April 30 (discharge, by extension of rating curve, 495 second-feet); minimum stage, 1.30 feet at 5.30 p. m. August 18 (discharge, 4.5 second-feet).

1920-1923: Maximum discharge recorded, 680 second-feet April 12, 1922; minimum discharge, 2.2 second-feet September 15, 1921 (by extension of rating curve).

ICE.—Ice forms at the gage and on rocks at the control; stage-discharge relation somewhat affected.

REGULATION.—Storage in Peacham Pond has some effect on the distribution of flow.

ACCURACY.—Stage-discharge relation changed about October 1, 1922, owing to reconstruction of bridge at control. Rating curve well defined between 5 and 200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying to rating table mean daily gage height corrected for effect of ice during winter. Records good.

Discharge measurements of Mollys Brook near Marshfield, Vt., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 5	W. E. Armstrong.....	1.68	15.2	May 2	H. F. Hill, jr.....	3.82	154
Apr. 25	H. F. Hill, jr.....	3.21	97	2	do.....	3.80	150
May 2	do.....	3.91	164	June 21	W. E. Armstrong.....	1.80	18.3
2	do.....	3.87	158	21	do.....	1.78	17.1

Daily discharge, in second-feet, of Mollys Brook near Marshfield, Vt., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	13	13	20	31	16	18	19	233	25	13	12	12
2.....	12	13	25	80	16	19	18	153	23	12	11	12
3.....	11	12	17	54	16	17	22	123	23	13	12	11
4.....	10	12	18	43	15	16	66	100	23	17	12	11
5.....	13	12	15	35	15	15	96	88	35	24	9.6	10
6.....	14	12	12	29	15	13	300	76	57	18	23	9.3
7.....	13	12	12	27	14	12	210	88	40	15	27	9.0
8.....	27	13	13	24	14	12	233	76	48	14	25	8.8
9.....	27	33	15	20	15	12	209	73	66	13	20	23
10.....	38	19	14	19	14	13	153	96	45	12	18	13
11.....	33	17	13	16	13	13	153	76	35	12	17	11
12.....	20	15	14	15	13	13	174	73	29	12	16	9.6
13.....	17	14	14	14	13	10	133	73	27	19	54	10
14.....	15	10	13	15	13	10	96	60	25	25	31	8.5
15.....	13	21	12	16	13	11	80	57	24	35	16	7.0
16.....	13	20	11	15	13	21	66	73	21	20	10	7.0
17.....	16	15	11	14	13	29	60	73	23	19	7.7	6.7
18.....	15	16	11	14	13	25	54	54	21	12	4.9	6.5
19.....	15	19	10	16	13	19	51	48	19	12	7.0	6.7
20.....	15	23	9	18	13	15	70	43	18	12	8.5	6.5
21.....	14	31	13	19	13	13	221	57	17	19	6.7	45
22.....	13	20	13	29	14	15	300	66	17	13	13	17
23.....	15	15	13	21	14	27	272	45	15	12	17	10
24.....	33	16	12	18	16	60	133	38	15	12	15	12
25.....	19	18	12	16	18	51	105	38	15	17	14	12
26.....	21	15	13	15	17	45	80	33	13	18	13	10
27.....	18	14	13	14	17	33	80	33	15	14	16	9.6
28.....	17	13	12	14	19	27	88	29	15	14	15	12
29.....	14	13	12	14	-----	24	360	29	16	18	19	14
30.....	14	14	11	14	-----	23	495	27	15	15	15	12
31.....	13	-----	12	16	-----	20	-----	25	-----	13	14	-----

NOTE.—Stage-discharge relation affected by ice Jan. 7-30 and Feb. 18 to Mar. 23; discharge based on gage heights corrected for effect of ice.

Monthly discharge of Mollys Brook near Marshfield, Vt., for the year ending September 30, 1923

[Drainage area, 24 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	38	10	17.5	0.729	0.84
November.....	33	10	16.3	.679	.76
December.....	25	9	13.4	.558	.64
January.....	80	14	22.7	.946	1.09
February.....	19	13	14.6	.608	.63
March.....	60	10	21.0	.875	1.01
April.....	495	18	147	6.12	6.83
May.....	233	25	69.5	2.90	3.34
June.....	66	13	26.0	1.08	1.20
July.....	35	12	16.2	.675	.78
August.....	54	4.9	16.1	.671	.77
September.....	45	6.5	11.7	.488	.54
The year.....	495	4.9	32.6	1.36	18.43

JAIL BRANCH^a AT EAST BARRE, VT.

LOCATION.—At ruins of old dam one-fourth mile above highway bridge in East Barre, Washington County, and 3 miles above confluence with Stevens Branch.

DRAINAGE AREA.—About 38 square miles, including 13 square miles tributary to Orange Brook reservoir (see "Diversions").

RECORDS AVAILABLE.—August 14, 1920, to September 30, 1923, when station was discontinued.

GAGE.—Inclined staff gage on left bank; read by George J. Dobbs.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed covered with rocks and boulders. Control formed by granite blocks and foundation of old dam near gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year ending September 30, 1922, 8.38 feet at 6 p. m. April 10 (discharge, by extension of rating curve, 1,350 second-feet); minimum discharge, 2.1 second-feet at 7 a. m. October 8. Maximum open-water stage recorded during year ending September 30, 1923, 7 feet at 7 a. m. April 5 (discharge, by extension of rating curve, 830 second-feet); minimum stage, 2.43 feet September 7 and 8 (discharge, by extension of rating curve, 0.6 second-foot).

1920-1923: Maximum stage recorded, that of April 10, 1922; minimum discharge, by extension of rating curve, 0.5 second-foot September 11, 1921.

ICE.—Ice forms at gage, and on rocks at the control; stage-discharge relation somewhat affected.

DIVERSIONS.—Water is diverted from about 13 square miles tributary to Orange Brook reservoir, and used for municipal supply of Barre. No records available as to quantity diverted or amount wasted back into Jail Branch.

ACCURACY.—Stage-discharge relation changed during high water of April 10, 1922. Rating curve used previous to the change well defined between 1 and 60 second-feet, and by measurements at 859 and 873 second-feet. Rating curve used subsequent to the date of change well defined between 5 and 350 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as shown in footnote to table of daily discharge. Records good.

Discharge measurements of Jail Branch at East Barre, Vt., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 5	W. E. Armstrong.....	3.08	17.8	May 1	H. F. Hill, jr.....	4.88	256
Apr. 25	H. F. Hill, jr.....	4.21	147	June 21	W. E. Armstrong.....	2.78	7.1
May 1	.....do.....	4.99	295	.....do.....	.....do.....	2.78	6.1
.....1	.....do.....	4.92	282				

^aPreviously published as "Jail Brook."

Daily discharge, in second-feet, of Jail Branch at East Barre, Vt., for the years ending September 30, 1922 and 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1921-22												
1	8.6	13	41	14	8	9	175	70	12	59	4.6	9.4
2	4.6	41	60	13	10	9	127	73	14	110	43	7.8
3	3.0	28	635	13	12	10	123	72	48	87	13	6.2
4	4.6	20	127	11	14	10	127	95	71	153	14	4.8
5	4.6	21	98	15	13	11	175	217	29	83	12	4.6
6	3.0	13	86	12	10	47	187	246	29	50	8.3	8.6
7	3.0	13	80	11	11	280	225	153	46	34	153	8.3
8	4.0	12	78	11	11	590	870	153	21	37	137	7.8
9	8.6	23	80	11	10	475	635	97	16	50	31	5.0
10	7.4	14	98	11	10	237	1,140	73	21	30	18	4.4
11	12	21	80	12	10	162	770	66	43	23	14	4.0
12	67	18	66	14	10	127	980	59	54	20	11	12
13	33	20	54	13	10	127	413	50	23	21	10	27
14	18	23	41	13	9	237	298	47	15	16	8.9	12
15	9.5	20	35	11	8	310	320	43	16	19	8.3	53
16	5.6	20	41	11	8	225	277	38	16	12	7.5	84
17	5.0	26	106	13	8	200	342	54	23	15	8.3	24
18	5.0	200	605	11	8	150	413	69	48	12	7.5	18
19	4.0	460	138	12	8	98	266	153	92	9.4	7.2	14
20	16	430	74	13	8	67	217	78	47	7.8	7.0	11
21	60	106	60	13	10	63	180	48	72	8.3	6.7	8.9
22	14	60	54	13	10	50	145	41	256	8.0	7.2	7.5
23	9.5	54	47	11	10	60	129	38	171	8.3	4.4	7.2
24	10	54	41	11	10	92	121	33	61	11	5.3	9.7
25	12	106	35	11	13	119	110	24	41	7.8	14	14
26	15	74	29	11	11	256	113	31	26	7.0	207	12
27	13	74	24	10	10	442	121	25	18	7.8	25	8.0
28	14	89	21	8	10	671	95	22	77	5.3	18	7.2
29	11	81	19	8	-----	954	76	19	198	5.0	15	6.2
30	10	50	17	8	-----	406	71	18	137	4.6	13	5.8
31	7.4	-----	15	8	-----	205	-----	15	-----	4.8	10	-----
1922-23												
1	5.8	10	29	73	18	14	38	320	20	6.7	11	1.6
2	6.7	11	29	200	17	14	34	236	15	5.5	10	1.1
3	7.2	12	21	115	18	15	42	162	12	3.8	4.8	.9
4	6.2	12	27	84	19	24	206	137	11	3.4	3.0	1.2
5	5.5	11	21	64	21	33	830	121	18	4.4	2.6	1.1
6	6.7	12	16	54	19	27	710	105	51	4.0	2.5	.9
7	7.2	14	18	48	18	22	403	94	73	4.4	2.6	.6
8	16	50	18	43	15	21	514	73	81	4.2	2.5	2.5
9	30	121	17	39	14	18	365	110	111	3.4	2.5	35
10	27	84	18	31	14	17	207	198	101	3.4	1.9	9.4
11	37	24	18	28	14	16	277	129	80	3.0	2.0	5.3
12	21	22	23	27	14	16	320	129	42	2.6	2.6	3.2
13	15	17	25	28	15	15	189	129	23	2.5	20	3.0
14	11	12	24	31	15	14	121	113	21	2.0	5.0	2.6
15	9.7	14	24	39	14	14	110	92	15	5.3	3.0	2.6
16	9.7	18	20	31	14	16	121	137	17	75	2.6	1.7
17	13	17	13	31	14	21	108	121	17	24	2.0	1.4
18	12	16	11	31	13	145	105	72	15	12	2.8	1.4
19	9.4	18	11	33	13	145	101	53	18	9.2	2.5	1.3
20	9.2	19	10	35	14	57	145	47	13	9.2	1.1	1.2
21	9.7	18	9.7	39	14	37	320	72	8.6	5.3	1.4	6.7
22	9.7	16	11	98	14	34	365	104	7.5	3.8	1.0	9.4
23	10	17	14	72	14	145	368	58	7.0	5.0	1.1	5.8
24	42	16	14	52	14	280	189	43	5.3	10	1.0	14
25	20	18	14	39	14	200	153	34	5.5	13	1.1	11
26	17	16	16	35	14	145	129	29	5.8	14	1.2	10
27	14	14	17	25	15	115	121	26	5.5	8.3	1.1	1.1
28	12	14	14	21	15	92	342	25	5.5	13	5.0	9.4
29	12	14	14	10	-----	66	710	26	6.2	5.8	18	9.4
30	12	15	14	18	-----	50	594	25	7.5	33	5.5	8.6
31	12	-----	14	18	-----	44	-----	23	-----	14	2.3	-----

NOTE.—Stage-discharge relation affected by ice Dec. 7-13, 15, 21-31, 1921, Jan. 1-3, and Feb. 2 to Mar. 7, 1922, Jan. 2-25, Mar. 18, 24-27, and Apr. 4, 1923; discharge based on gage heights corrected for effect of ice. Daily discharge, Apr. 11 to Sept. 30, 1922, supersedes that published in Water-Supply Paper 544.

Monthly discharge, in second-feet, of Jail Branch at East Barre, Vt., for the years ending September 30, 1922 and 1923

Month	1921-22			1922-23		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
October.....	67	3.0	13.0	42	5.5	14.1
November.....	460	12	72.8	121	10	22.4
December.....	635	15	96.3	29	9.7	17.6
January.....	15	8	11.5	200	18	48.4
February.....	14	8	10.0	21	13	15.2
March.....	954	9	216	280	14	60.4
April.....	1,140	71	308	830	34	278
May.....	246	15	71.0	320	23	98.2
June.....	256	12	58.0	111	5.3	27.3
July.....	153	4.6	29.9	75	2.0	10.1
August.....	207	4.4	27.4	20	1.0	4.05
September.....	84	4.0	13.7	35	.6	5.78
The year.....	1,140	3.0	77.5	830	.6	50.1

NOTE.—Monthly discharge April to September, 1922, and yearly discharge, 1922, supersedes that published in Water-Supply Paper 544.

LAMOILLE RIVER AT CADYS FALLS, VT.

LOCATION.—One-fourth mile below power plant of Morrisville Electric Light & Power Co., at what was formerly known as Cadys Falls, 2 miles downstream from village of Morrisville, Lamoille County.

DRAINAGE AREA.—280 square miles.

RECORDS AVAILABLE.—September 4, 1913, to September 30, 1923, when station was discontinued.

GAGE.—Friez water-stage recorder in gage house on right bank, one-fourth mile below highway bridge at Cadys Falls. Gage heights are referred to gage datum by means of a hook gage inside the well; an outside staff gage is used for auxiliary readings. Recorder inspected by N. E. Cobleigh.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Channel smooth gravel; well-defined gravel control 500 feet downstream from gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 9.46 feet at 2 p. m. April 30 (discharge, 5,820 second-feet); discharge practically nil at various times in October (water held back by dam).

1913-1923: Maximum stage recorded, 11.63 feet October 1, 1920 (discharge, from extension of rating curve, 8,730 second-feet); discharge practically nil at various times when water was held back by dam.

ICE.—River freezes over at gage during extremely cold weather, but control usually remains partly open.

REGULATION.—Dams at Cadys Falls and Morrisville have some effect on the distribution of flow. There are several lakes and ponds in the basin, but these have little if any regulation for storage.

ACCURACY.—Stage-discharge relation practically permanent, except when affected by ice. Rating curve well defined. Operation of water-stage recorder satisfactory except for short periods mentioned in footnote to daily discharge table. Daily discharge for open-water period ascertained by discharge integrator. Open-water records excellent; winter records fair.

Discharge measurements of Lamoille River at Cadys Falls, Vt., during the year ending September 30, 1923

[Made by H. F. Hill, jr.]

Date	Gage height	Dis-charge
Feb. 6.....	<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 22.....	2.72	187
	7.09	3,290

• Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Lamoille River at Cadys Falls, Vt., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	64	190	156	230	182	130	320	2,500	195	150	120	100
2.....	114	160	290	1,000	166	110	310	1,600	195	170	120	65
3.....	102	134	150	630	85	64	265	1,100	90	190	115	110
4.....	100	140	210	470	30	10	870	870	130	90	90	100
5.....	98	50	196	350	96	44	1,740	690	530	135	65	110
6.....	90	132	220	290	105	52	4,000	545	980	170	180	95
7.....	164	134	186	250	105	60	3,200	475	750	190	140	95
8.....	48	136	186	240	96	220	2,950	460	870	110	120	130
9.....	190	126	186	230	125	200	2,600	430	1,960	130	120	70
10.....	210	136	90	230	145	150	1,840	540	1,000	120	115	165
11.....	198	100	180	210	66	96	1,840	640	570	125	110	125
12.....	196	120	170	220	180	110	2,200	365	360	120	40	120
13.....	194	156	170	210	180	115	1,660	270	290	110	75	120
14.....	162	156	162	70	160	130	1,260	485	250	125	155	145
15.....	52	180	130	172	150	140	1,060	400	230	45	90	155
16.....	116	230	160	172	105	125	920	570	195	100	80	95
17.....	136	200	50	166	96	94	820	1,500	180	115	100	200
18.....	152	194	116	160	62	115	740	830	200	115	125	13 1/2
19.....	128	150	140	141	98	320	650	560	195	115	95	100
20.....	100	245	150	141	120	320	770	395	175	105	160	120
21.....	84	345	106	138	125	360	2,750	460	170	115	125	275
22.....	15	290	106	191	120	350	3,600	600	175	110	90	340
23.....	80	230	104	231	115	330	3,700	420	150	125	110	180
24.....	150	215	17	153	125	1,340	1,740	340	120	170	110	180
25.....	200	215	24	141	86	1,240	1,160	340	170	145	125	120
26.....	188	80	85	141	120	810	920	290	190	115	90	150
27.....	180	170	98	147	135	610	950	195	225	155	115	200
28.....	188	194	106	109	125	495	1,040	225	205	165	125	190
29.....	100	184	180	172	-----	405	4,100	230	240	70	110	190
30.....	182	100	174	185	-----	395	4,650	165	195	85	140	140
31.....	210	-----	53	191	-----	225	-----	200	-----	130	115	-----

NOTE.—Stage-discharge relation affected by ice Jan. 4 to Mar. 23; discharge for this period based on gage heights corrected for effect of ice.

Monthly discharge of Lamoille River at Cadys Falls, Vt., for the year ending September 30, 1923

[Drainage area, 280 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	210	15	135	0.482	0.56
November	345	50	170	.607	.68
December	290	17	140	.500	.58
January	1,000	70	238	.850	.98
February	182	30	118	.421	.44
March	1,340	10	296	1.06	1.22
April	4,650	265	1,820	6.50	7.25
May	2,500	165	603	2.15	2.48
June	1,960	90	373	1.33	1.48
July	190	45	126	.450	.52
August	180	40	112	.400	.46
September	340	65	144	.514	.57
The year.....	4,650	10	355	1.27	17.22

NOTE.—See paragraph on "Regulation."

GREEN RIVER AT GARFIELD, VT.

LOCATION.—At site of old dam above highway bridge at Garfield village, town of Hyde Park, Lamoille County. Green River is tributary to Lamoille River 4 miles east of Morrisville.

DRAINAGE AREA.—About 20 square miles.

RECORDS AVAILABLE.—January 23, 1915, to March 16, 1921, and December 3, 1922, to September 30, 1923.

GAGE.—Inclined staff on left bank in pool back of weir; read by P. M. Trescott.

DISCHARGE MEASUREMENTS.—Made at footbridge half a mile downstream from weir or at old bridge half a mile above weir.

CHANNEL AND CONTROL.—Sharp-crested compound weir, installed December, 1922; length of crest at gage height 0.00 is 9.0 feet; at gage height 0.83 foot length of crest is increased 11.17 feet. A pool of considerable size is formed by the old mill dam on which the weir is built; at ordinary stages the velocity of approach to the weir is very small.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the period December 3, 1922, to September 30, 1923, 4.07 feet at 9 a. m. April 22 (discharge, by extension of rating curve, 586 second-feet); minimum stage recorded during period, 0.11 foot at 5 p. m. August 11 and 5 p. m. August 12 (discharge, 2.2 second-feet).

1915–1921; 1922–1923: Maximum discharge (determined from high-water marks and extension of rating curve), 710 second-feet on April 12, 1919; minimum discharge recorded, 2.2 second-feet August 11 and 12, 1923.

ICE.—Weir kept clear of ice during winter; stage-discharge relation not affected by ice.

REGULATION.—An old timber dam 2 miles upstream affects flow to some extent. Leakage through dam exceeds low-water flow. During prolonged low stages the surface of water in pond (103 acres) falls below crest of dam; subsequent increased flow into pond is retained until water again flows over crest, when the increased flow is apparent at gaging station.

ACCURACY.—Stage-discharge relation permanent since weir was rebuilt, in December, 1922. Rating curve based on weir formula, $Q = 3.33 LH^{1.5}$ with corrections determined from current-meter measurements and with logarithmic extension above gage height 1.5 feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records below 130 second-feet good; a higher stages weir is flooded and records are somewhat uncertain.

Discharge measurements of Green River at Garfield, Vt., during the year ending September 30, 1923

[Made by H. F. Hill, Jr.]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 23 ^a	3.36	444	May 4 ^b	1.24	51
May 4 ^b	1.26	52	4 ^a	1.23	60
4 ^a	1.26	60			

^a Made at footbridge half a mile below gage.

^b Made at old bridge half a mile above gage.

Daily discharge, in second-feet, of Green River at Garfield, Vt., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....				11	10	8.5	31	173	12	10	4.3	3.8
2.....				25	10	8.5	28	104	11	8.5	3.8	3.4
3.....				27	33	10	8.5	28	74	10	7.6	9.1
4.....				24	39	10	10	30	55	9.7	8.2	8.5
5.....				17	38	10	11	34	45	40	8.2	7.0
6.....				14	30	10	12	97	38	72	12	5.5
7.....				12	26	10	10	186	35	78	15	4.9
8.....				11	18	10	8.8	177	30	76	12	3.4
9.....				11	16	10	8.8	176	28	183	9.4	3.2
10.....				11	15	10	8.5	163	34	106	7.3	3.0
11.....				10	13	10	8.8	139	40	58	5.8	2.4
12.....				9.7	13	10	8.8	148	76	37	4.6	2.2
13.....				9.1	13	9.7	9.4	171	87	27	3.8	6.1
14.....				9.1	12	9.7	9.4	135	58	21	3.4	5.5
15.....				8.8	12	9.7	9.4	109	33	17	4.9	7.3
16.....				8.5	12	9.7	9.7	84	62	14	4.6	5.5
17.....				8.5	12	9.4	10	64	139	15	4.3	4.3
18.....				8.2	12	9.1	11	51	94	15	3.8	3.8
19.....				8.2	12	9.1	11	58	57	13	3.6	3.4
20.....				7.9	12	9.1	12	70	41	11	3.4	3.2
21.....				7.9	12	9.1	12	260	40	9.1	4.6	3.2
22.....				7.9	12	8.8	14	565	52	7.9	3.8	5.2
23.....				7.9	12	8.8	16	399	39	7.3	3.8	4.3
24.....				7.6	12	8.8	19	199	33	7	3.8	3.8
25.....				8.5	11	8.5	20	129	30	7	5.8	4.0
26.....				10	11	8.5	21	114	25	7	9.1	3.8
27.....				9.1	11	8.5	25	114	21	8.2	10	3.6
28.....				8.5	11	8.5	28	114	19	8.5	8.5	4.3
29.....				8.5	11	-----	31	209	15	14	7.0	4.9
30.....				8.5	11	-----	33	280	14	14	6.1	4.6
31.....				8.5	11	-----	35	-----	13	-----	4.9	4.3

Monthly discharge, in second-feet, of Green River at Garfield, Vt., for the year ending September 30, 1923

Month	Maximum	Minimum	Mean	Month	Maximum	Minimum	Mean
December 3-31	27	7.6	10.6	May	173	13	51.8
January	39	11	16.1	June	183	7.3	30.5
February	10	8.5	9.5	July	15	3.4	6.7
March	35	8.5	14.4	August	9.1	2.2	4.6
April	565	28	145	September	70	2.6	11.9

NOTE.—See paragraph on "Regulation."

MISSISQUOI RIVER NEAR RICHFORD, VT.

LOCATION.—3 miles downstream from Richford, Franklin County, and mouth of North Branch and 2 miles above mouth of Trout River.

DRAINAGE AREA.—445 square miles.

RECORDS AVAILABLE.—May 22, 1909, to December 3, 1910, and June 26, 1911, to September 30, 1923, when station was discontinued.

GAGE.—Gurley water-stage recorder on left bank, one-fourth mile above highway bridge; inspected by Harry Jenne. Chain gage on highway bridge used from June 26, 1911, to July 31, 1915. From May 22, 1909, to December 3, 1910, gage was just below plant of the Sweat-Comings Co. in Richford.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Channel deep, banks not subject to overflow; stream bed composed of gravel, boulders and ledge rock; control is sharply defined by rock outcrop 100 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 14.38 feet at 8 p. m. April 7 (discharge, by extension of rating curve, 13,000 second-feet); minimum stage, from water-stage recorder, 1.94 feet at 2 a. m. October 2 (discharge, 20 second-feet, water held back by dams).

1911-1923: Maximum discharge, that of April 7, 1923; minimum discharge, about 8 second-feet July 14, 1911 (water held back by dams).

ICE.—Stage-discharge relation usually affected by ice from December to March; discharge determined from gage heights corrected for effect of ice by means of current-meter measurements, observer's notes, and weather records.

REGULATION.—Considerable daily fluctuation at low stages caused by operation of power plants at Richford.

ACCURACY.—Stage-discharge relation practically permanent except when affected by ice. Rating curve fairly well defined below 6,000 second-feet. Operation of water-stage recorder generally satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of recorder sheets, with corrections for effect of ice during the winter or, for days having large variation in stage, by averaging discharge of 12 two-hour periods. Open-water records good; winter records fair.

Discharge measurements of Missisquoi River near Richford, Vt., during the year ending September 30, 1923

Date	Made by—	Gage height	Discharge
		<i>Fect.</i>	<i>Sec.-ft.</i>
Oct. 30	W. E. Armstrong	2.99	250
Feb. 8	.....do	3.96	181
Apr. 21	H. F. Hill, jr.	7.50	4,080

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Missisquoi River near Richford, Vt., for year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	88	221	460	260	175	150	860	6,720	407	460	112	127
2.....	73	191	650	1,100	190	150	830	4,160	355	339	102	110
3.....	70	188	580	1,000	195	150	1,700	2,340	282	279	90	86
4.....	75	194	530	680	200	170	3,000	1,760	275	282	86	88
5.....	132	185	460	480	200	180	4,500	1,520	523	300	84	73
6.....	140	194	470	380	195	210	7,220	1,320	2,640	339	77	88
7.....	140	200	480	330	180	230	11,000	1,170	1,970	424	68	86
8.....	152	179	500	290	190	230	11,500	960	1,520	391	73	68
9.....	215	206	500	300	200	200	10,700	890	3,610	296	50	197
10.....	206	233	400	290	200	180	5,400	960	2,840	265	55	185
11.....	224	359	310	270	195	175	4,710	1,030	1,240	254	58	188
12.....	233	403	280	260	195	175	4,820	1,100	800	206	68	155
13.....	215	446	260	240	200	170	4,820	1,360	686	170	84	160
14.....	167	375	240	240	210	170	4,600	995	565	162	86	167
15.....	147	451	230	230	220	190	3,830	890	500	155	90	147
16.....	157	645	220	230	200	220	2,150	2,640	469	152	97	125
17.....	137	532	220	240	190	380	1,800	5,280	478	140	105	140
18.....	132	419	210	210	185	520	1,640	3,610	433	152	84	135
19.....	130	415	210	210	185	600	1,600	2,060	343	140	71	162
20.....	135	560	200	210	180	560	1,600	1,400	307	135	88	147
21.....	130	960	200	220	180	500	3,940	1,240	272	137	107	478
22.....	137	860	210	280	195	560	7,090	1,440	237	137	331	536
23.....	157	650	210	300	180	600	7,610	1,130	221	135	227	387
24.....	424	550	210	270	185	1,700	5,400	1,030	182	117	176	261
25.....	505	478	210	250	190	1,950	3,060	860	179	115	188	209
26.....	514	451	210	250	170	1,850	2,060	800	254	125	170	182
27.....	482	491	220	230	170	1,600	1,970	625	428	130	137	279
28.....	343	428	220	210	155	1,400	2,190	575	523	132	105	303
29.....	272	355	220	230	-----	1,100	4,930	523	536	145	157	343
30.....	240	339	220	200	-----	960	7,610	424	590	117	145	351
31.....	230	-----	220	180	-----	880	-----	399	-----	112	135	-----

NOTE.—Stage-discharge relation affected by ice Dec. 1 to Apr. 5; daily discharge for days when gage was read based on gage heights corrected for effect of ice. No gage-height record Nov. 9, 10, Jan. 30, Feb. 4-6, Feb. 22 to Mar. 3, Mar. 11-15, 21, 22, Mar. 31 to Apr. 3, Apr. 13-15, 18-20, and May 17 and 18; daily discharge estimated by hydrograph comparisons and meteorological data.

Monthly discharge of Missisquoi River near Richford, Vt., for the year ending September 30, 1923

[Drainage area, 445 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	514	70	206	0.463	0.53
November.....	960	179	405	.910	1.02
December.....	650	200	315	.708	.82
January.....	1,100	180	325	.730	.84
February.....	220	155	190	.427	.44
March.....	1,950	150	584	1.31	1.51
April.....	11,500	830	4,470	10.0	11.16
May.....	6,720	399	1,650	3.71	4.28
June.....	3,610	179	789	1.77	1.98
July.....	460	112	208	.467	.54
August.....	331	50	113	.254	.29
September.....	536	68	199	.447	.50
The year.....	11,500	50	786	1.77	23.91

CLYDE RIVER AT WEST DERBY (NEWPORT), VT.

LOCATION.—Just below plant of Newport Electric Light Co. at West Derby (Newport), Orleans County, 1 mile above mouth of river.

DRAINAGE AREA.—150 square miles.

RECORDS AVAILABLE.—May 25, 1909, to September 30, 1919, and May 24, 1920, to September 30, 1923.

GAGES.—Water-stage recorder on right bank; referenced to gage datum by hook gage inside well; chain gage fastened to tree is used for auxiliary readings. Recorder inspected by F. R. Sherwell.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from highway bridge one-half mile downstream.

CHANNEL AND CONTROL.—Stream bed rough and irregular; covered with boulders and ledge rock; fall of river rapid for some distance below gage.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 4.58 feet at 11 p. m. April 1 (discharge, from extension of rating curve, 2,310 second-feet); minimum discharge practically nil at 8 a. m. December 25 (water held back by dams).

1909–1923: High water of March 25–30, 1913, reached maximum stage of 5.8 feet, as determined from high-water marks (discharge, about 6,300 second-feet); minimum discharge practically nil at various times when water was held back by dams.

ICE.—River usually remains open at control; stage-discharge relation seldom affected.

REGULATION.—Flow at ordinary stages fully controlled by two dams at West Derby; distribution of flow affected also by several dams above West Derby. Seymour Lake and several small ponds in the basin afford a large amount of natural storage, but at the present time there is little if any artificial regulation at these ponds.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined. Operation of water-stage recorder satisfactory except for periods indicated in footnote to daily-discharge table. Daily discharge ascertained by applying mean daily gage height to rating table. Records good when water-stage recorder was in operation.

Discharge measurements of Clyde River at West Derby (Newport), Vt., during the year ending September 30, 1923

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 28	W. E. Armstrong.....	2.20	93	Feb. 9	W. E. Armstrong.....	2.25	109
28	do.....	2.18	86	Apr. 20	H. F. Hill, Jr.....	2.87	471
29	do.....	2.18	83	20	do.....	2.87	475

Daily discharge, in second-feet, of Clyde River at West Derby (Newport), Vt., for the year ending September 30, 1923

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....		68	142			48	202	2,100	227	142	76	89
2.....		70	79			50	182	2,080	217	125	76	66
3.....		58	73			68	197	1,800	202	121	76	68
4.....		76	133			58	232	1,400	173	125	85	82
5.....		60	133		85	89	212	1,150	173	117	66	82
6.....		70	117	155		64	316	990	187	151	76	73
7.....	55	79	117			62	474	870	248	164	68	66
8.....		101	113			58	950	790	316	178	70	58
9.....		109	93		121	54	1,080	622	374	155	73	52
10.....		46	50		125	70	1,080	660	394	151	68	82
11.....		40	73		117	40	1,040	631	394	142	70	82
12.....		48	89		113	58	1,040	631	387	125	50	76
13.....		56	89		93	64	970	622	360	121	70	79
14.....	54	58	85		89	73	900	603	328	101	70	93
15.....	48	66	85		109	64	820	593	286	113	68	109
16.....	70	64	93	120	105	68	730	593	248	93	73	70
17.....	62	60	17		113	66	641	593	243	82	73	97
18.....	68	54	31		64	56	565	574	212	97	82	93
19.....	58	56	39		85	85	532	565	202	79	52	97
20.....	60	64	52		169	113	498	557	178	85	85	105
21.....	56	101	60		169	137	548	507	164	79	89	109
22.....	46	113	58		129	178	641	474	151	89	89	121
23.....	64	109	58		109	173	930	445	137	101	89	129
24.....	68	105	26		97	133	1,170	407	121	79	93	125
25.....	68	109	26		54	121	1,170	394	70	76	101	133
26.....	62	101	62	100	54	85	1,060	367	82	76	52	133
27.....	73	121			60	82	950	347	89	79	93	129
28.....	105	105			46	133	770	310	89	89	82	129
29.....	82	113	100			178	990	292	109	66	89	160
30.....	85	105				178	1,500	275	109	85	89	142
31.....	93					178		243		79	97	

NOTE.—Water-stage recorder not in operation Oct. 1-13, Dec. 27 to Feb. 8, Mar. 29, 30, Sept. 6-8, 26 and 27; discharge estimated.

Monthly discharge of Clyde River at West Derby (Newport), Vt., for the year ending September 30, 1923

[Drainage area, 150 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Persquare mile	
October.....	105	46	62.5	0.417	0.48
November.....	121	40	79.5	.530	.59
December.....	142	17	80.4	.536	.62
January.....			124	.827	.95
February.....	169	46	96.4	.643	.67
March.....	178	40	93.0	.620	.71
April.....	1,500	182	746	4.97	5.55
May.....	2,100	243	725	4.83	5.57
June.....	394	70	216	1.44	1.61
July.....	178	66	109	.737	.85
August.....	101	50	77.1	.514	.59
September.....	160	52	97.6	.651	.73
The year.....	2,100	17	209	1.39	18.92

NOTE.—See paragraph on "Regulation."

MISCELLANEOUS DISCHARGE MEASUREMENTS

Discharge measurements of streams in the St. Lawrence River drainage basin at points other than regular gaging stations, made during the year ending September 30, 1923, are listed in the following table:

Miscellaneous discharge measurements in the St. Lawrence River drainage basin during the year ending September 30, 1923

Date	Stream	Tributary to or diverting from—	Locality	Discharge
				<i>Sec.-ft.</i>
Oct. 4	Maumee River.....	Lake Erie.....	Napoleon, Ohio.....	521
27	do.....	do.....	do.....	394
May 11	do.....	do.....	do.....	693
Aug. 2	do.....	do.....	do.....	667
16	do.....	do.....	do.....	613
May 8	Ottawa River.....	Auglaize River.....	Kalida, Ohio.....	56
Aug. 3	Miami and Erie Canal.....	Maumee River.....	Florida, Ohio.....	201
Oct. 4	do.....	do.....	Napoleon, Ohio.....	14
27	do.....	do.....	do.....	31
May 11	do.....	do.....	do.....	30
Aug. 3	do.....	do.....	do.....	6
16	do.....	do.....	do.....	36
May 14	Sandusky River.....	Lake Erie.....	Tiffin, Ohio.....	5, 520

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES

INTRODUCTION

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

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

Part I. North Atlantic slope basins (St. John River to York River).

II. South Atlantic slope and eastern Gulf of Mexico basins (James River to the Mississippi).

III. Ohio River basin.

IV. St. Lawrence River basin.

V. Upper Mississippi River and Hudson Bay basins.

VI. Missouri River basin.

VII. Lower Mississippi River basin.

VIII. Western Gulf of Mexico basins.

IX. Colorado River basin.

X. Great Basin.

XI. Pacific slope basins in California.

XII. North Pacific slope basins, in three parts:

A, Pacific slope basins in Washington and upper Columbia River basin.

B, Snake River basin.

C, Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED

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

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

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

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

Boston, Mass., 2500 Customhouse.

Albany, N. Y., 704 Journal Building.

Trenton, N. J., Statehouse.

Charlottesville, Va., care of University of Virginia.

Asheville, N. C., 316 Jackson Building.

Chattanooga, Tenn., 37 Municipal Building.

Columbus, Ohio, Engineering Experiment Station, Ohio State University.

Chicago, Ill., 950 Transportation Building.

Madison, Wis., care of Railroad Commission of Wisconsin.

Ames, Iowa, State Highway Commission Building.

Rolla, Mo., Rolla Building, School of Mines and Metallurgy.

Topeka, Kans., 23 Federal Building.

Helena, Mont., 45-46 Federal Building.

Denver, Colo., 403 Post Office Building.

Salt Lake City, Utah, 313 Federal Building.

Idaho Falls, Idaho, 228 Federal Building.

Boise, Idaho, Federal Building.

Tacoma, Wash., 404 Federal Building.

Portland, Oreg., 606 Post Office Building.

San Francisco, Calif., 303 Customhouse.

Los Angeles, Calif., 600 Federal Building.

Tucson, Ariz., room 106, College of Law Building, University of Arizona.

Austin, Tex., State Capitol.

Honolulu, Hawaii, 25 Capitol Building.

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

STREAM-FLOW REPORTS

Stream-flow records have been obtained at about 5,600 points in the United States, and the data obtained have been published in the reports tabulated below.

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

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

Report	Character of data	Year
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River, and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings.	1899.
21st A, pt. 4	Monthly discharge.	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings.	1900.
22d A, pt. 4	Monthly discharge.	1900.
W 55, 56	Descriptions, measurements, gage heights, and ratings.	1901.
W 75	Monthly discharge.	1901.
W 82 to 85	Complete data.	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907-8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 391	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.
W 451 to 464	do	1917.
W 471 to 484	do	1918.
W 501 to 514	do	1919-20.
W 521 to 534	do	1921.
W 541 to 554	do	1922.
W 561 to 574	do	1923.

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

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1923. 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, Maine, 1903 to 1921, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, 431, 451, 471, 501, and 521, which contain records for the New England streams from 1903 to 1921. Results of miscellaneous measurements are published by drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899-1923

[For basins included see p. 147]

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												A	B	C
1899 ^a	35	b 35, 36	36	36	36	c 36, 37	37	37	d 37, 38	i 39	38, f 39	38	38	38
1900 ^a	47, h 48	48	48, i 49	48	49	49, f 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	k 65, 66, 75	66, 75	k 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	b 82, 83	83	i 82, 83	k 83, 84	k 83, 84	k 83, 84	84	85	85	85	85	85	85
1903	97	b 97, 98	98	97	k 98, 99, m 100	99	k 98, 99	99	100	100	100	100	100	100
1904	n 124, o 125,	p 126, 127	128	129	k 128, 130	130, q 131	k 128, 131	132	133	133, r 134	134	135	135	135
1905	n 165, o 166,	p 167, 168	169	170	171	172	k 169, 173	174	175, s 177	176, r 177	177	178	178	t 177, 178
1906	*201, o 202,	p 203, 204	205	206	207	208	k 205, 209	210	211	212, r 213	213	214	214	214
1907-8	241	242	243	244	245	246	247	248	249	250, r 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, r 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332-A	332-B	332-C
1913	351	352	353	354	355	356	357	358	359	360	361	362-A	362-B	362-C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917	451	452	453	454	455	456	457	458	459	460	461	462	463	464
1918	471	472	473	474	475	476	477	478	479	480	481	482	483	484
1919-20	501	502	503	504	505	506	507	508	509	510	511	512	513	514
1921	521	522	523	524	525	526	527	528	529	530	531	532	533	534
1922	541	542	543	544	545	546	547	548	549	550	551	552	553	554
1923	561	562	563	564	565	566	567	568	569	570	571	572	573	574

^a Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in Twenty-first Annual Report, Part IV.

^b James River only.

^c Gallatin River.

^d Green and Gunnison rivers and Grand River above junction with Gunnison.

^e Mohave River only.

^f Kings and Kern rivers and south Pacific slope basins.

^g Rating tables and index to Water-Supply Papers 47-52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.

^h Tables of monthly discharge for 1900 in Twenty-second Annual Report, Part IV.

ⁱ Wissahickon and Schuylkill rivers to James River.

^j Seloto River.

^k Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

^l Tributaries of Mississippi from east.

^m Lake Ontario and tributaries to St. Lawrence River proper.

ⁿ Hudson Bay only.

^o New England rivers only.

^p Hudson River to Delaware River, inclusive.

^q Susquehanna River to Yackin River, inclusive.

^r Platte and Kansas rivers.

^s Great Basin in California, except Truckee and Carson river basins

^t Below junction with Gila.

^u Rogue, Umpqua, and Siletz rivers only.

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

In exception to this rule the records for Mississippi River are given in four parts, as indicated on page 147, and the records for large lakes are presented in order of streams around the rim of the lake.

PRINCIPAL STREAMS

The St. Lawrence River basin includes streams which drain into the Great Lakes and St. Lawrence River. The principal streams flowing directly or indirectly into Lake Superior from the United States are St. Louis, Ontonagon, Dead, and Carp rivers; streams flowing into Lake Michigan are Escanaba, Menominee, Peshtigo, Oconto, Fox, St. Joseph, and Grand rivers; into Lake Huron flow Thunder Bay, Ausable, Rifle, and Saginaw rivers; into Lake Erie flow Huron, Maumee, Sandusky, Black, and Cuyahoga rivers. Streams flowing into Lake Ontario are Genesee, Oswego, Salmon, and Black rivers. The St. Lawrence receives Oswegatchie and Raquette rivers, Richelieu River (the outlet of Lake Champlain), and St. Francis River, whose principal tributary, Clyde River, reaches it through Lake Memphremagog. The streams of this basin drain wholly or in part the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, this part contains brief references to reports published by State and other organizations. (See p.163.)

GAGING STATIONS

NOTE.—Dash following a date indicates that station was being maintained September 30, 1923. Period after date indicates discontinuance.

Streams tributary to Lake Superior:

Brule River at mouth, Minn., 1911.

Devil Track River at mouth, Minn., 1911.

Cascade River at mouth, Minn., 1911.

Poplar River at Lutsen, Minn., 1911–1917.

Beaver Bay River at Beaver Bay, Minn., 1911–1914.

St. Louis River near Cloquet, Minn., 1903.

St. Louis River near Thomson, Minn., 1909–1915.

Whiteface River at Meadowlands, Minn., 1909–1912.

Whiteface River below Meadowlands, Minn., 1912–1917.

Cloquet River at Independence, Minn., 1909–1917.

Streams tributary to Lake Superior—Continued.

Aminicon River near Aminicon Falls, Wis., 1914-1916.

Brule River near Brule, Wis., 1914-1917.

Bad River near Odanah, Wis., 1914-1922.

Montreal River at Ironwood, Mich., 1918-1922.

West Branch of Montreal River at Gile, Wis., 1918-

Ontonagon River near Rockland, Mich., 1903.

Sturgeon River near Sidnaw, Mich., 1912-1915.

Perch River near Sidnaw, Mich., 1912-1915.

Dead River near Negaunee, Mich., 1902-3.

Dead River at Forestville, Mich., 1898-1902.

Carp River near Marquette, Mich., 1902-3.

Streams tributary to Lake Michigan:

Escanaba River near Escanaba, Mich., 1903-1915.

Brule River (head of Menominee River) near Florence, Wis., 1914-1916.

Menominee River at Twin Falls, near Iron Mountain, Mich., 1914-

Menominee River near Iron Mountain, Mich., 1902-1914.

Menominee River at Lower Quinnesec Falls, Wis., 1898-99.

Menominee River at Koss, Mich., 1907-1909; 1914.

Menominee River below Koss, Mich., 1913-

Iron River near Iron River, Mich., 1900-1905.

Pine River near Florence, Wis., 1914-

Pike River at Amberg., Wis., 1914-

Peshtigo River at High Falls, near Crivitz, Wis., 1912-

Peshtigo River near Crivitz, Wis., 1906-1909.

Peshtigo River at Crivitz, Wis., 1906.

Oconto River near Gillett, Wis., 1906-1909; 1914-

Oconto River at Stiles, Wis. 1906.

Fox River at Berlin, Wis., 1898-

Fox River at Omro, Wis., 1902-3.

Fox River at Oshkosh, Wis., 1902.

Fox River at Wrightstown, Wis., 1902-1904.

Fox River at Rapide Croche dam, near Wrightstown, Wis., 1896-

Wolf River at Keshena, Wis., 1907-1909; 1911-

Wolf River at White House Bridge, near Shawano, Wis., 1906-7.

Wolf River at Darrows Bridge, near Shawano, Wis., 1906.

Wolf River at New London, Wis., 1913-

Wolf River at Northport, Wis., 1905.

Wolf River at Winneconne, Wis., 1902-3.

West Branch of Wolf River at Neopit, Wis., 1911-1917.

Embarrass River near Embarrass, Wis., 1919-

Little Wolf River at Royalton, Wis., 1914-

Little Wolf River near Northport, Wis., 1907-1910.

Waupaca River near Waupaca, Wis., 1917-

Waupaca River near Weyauwega, Wis., 1916-17.

Fond du Lac River, West Branch (head of Fond du Lac River), at Fond du Lac, Wis., 1903.

East Branch of Fond du Lac River at Fond du Lac, Wis., 1903.

Sheboygan River near Sheboygan, Wis., 1916-

Milwaukee River near Milwaukee, Wis., 1914-

Little Calumet River at Harvey, Ill., 1916-

St. Joseph River at Mendon, Mich., 1902-1905.

St. Joseph River near Buchanan, Mich., 1901-1906.

Fawn River at White Pigeon, Mich., 1903-4.

Streams tributary to Lake Michigan—Continued.

- Kalamazoo River near Allegan, Mich., 1901–1907.
- Reeds Springs near Albion, Mich., 1904–1906.
- Grand River at North Lansing, Mich., 1901–1906.
- Grand River at Grand Rapids, Mich., 1901–1918.
- Red Cedar River at Agricultural College, Mich., 1902–3.
- Crockery Creek at Slocums Grove, Mich., 1902–3.
- Muskegon River at Newaygo, Mich., 1901–1906.
- Manistee River near Sherman, Mich., 1903–1916.
- Boardman River at Traverse City, Mich., 1904.

Streams tributary to Lake Huron:

- Thunder Bay River near Alpena, Mich., 1901–1908.
- Au Sable River near Lovells, Mich., 1908–1914.
- Au Sable River at Bamfield, Mich., 1902–1913.
- Rifle River near Sterling, Mich., 1905–1908.
- Rifle River at Omer, Mich., 1902–3.
- Shiawassee River (head of Saginaw River):
 - Flint River at Flint, Mich., 1903–4.
 - Cass River at Frankenmuth, Mich., 1908–9.
 - Cass River at Bridgeport, Mich., 1908.
 - Tittabawassee River at Freeland, Mich., 1903–1909; 1912–

Streams tributary to Lake Erie:

- Huron River at Dover, Mich., 1904.
- Huron River at Dexter, Mich., 1904–1916.
- Huron River at Barton, Mich., 1914–
- Huron River at Geddes, Mich., 1904–1914.
- Huron River at French Landing, Mich., 1904–5.
- Huron River at Flat Rock, Mich., 1904–1922.
- Maumee River at Antwerp, Ohio, 1921–
- Maumee River near Sherwood, Ohio, 1903–1906.
- Maumee River at Waterville, Ohio, 1898–1901; 1921–
 - St. Marys River at Fort Wayne, Ind., 1905–6.
 - St. Joseph River at Fort Wayne, Ind., 1905–6.
 - Tiffin River near Stryker, Ohio, 1921–
 - Tiffin River near Defiance, Ohio, 1903–1906.
 - Auglaize River near Fort Jennings, Ohio, 1921–
 - Auglaize River near Defiance, Ohio, 1903; 1915–
 - Ottawa River at Lima, Ohio, 1902–3.
 - Blanchard River at Ottawa, Ohio, 1902–3.
 - Blanchard River at Glandorf, Ohio, 1921–
- Miami and Erie Canal at Waterville, Ohio, 1921–
- Sandusky River near Upper Sandusky, Ohio, 1921–
- Sandusky River near Mexico, Ohio, 1898–1900; 1923–
- Sandusky River at Fremont, Ohio, 1898–1901.
- Black River near Elyria, Ohio, 1903–1906.
- East Branch of Black River at Elyria, Ohio, 1922–
- Cuyahoga River at Old Portage, Ohio, 1921–
- Cuyahoga River at Brecksville, Ohio, 1923–
- Cuyahoga River at Independence, Ohio, 1903–1906; 1921–1923.
- Cuyahoga River at Cleveland, Ohio, 1903.
- Ohio Canal feeder at Brecksville, Ohio, 1923–
- Ohio Canal at Independence, Ohio, 1921–1923.
- Grand River near Madison, Ohio, 1922–
- Conneaut Creek at Amboy, Ohio, 1922–
- Cattaraugus Creek at Versailles, N. Y., 1910–1923.

Streams tributary to Lake Ontario:

Niagara River:

Tonawanda Creek:

- Little Tonawanda Creek at Linden, N. Y., 1912-
- Barge Canal at Lock 30, Macedon, N. Y., 1919-1920.
- Barge Canal at Lock 32, Pittsford, N. Y., 1919-1921.
- Genesee River at Scio, N. Y., 1916-
- Genesee River at St. Helena, N. Y., 1908-
- Genesee River at Mount Morris, N. Y., 1905-1909.
- Genesee River at Jones Bridge, near Mount Morris, N. Y., 1903-1906; 1908-1913; 1915-
- Genesee River at Rochester, N. Y., 1904-1919.
- Genesee River at Driving Park Avenue, Rochester, N. Y., 1919-
- Canaseraga Creek near Dansville, N. Y., 1910-1912; 1915-1917; 1919-
- Canaseraga Creek at Cumminsville, N. Y., 1917-1919.
- Canaseraga Creek at Groveland Station, N. Y., 1915-1920.
- Canaseraga Creek at Shakers Crossing, N. Y., 1915-1922.
- Keshequa Creek at Sonyea, N. Y., 1910-1912; 1917-
- Keshequa Creek near Sonyea, N. Y., 1915-1917.
- Conesus Creek near Lakeville, N. Y., 1919-
- Hemlock Lake at Hemlock, N. Y., 1894-1902.
- Canadice Lake outlet near Hemlock, N. Y., 1903-
- Honeoye Creek at East Rush, N. Y., 1903-1906.
- Seneca River (head of Oswego River) at Baldwinsville, N. Y., 1898-1908.
- Oswego River at Fulton, N. Y., 1900; 1902.
- Oswego River at Battle Island, above Minetto, N. Y., 1900-1906.
- Oswego River at high dam, near Oswego, N. Y., 1897-1901.
- Seneca Lake at Geneva, N. Y., 1905-6.
- Cayuga Lake at Ithaca, N. Y., 1905-1908.
- Fall Creek near Ithaca, N. Y., 1908-9.
- Owasco Lake outlet near Auburn, N. Y., 1912-
- Skaneateles Lake at Skaneateles, N. Y., 1890-91.
- Skaneateles Lake outlet at Willow Glen, N. Y., 1892-1908.
- Skaneateles Lake outlet at Jordan, N. Y., 1890-1892.
- Onondaga Lake outlet at Long Branch, N. Y., 1904.
- West Branch of Onondaga Creek at South Onondaga, N. Y., 1916-1918.
- Fish Creek, East Branch (through Oneida Lake, head of Oneida River), at Point Rock, N. Y., 1898-99.
- Fish Creek, East Branch, at Taberg, N. Y., 1923-
- Oneida River at Brewerton, N. Y., 1899.
- Oneida River at Oak Orchard, near Euclid, N. Y., 1902-1909.
- Oneida River at Caughdenoy, N. Y., 1910-1913.
- West Branch of Fish Creek at McConnellsville, N. Y., 1898-1901.
- Oneida Creek at Kenwood, N. Y., 1898-1900.
- Chittenango Creek at Chittenango, N. Y., 1901-1906.
- Chittenango Creek at Bridgeport, N. Y., 1898-1901.
- Salmon River at Stillwater Bridge, near Redfield, N. Y., 1911-1913.
- Salmon River near Pulaski, N. Y., 1900-1908; 1910-1914.
- Orwell Brook near Altmar, N. Y., 1911-1916.
- Black River near Boonville, N. Y., 1911-
- Black River near Felts Mills, N. Y., 1902-1913.
- Black River at Black River, N. Y., 1917-1920.
- Black River at Huntingtonville dam, near Watertown, N. Y., 1897-1901.

Streams tributary to Lake Ontario—Continued.

Black River at Watertown, N. Y., 1920—

Forestport feeder near Boonville, N. Y., 1915—

Black River canal (flowing south) near Boonville, N. Y., 1915—

Moose River at McKeever, N. Y., 1922—

Moose River at Moose River, N. Y., 1900–1922.

Middle Branch of Moose River at Old Forge, N. Y., 1911—

Beaver River at State dam, near Beaver River, N. Y., 1908—

Beaver River at Eagle Falls, near Number Four, N. Y., 1921—

Beaver River at Croghan, N. Y., 1901–1903.

Streams tributary to St. Lawrence River:

Oswegatchie River, East Branch (head of Oswegatchie River), at Cranberry Lake, N. Y., 1923—

Oswegatchie River, East Branch, at Newton Falls, N. Y., 1912–1923.

Oswegatchie River near Heuvelton, N. Y., 1916—

Oswegatchie River near Ogdensburg, N. Y., 1903–1916.

West Branch of Oswegatchie River near Harrisville, N. Y., 1916—

Raquette River at Raquette Falls, near Coreys, N. Y., 1908–1912.

Raquette River at Piercefield, N. Y., 1908—

Raquette River at South Colton, N. Y., 1904.

Raquette River at Massena Springs, N. Y., 1903–1916.

Bog River near Tupper Lake, N. Y., 1908–1912.

St. Regis River at Brasher Center, N. Y., 1910–1917; 1919—

Deer River at Brasher Iron Works (railroad station), Ironton, N. Y., 1912–1916.

Chateaugay River near Chateaugay, N. Y., 1908.

Richelieu River at Fort Montgomery, Rouses Point, N. Y., 1875—

Lake Champlain at Burlington, Vt., 1907—

Big Chazy River at Mooers, N. Y., 1908.

Saranac River at Saranac Lake, N. Y., 1902–3.

Saranac River near Plattsburg, N. Y., 1903—

Ausable River, West Branch (head of Ausable River), near Newman, N. Y., 1916–1917; 1919—

Ausable River at Ausable Forks N. Y., 1910—

Ausable River at Keeseville, N. Y., 1904; 1908.

Boquet River at Willsboro, N. Y., 1904; 1908.

Lake George at Rogers Rock, N. Y. 1913—

Lake George at Glen Island, near Bolton Landing, N. Y., 1919—

Lake George outlet at Ticonderoga, N. Y., 1904–5.

Poultney River at Fairhaven, Vt., 1908.

Mettawee River at Whitehall, N. Y. 1908.

Otter Creek at Middlebury, Vt., 1903–1907; 1910–1920.

East Creek near Rutland, Vt., 1911–1913.

Winooski River above Stevens Branch, near Montpelier, Vt., 1909–1914.

Winooski River at Montpelier, Vt., 1909–1923.

Winooski River at Richmond, Vt., 1903–1907; 1910.

Winooski River near Winooski, Vt., 1903.

Mollys Brook near Marshfield, Vt., 1920–1923.

Stevens Branch:

Jail Branch at East Barre, Vt., 1920–1923.

Streams tributary to St. Lawrence River—Continued.

Richelieu River tributaries—Continued.

Lake Champlain tributaries—Continued.

Winooski River tributaries—Continued.

North Branch (Worcester Branch) of Winooski River at Montpelier, Vt., 1909-1914.

Dog River at Northfield, Vt., 1909-1920.

Dog River near Montpelier Junction, Vt., 1910.

Mad River near Moretown, Vt., 1910.

Waterbury (Little) River near Waterbury, Vt., 1910.

Huntington River at Jonesville, Vt., 1910

Lamoille River at Morrisville, Vt., 1909-10.

Lamoille River at Cadys Falls, Vt., 1913-1923.

Lamoille River at Johnson, Vt., 1910-1913.

Lamoille River at West Milton, Vt., 1903.

Green River at Garfield, Vt., 1915-1921; 1922-

Missisquoi River at Richford, Vt., 1909-10.

Missisquoi River near Richford, Vt., 1911-1923.

Missisquoi River at Swanton, Vt., 1903.

St. Francis River (by way of Lake Memphremagog and Magog River):

Clyde River at West Derby (Newport), Vt., 1909-

REPORTS ON WATER RESOURCES OF THE ST. LAWRENCE RIVER BASIN¹

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY

WATER-SUPPLY PAPERS

Water-supply papers may be purchased (at price quoted below) from the Superintendent of Documents, Washington, D. C. An asterisk (*) indicates that the report is out of print. Water-supply papers are of octavo size.

- *21. Wells of northern Indiana, by Frank Leverett. 1899. 82 pp., 2 pls. (Continued in No. 26.)

Discusses, by counties, the glacial deposits and the sources of well water; gives many well sections.

24. Water resources of the State of New York, Part I, by G. W. Rafter. 1899. 99 pp., 13 pls. 15c.

- *25. Water resources of the State of New York, Part II, by G. W. Rafter. 1899. 100 pp. 12 pls.

No. 24 contains descriptions of the principal rivers of New York and their more important tributaries and data on temperature, precipitation, evaporation, and stream flow.

No. 25 contains discussion of water-storage projects on Genesee and Hudson Rivers, power development at Niagara Falls, description and early history of State canals, and a chapter on the use and value of the water powers of the streams and canals; also brief discussion of the water yield of sand areas of Long Island.

- *26. Wells of southern Indiana (continuation of No. 21), by Frank Leverett. 1899. 64 pp.

Discusses, by counties, the glacial deposits and the sources of well water; contains many well sections.

- *30. Water resources of the Lower Peninsular of Michigan, by A. C. Lane. 1899. 97 pp., 7 pls.

Describes lake and river transportation and navigation, water powers and domestic water supplies; discusses climate, topography, geology, and well waters; compares quality and quantity of waters.

31. Lower Michigan mineral waters, by A. C. Lane. 1899. 97 pp., 4 pls. 10c.

Treats of economic value of mineral waters and discussion and classification of analyses; contains analyses of waters of Lake Superior and of smaller lakes and rivers and of well waters from various geologic formations; also sanitary condition of drinking waters.

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

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

Nos. 57 to 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.).

¹ For stream measurement reports, see tables on pp. 149 and 150.

91. The natural features and economic development of the Sandusky, Maumee, Muskingum, and Miami drainage areas in Ohio, by B. H. and M. S. Flynn. 1904. 130 pp. 10c.
- Describes the topography, geology, and soils of the areas, and discusses stream flow, dams, water powers, and public water supplies.
- *102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp.
- Contains brief reports on wells and springs of Minnesota and of lower Michigan. The report comprises tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use and quality; many miscellaneous analyses.
- *103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. Superseded by 152.
- Cites statutory restrictions of water pollution.
- *110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls.
- Contains:
- Water resources of the Watkins Glen quadrangle, New York, by Ralph S. Tarr; pp. 134-140. Discusses the use of the surface and underground waters for municipal supplies and their quality as indicated by examination of Sixmile and Fall creeks, and sanitary analyses of well water at Ithaca.
- New artesian water supply at Ithaca, New York, by F. L. Whitney, pp. 55-64.
- *114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls.
- Contains brief reports as follows:
- Minnesota, by C. W. Hall; Wisconsin district, by Alfred R. Schultz; Lower Michigan; Illinois, by Frank Leverett; Indiana, by Frank Leverett; New York, by F. B. Weeks; Ohio, by Frank Leverett.
- Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.
121. Preliminary report on the pollution of Lake Champlain, by M. O. Leighton. 1905. 119 pp., 13 pls. 20c.
- Describes the lake and principal inflowing streams and discusses the characteristics of the water and the wastes resulting from the manufacturing processes by which the waters are polluted. Discusses also the effect of mill waste on algae, bacteria, and fish.
- *122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp.
- Cites legislative acts relating to ground waters in Michigan and Wisconsin.
144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.
- Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.
- *145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.
- Contains three brief reports pertaining chiefly to areas in the St. Lawrence River basin:
- Two unusual types of artesian flow, by Myron L. Fuller. Describes (1) artesian flows from uniform, unconfined sand on Long Island, N. Y., and in Michigan; and (2) flow from jointed upper portions of limestone and other rocks in southeastern Michigan.
- Water resources of the Catatonk area, New York, by E. M. Kindle. Describes topography and geology of areas southeast of Finger Lake region, New York, including part of city of Ithaca; discusses briefly the artesian wells of Ithaca, the quality of the spring water at several small towns, and of the streams used for municipal supplies and for power.
- A ground-water problem in southeastern Michigan, by Myron L. Fuller. Discusses cause of failure of wells in certain areas in southeastern Michigan in 1904 and the applications of the conclusions to other regions.

- *147. Destructive floods in the United States in 1904, by E. C. Murphy and others 1905. 206 pp., 18 pls.
Describes flood on Grand River, Mich. (from report of R. E. Horton), discussing streams, precipitation, temperature, discharge, damage, and prevention of future damage.
- 149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.
Gives by States (and within the States by counties) the location, depth, diameter, yield, height of water, and other features of wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.
- *152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 140 pp.
Cites statutory restrictions of water pollution in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin.
- *156. Water powers of northern Wisconsin, by L. S. Smith. 1906. 145 pp., 5. pls.
Describes, by river systems, the drainage geology, topography, rainfall, and run-off, water-powers and dams.
- *160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.
Contains brief report entitled "Flowing well districts in the eastern part of the northern peninsula of Michigan," by Frank Leverett.
- *162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls.
Contains accounts of floods on Sixmile Creek and Cayuga Inlet, N. Y. (in 1857, 1901, and 1905), and on Grand River, Mich., and estimate of flood discharge and frequency for Genesee River; gives index to literature on floods in American streams.
- 182. Flowing wells and municipal water supplies in the southern portion of the southern peninsula of Michigan, by Frank Leverett and others. 1906. 292 pp., 5 pls. 50c.
- 183. Flowing wells and municipal water supplies in the middle and northern portions of the southern peninsula of Michigan, by Frank Leverett and others. 1907. 393 pp., 5 pls. 50c.
Water-Supply Papers 182 and 183 describe in general the geographic features, water-bearing formations, drainage, quality of water, and subterranean-water temperature, and give details concerning water supplies by counties. The report contains many analyses.
- 193. The quality of surface waters in Minnesota, by R. B. Dole and F. F. Westbrook. 1907. 171 pp., 7 pls. 25c.
Describes by river basins the topography, geology, and soils, the industrial and municipal pollution of the streams, and gives notes on the municipalities; contains many analyses.
- *194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri v. the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369. pp., 2 pls.
Scope indicated by amplification of title.

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

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Lake Superior and Lake Michigan, Kalamazoo and Grand rivers, Lake Huron, Lake Erie, Maumee River and St. Lawrence and Oswegatchie rivers.

239. The quality of the surface waters of Illinois, by W. D. Collins. 1910. 94 pp., 3 pls. 10c.

Discusses the natural and economic features that determine the character of the streams, describes the larger drainage basins and the methods of collecting and analyzing the samples of water, and discusses each river in detail with reference to its source, course, and quality of water; includes short chapters on municipal supplies and industrial uses.

254. The underground waters of north-central Indiana, by S. R. Capps, with a chapter on the chemical character of the waters, by R. B. Dole. 1910. 279 pp., 7 pls. 40c.

Describes relief, drainage, vegetation, soils and crops, industrial development, geologic formations; sources, movements, occurrence, and volume of ground water; methods of well construction and lifting devices; discusses in detail, for each county, surface features and drainage, geology, and ground water, city, village, and rural supplies, and gives record of wells and analyses of water. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effects of the constituents on waters for domestic, industrial, and medicinal uses, methods of purification and chemical composition; many analyses and field assays.

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

Contains analyses of water from Caledonia Spring, New York, and from the Quincy mine, Mich.

417. Profile surveys of rivers in Wisconsin, prepared under the direction of W. H. Herron, acting chief geographer. 1917. 16 pp., 32 pls. 45c.

Contains brief description of general features of drainage of Wisconsin and of the rivers surveyed, but consists chiefly of maps showing "not only the outlines of the river banks, the islands, the position of rapids, falls, shoals, and existing dams, and the crossings of all ferries and roads, but the contours of banks to an elevation high enough to indicate the possibility of using the stream."

424. Surface waters of Vermont, by C. H. Pierce. 1917. 218 pp., 14 pls. 25c.

Gives gaging-station descriptions and stream-flow records for streams in the St. Lawrence and Connecticut River basins. Contains a gazetteer of streams.

ANNUAL REPORTS

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

Annual reports may be purchased (at the price quoted below) from the Superintendent of Documents, Washington, D. C. An asterisk (*) indicates that the report is out of print.

Fourteenth Annual Report of the United States Geological Survey, 1892-93, J.

W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. Pt. II. Accompanying papers, xx, 597 pp., 73 pls. \$2.10. Contains:

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

Seventeenth Annual Report of the United States Geological Survey, 1895-96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. Contains:

*The water resources of Illinois, by Frank Leverett, pp. 695-849, pls. 108-113. Describes the physical features of the State, and the drainage basins, including Illinois, Des Plaines, Kankakee, Fox, Illinois-Vermilion, Spoon, Mackinaw, and Sangamon rivers, Macoupin Creek, Rock River, tributaries of the Mississippi in western Illinois, Kaskaskia, Big Muddy, and tributaries of the Wabash; discusses the rainfall and run-off, navigable waters and water powers, the wells supplying water for rural districts, and artesian wells; contains tabulated artesian well data and water analyses.

Eighteenth Annual Report, United States Geological Survey, 1896-97, Charles D. Walcott, Director. 1897. 5 parts in 6 volumes. Pt. IV. Hydrography, x, 756 pp., 102 pls. \$1.75. Contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419-560, pls. 33-37. Describes Wabash, Whitewater, Great Miami, Little Miami, Scioto, Hocking Muskingum, and Beaver rivers and lesser tributaries of the Ohio in Indiana and Ohio, the streams discharging into Lake Erie and Lake Michigan, and streams flowing to the Upper Mississippi through the Illinois; discusses shallow and drift wells, the flowing wells from the drift and deeper artesian wells, and gives records of wells at many of the cities; describes the mineral springs and gives analyses of the waters, contains also tabulated lists of cities using surface waters for waterworks, and of cities and villages using shallow and deep well waters; discusses the source and quality of the city and village supplies, and gives precipitation tables for various points.

Nineteenth Annual Report of the United States Geological Survey, 1897-98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 volumes and separate case for maps with Pt. V. Pt. IV. Hydrography. \$1.85. Contains:

*The rock waters of Ohio, by Edward Orton, pp. 633-717, pls. 71-73. Describes the principal geologic formations of Ohio and the waters from the different strata; discusses the flowing wells at various points and the artesian wells of the deep preglacial channels in Allen, Auglaize, and Mercer counties; discusses city and village supplies; gives analyses of waters from various formations.

MONOGRAPHS

Monographs may be purchased (at price quoted below) from the Superintendent of Documents, Washington, D. C. An asterisk (*) indicates that the report is out of print. Monographs are of quarto size.

41. Glacial formations and drainage features of the Erie and Ohio basins, by Frank Leverett. 1902. 802 pp., 26 pls. \$1.75.

Treats of an area extending westward from Genesee Valley in New York across northwestern Pennsylvania and Ohio, central and southern Indiana, and southward from Lakes Ontario and Erie to Allegheny and Ohio rivers.

PROFESSIONAL PAPERS

Professional papers may be purchased (at price quoted below) from the Superintendent of Documents, Washington, D. C. An asterisk (*) indicates that the report is out of print. Professional papers are of quarto size.

***135. The composition of the river and lake waters of the United States, by F. W. Clarke. 1924. iv, 199 pp.**

Gives analyses of the water of the Great Lakes and many of their tributaries.

BULLETINS

Bulletins may be purchased (at price quoted below) from the Superintendent of Documents, Washington, D. C. An asterisk (*) indicates that the report is out of print. Bulletins are of octavo size.

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

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin, and detailed record of wells in Onondaga County, N. Y., and Hancock and Wood counties, Ohio. These wells were selected because they gave definite stratigraphic information.

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

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin, and detailed records of wells in Cook County, Ill.; Erie County, N. Y.; Ottawa, Sandusky, and Summit counties, Ohio; and Manitowoc County, Wis. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.² The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

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

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

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

An asterisk (*) indicates that the stock of the folio is exhausted.

***81. Chicago, Illinois-Indiana.**

Describes an area embracing not only the immediate site of the city but adjacent parts of Cook, Dupage, and Will counties, Ill.; gives an account of the water power, discusses the quality of the waters, and gives analyses of waters from artesian wells; gives also a list of papers relating to the geology and paleontology of the area.

***140. Milwaukee special, Wisconsin.**

Gives analyses of spring waters and of artesian water in Milwaukee; also tabulated data concerning wells.

² Index maps showing areas in the St. Lawrence basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director U. S. Geological Survey, Washington D. C.

155. Ann Arbor, Mich. 25c.

Discusses the present lakes, the lakes of the glacial period, and under "Economic geology" the water resources, including the use of the rivers for power and of the underground waters, shallow and artesian, for city and village supplies; discusses the quality of the waters, and gives details by townships.

*169. Watkins Glen-Catatonk, New York.

Includes discussion of water supply at Ithaca.

190. Niagara, N. Y. 50c. field edition.³

Gives analyses of mineral water from well at Akron; discusses briefly the municipal supplies of Buffalo, Niagara Falls, Tonawanda, La Salle, and Youngstown, and the use of Niagara River for power development.

205. Detroit, Mich. 50c. either edition.

Discusses surface and ground waters; gives mineral analyses of water from Lake Huron, from rivers near Detroit, and from salt wells.

MISCELLANEOUS REPORTS

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the St. Lawrence River basin are the reports of the Chief of Engineers, United States Army, the State Geological Survey of Illinois, the Illinois Water-Supply Commission, the Rivers and Lakes Commission of Illinois, the New York State Conservation Commission, the New York State Water-Supply Commission, the New York State engineer and surveyor, the Vermont State geologist, and the water-power report of the Tenth Census (vol. 16). The following reports deserve special mention:

The mineral content of Illinois waters, by Edward Bartow, J. A. Udden, S. W. Parr, and George T. Palmer: Illinois State Geol. Survey Bull. 10, 1909.

Chemical and biological survey of waters of Illinois, by Edward Bartow: Univ. Illinois Pubs. 3, 6, 7, 1906-1909.

Chemical survey of the waters of Illinois, report for the years 1897-1902, by A. W. Palmer, with report on geology of Illinois as related to its water supply, by Charles W. Rolfe: Univ. Illinois Pub.

Diversion of the waters of the Great Lakes by way of the Sanitary and Ship canal of Chicago: A brief of the facts and issues, by Lyman E. Cooley, Chicago, 1913.

The State of Missouri *v.* the State of Illinois and the Sanitary district of Chicago, before Frank S. Bright, commissioner of the Supreme Court of the United State, 1904.

The mineral waters of Indiana, their location, origin, and character, by W. S. Blatchley: Indiana Dept. Geology and Nat. Res. Twenty-sixth Ann. Rept., 1901.

Reports of the water resources investigation of Minnesota, by the State Drainage Commission, 1909-1912.

Water powers of Wisconsin, by L. S. Smith: Wisconsin Geol. and Nat. Hist. Survey Bull. 20, 1908.

First report of the Railroad Commission of Wisconsin to the legislature on water powers, 1915.

³ Library edition out of stock.

Second report of the Railroad Commission of Wisconsin on water powers 1914-1923.

Reexamination of Fox River, Wis.: 67th Cong., 2d sess., H. Doc. 146., 1922.

Special report of the Vermont Water Resources Commission to the legislature of 1921.

Diversion of water from the Great Lakes and Niagara River: Report of Corps of Engineers, 1921.

Hydrology of the State of New York, by George W. Rafter: New York State Mus. Bull. 85, 1905.

Many of these reports can be obtained from the various commissions, and probably all can be consulted in the public libraries of the larger cities.

AREAS AND PUBLICATIONS COVERED

[A=Annual Report; M=Monograph; B=Bulletin; P=Professional papers; W=Water-supply paper;
G F=Geologic folio]

Artesian waters: Essential conditions.....	W 114
Chemical analyses ⁴ : Methods and interpretation.....	W 236, 364; P 135
Engineering methods.....	W 110
Floods.....	W 147, 162
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⁴ Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts

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