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DEPARTMENT OF THE INTERIOR
HUBERT WORK, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

WATER-SUPPLY PAPER 545

SURFACE WATER SUPPLY OF THE UNITED STATES
1922
PART V. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS

NATHAN C. GROVER, Chief Hydraulic Engineer
W. A. LAMB, S. B. SOULE, E. D. BURCHARD, J. B. SPIEGEL
H. E. GROSBACH, and E. L. WILLIAMS
District Engineers

Prepared in cooperation with the States of
NORTH DAKOTA, MINNESOTA, WISCONSIN, IOWA, ILLINOIS, and MISSOURI

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Water Resources Branch,
Geological Survey,
Box 3106, Capitol Station
Oklahoma City, Okla.

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ILLUSTRATIONS

SURFACE WATER SUPPLY OF HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, 1922

AUTHORIZATION AND SCOPE OF WORK

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1922.

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, 1895–1923

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

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 page 9.

Measurements of stream flow have been made at about 5,480 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1922, 1,540 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are 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.

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-feet, gallons per minute, miner's inches, and discharge in second-feet 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-feet, second-feet per square mile, and run-off in inches and acre-feet. They may be defined as follows:

"Second-feet" 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 1 foot per second. It is generally used as a fundamental unit from which others are computed.

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

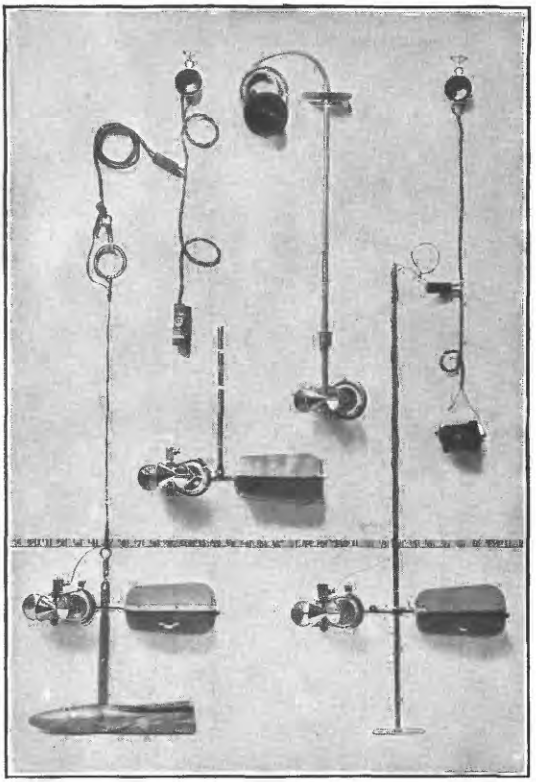
"Run-off in inches" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

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.

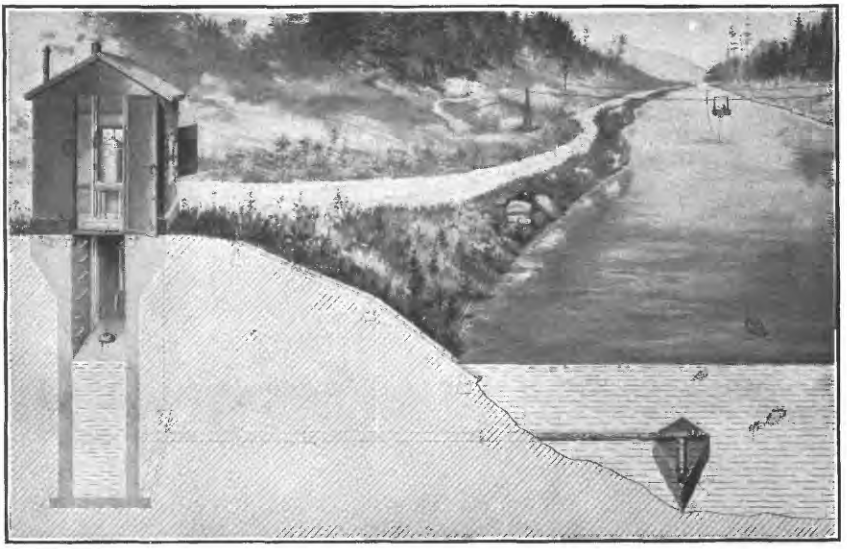
The following terms not in common use are here defined:

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

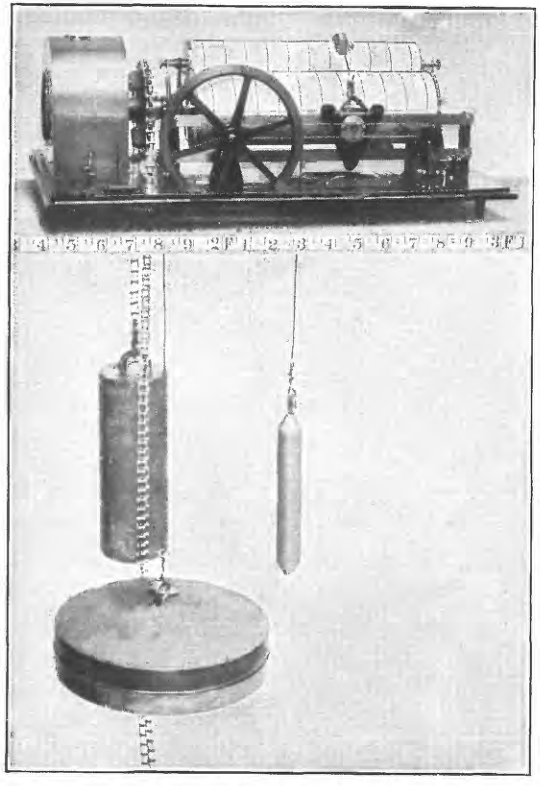
"Control," a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.



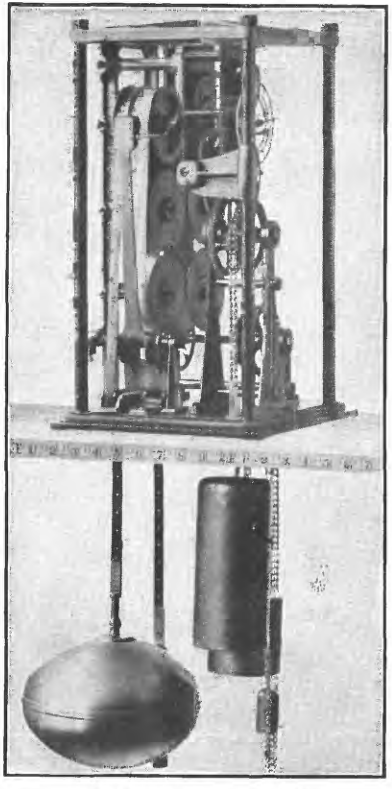
A. PRICE CURRENT METERS.



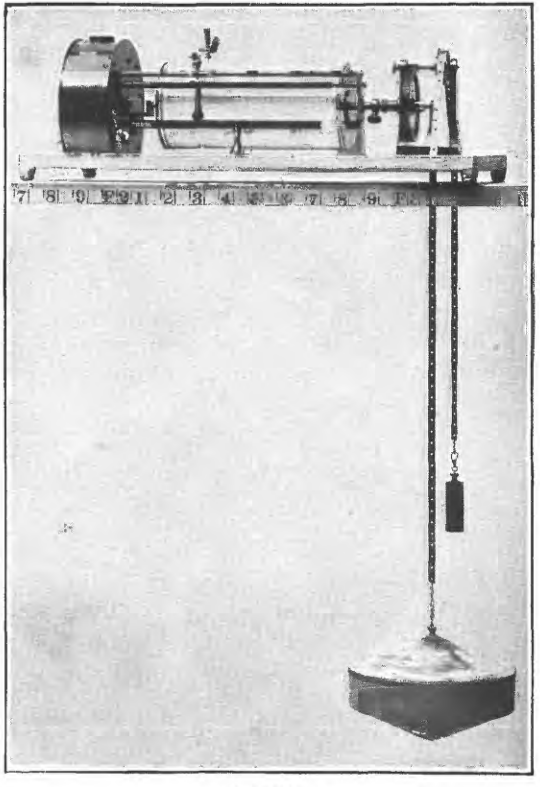
B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.



B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

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, 1921, and ending September 30, 1922. 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 gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) 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 results 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 heights and results 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 affect the constancy 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

105449—25†—WSP 545——2

each day. At stations on streams subject to sudden or rapid diurnal fluctuation 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 permanence 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 heights to the rating table to obtain the daily discharge.[1]

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 quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of 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

[1] For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53-59, 1916.

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 by the Survey in earlier reports 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 located 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 table of monthly discharge gives 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.

PUBLICATIONS

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 investigations of such closely allied subjects as irrigation, water storage, water powers, underground 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 bulletins, professional papers, monographs, 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.
II. South Atlantic slope and eastern Gulf of Mexico basins.
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.

Part 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.

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 obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted,

2. 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.

3. Sets of the reports may be consulted in the libraries of the principal cities of the United States.

4. 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., State House.
Asheville, N. C., 316 Jackson Building.
Chattanooga, Tenn., 37 Municipal Building.
Columbus, Ohio, Brown Hall, Ohio State University.
Chicago, Ill., 1404 Kimball 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, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Calif., 328 Customhouse.
Los Angeles, Calif., 600 Federal Building.
Tucson, Ariz., 210 Agricultural 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 applying to the Director, United States Geological Survey, Washington, D. C.

Stream-flow records have been obtained at about 5,480 points in the United States, and the data obtained have been published in the reports tabulated on pages 7 and 8.

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 September, 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. 4	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 65, 66	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 394	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.

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

The records at most of the stations discussed in these reports extend over a series of years, 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 1922. The data for any particular station will, as a rule, 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, 1899–1922

Year	I North Atlantic slope (St. John River to York River)	II South Atlantic and eastern Gulf of Mexico (James River to the Mississippi)	III Ohio River	IV St. Lawrence River and Great Lakes	V Hudson Bay and upper Mississippi River	VI Missouri River	VII Lower Mississippi River	VIII Western Gulf of Mexico	IX Colorado River	X Great Basin	XI Pacific slope in California	XII North Pacific slope basins: Pacific slope in Washington and upper Columbia River	XII North Pacific slope basins: Snake River basin	XII North Pacific slope basins: Lower Columbia River and Pacific slope in Oregon
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 39	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 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, 78	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	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	[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	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[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	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
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

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. 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. Monthly discharge for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

COOPERATION

In Montana the work was carried on in cooperation with the United States Bureau of Reclamation. With the exception of the station on St. Mary River near Babb, all stations in Montana were maintained jointly with the Reclamation Service, Department of the Interior, Canada.

In North Dakota the work was carried on in cooperation with the State engineer.

In Minnesota the work was carried on in the Red River drainage basin in cooperation with the Minnesota State Drainage Commission, E. V. Willard, commissioner, and with the United States Weather Bureau (Mississippi River at St. Paul and Minnesota River near Mankato) and United States Engineer Corps (Mississippi River at Elk River and Minnesota River near Montevideo).

In Wisconsin the work was carried on in cooperation with the Railroad Commission of Wisconsin, C. M. Larson, chief engineer, and with Wisconsin-Minnesota Light & Power Co. (Red Cedar River near Colfax, Red Cedar River at Cedar Falls, and Red Cedar River at Menomonie).

In Iowa the work was carried on in cooperation with the State Geological Survey, George F. Kay, director; the Iowa Highway Commission, F. R. White, chief engineer; and the Mississippi River Power Co., of Keokuk, Iowa, Albion Davis, hydraulic engineer.

The United States Weather Bureau paid the salaries of gage observers for stations on Cedar River at Cedar Rapids and Des Moines River at Ottumwa and part of the salaries of observers for the stations on Des Moines River near Boone and Raccoon River at Van Meter. The Interstate Power Co., of Chicago, paid the salary of the observer for the station on upper Iowa River near Decorah.

In Illinois the work was carried on in cooperation with the Illinois Department of Public Works and Buildings, division of waterways, W. L. Sackett, superintendent, and at certain stations with the following organizations: United States Public Health Service, J. K. Hoskins, sanitary engineer (Illinois River at Peoria, at Havana, and at Beardstown, Kankakee River at Custer Park, Fox River at Wedron, Vermilion River near Streator; Mackinaw River near Green Valley; Spoon River at Seville; Crooked Creek at Ripley; and Macoupin Creek near Kane); and Central Illinois Public Service Co. (South Fork of Sangamon River at power plant near Taylorville).

In Missouri the work has been maintained in cooperation with the State Geological Survey, through H. A. Buehler, State geologist.

DIVISION OF WORK

The data for stations in the Hudson Bay basin in Montana and North Dakota were collected and prepared for publication under the direction of W. A. Lamb, district engineer, Helena, Mont., assisted by A. H. Tuttle and E. F. Chandler.

The data for stations in the Hudson Bay basin in Minnesota were collected and prepared for publication under the direction of S. B. Soulé, district engineer, and by E. F. Chandler, assisted by Edgar E. Foster, Kenneth H. Oakley, and R. V. Tilly.

The data for stations in the Mississippi River basin in Wisconsin and Minnesota were collected and prepared for publication under the direction of S. B. Soulé, district engineer, assisted by Edgar E. Foster, S. R. Collins, and Arthur O. Olson.

The data for stations in the Mississippi River basin in Iowa were collected by E. D. Burchard until March 11, 1922, and after that date were collected and prepared for publication under the direction of J. B. Spiegel, district engineer, assisted by C. Herlofson and Albion Davis.

The data for stations in the upper Mississippi River basin in Illinois were collected and prepared for publication under the direction of H. E. Grosbach, district engineer, assisted by A. M. Wahl.

The data for stations in the upper Mississippi River basin in Missouri were collected and prepared for publication under the direction of E. L. Williams, district engineer, assisted by Reginald Waldo, V. L. Austin, W. R. Denison, H. E. Zoller, and Miss Jean I. McCaw.

The records were received and manuscript assembled by E. E. R. Dornbach.

GAGING-STATION RECORDS

HUDSON BAY DRAINAGE BASIN

ST. MARY RIVER NEAR BABB, MONT

[Including diversion from Swiftcurrent Creek]

LOCATION.—In SE. ¼ sec. 27, T. 36 N., R. 14 W., above headworks of the United States Bureau of Reclamation St. Mary canal and 1 mile east of Babb, Glacier County, on Blackfeet Indian Reservation.

DRAINAGE AREA.—278 square miles (including area of Swiftcurrent Creek above point of diversion into St. Mary Lake); measured on topographic maps.

RECORDS AVAILABLE.—January 1, 1902, to September 30, 1922.

GAGE.—Stevens water-stage recorder in wooden shelter on right bank 20 feet above diversion dam and referenced to staff gage which reads the head on the crest. Chain gage on right bank 1,040 feet above headworks was read prior to October 1, 1921. Gages read by employees of United States Bureau of Reclamation.

DISCHARGE MEASUREMENTS.—Made from cable 560 feet below chain gage or by wading 800 feet below chain gage.

CHANNEL AND CONTROL.—Channel practically permanent. Banks high not subject to overflow. Concrete diversion works for St. Mary canal form the control. Dam is provided with flashboard sluice gates near canal

head gates. When canal gates are closed and flashboards are at level crest of dam, the stage-discharge relation remains stable.

EXTREMES OF DISCHARGE.—Maximum discharge, 4,970 second-feet June 7. Minimum stage, 0.35 foot (staff gage at dam) March 17–21 (discharge, 110 second-feet).

1902–1922: Maximum stage recorded, estimated 9.4 feet June 5, 1908 (discharge, 7,980 second-feet); minimum discharge, 30 second-feet; April April 3–7, 1904.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—Natural storage in St. Mary Lakes. Swiftcurrent Creek was diverted into St. Mary Lake October 1, 1915, and the flow is regulated by gate operations at Sherburne Lake reservoir.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 300 and 3,750 second-feet. Mean daily gage height obtained from graph of water-stage recorder October 1 to November 10 and May 15 to September 30. Staff gage read once daily to hundredths for remainder of year. Daily discharge ascertained by applying mean daily gage height to rating table and adding flow in canal for period May 20 to September 30. Records good.

Discharge measurements of St. Mary River near Babb, Mont., during the year ending Sept. 30, 1922

[Made by W. A. Lamb]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
May 15	1.16	793	Aug. 7	0.76	393
June 15	2.41	3,460	18	1.04	679
July 11	1.18	839	Sept. 9	.75	354
17	.95	460			

NOTE.—Measurements made from cable above diversion dam and flow of canal subtracted to obtain flow over crest of dam.

Daily discharge, in second-feet, of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1922

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	540	800	209	129	129	385	2,910	1,550	823	658
2	638	800	196	129	129	464	3,040	1,510	812	642
3	662	590	209	125	129	520	3,160	1,440	792	633
4	675	510	209	120	134	570	3,610	1,400	826	633
5	688	473	209	120	145	675	4,190	1,400	841	633
6	712	437	209	115	140	800	4,770	1,370	867	642
7	770	385	222	115	134	800	4,970	1,310	855	642
8	800	385	222	120	140	800	4,790	1,340	861	642
9	800	385	------	129	134	815	4,450	1,380	887	633
10	800	369	------	129	140	770	4,140	1,360	915	617
11	800	336	------	120	140	740	3,800	1,330	921	601
12	800	313	------	120	134	740	3,620	1,240	928	578
13	740	313	------	120	129	725	3,630	1,170	937	576
14	740	306	------	115	129	740	3,710	1,120	927	566
15	740	306	------	115	129	800	3,740	1,060	940	564
16	740	284	------	115	134	908	3,720	1,050	948	556
17	725	276	------	110	140	1,280	3,610	1,020	913	549
18	800	261	------	110	134	1,470	3,550	1,020	930	541
19	800	248	------	110	140	1,650	3,450	1,070	922	524
20	800	235	------	110	151	1,950	3,220	1,100	933	524
21	800	235	------	110	168	2,430	2,720	1,160	930	509
22	830	235	------	120	190	2,460	2,530	1,160	899	504
23	800	235	------	115	203	2,300	2,270	1,130	870	476
24	785	235	------	110	209	2,160	2,100	1,150	864	463
25	785	235	------	115	222	2,550	1,900	1,130	797	450
26	770	235	------	120	228	3,050	1,770	1,110	743	437
27	770	235	------	120	235	3,450	1,720	1,090	698	431
28	770	222	------	125	241	3,570	1,670	1,080	678	424
29	770	222	------	125	298	3,470	1,640	1,020	666	428
30	770	216	------	129	361	3,200	1,600	934	667	419
31	800	------	------	129	------	3,020	------	869	666	------

NOTE.—Stage-discharge relation affected by ice Dec. 9 to Feb. 28; discharge not computed.

Monthly discharge of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1922

Month	Discharge in second feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	830	540	755	46,400
November	800	216	344	20,500
December 1-8	222	196	211	3,250
March	129	110	119	7,320
April	361	129	169	10,100
May	3,570	385	1,590	97,800
June	4,970	1,600	3,200	190,000
July	1,550	869	1,200	73,800
August	948	666	847	52,100
September	658	419	550	32,700

ST. MARY RIVER NEAR KIMBALL, ALBERTA

LOCATION.—In SW. ¼ sec. 25, T. 1 N., R. 25 W. fourth meridian, 1 mile south and 1 mile west of Kimball, Alberta; and 5 miles north of international boundary.

DRAINAGE AREA.—472 square miles (measured on topographic maps).

RECORDS AVAILABLE.—January 1, 1913, to September 30, 1922. September 1, 1902, to December 31, 1912, records were obtained at a point half a mile north of boundary line. Records were also obtained by the irrigation branch, Department of Interior, Canada, at a point half a mile below present

station, from 1905 to 1912. The discharge at the three points is practically the same.

GAGE.—Stevens continuous water-stage recorder in a concrete well and shelter on right bank used during open-water season. During winter a chain gage located on highway bridge 3 miles below station is used.

DISCHARGE MEASUREMENTS.—Made from cable 1,200 feet above gage and by wading near gage.

CHANNEL AND CONTROL.—Bed of stream at gage and at control is composed of boulders and sandstone ledges. Control is formed by an outcropping ledge of sandstone covered with boulders near left bank. Shifts occasionally during high stage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 6.55 feet at 8 a. m., June 7 (discharge, 5,260 second-feet); minimum discharge, 90 second-feet, March 26–29, when channel was obstructed by ice.

1902–1922: Maximum discharge, 18,000 second-feet, June 5, 1908, estimated by comparison with record for station near Babb; minimum discharge, 46 second-feet, December 1, 1919, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—St. Mary canal, constructed by United States Bureau of Reclamation, diverts water from St. Mary River near Babb, Mont., to North Fork of Milk River. Alberta Railway & Irrigation Co. canal diverts from St. Mary River 2 miles below station.

REGULATION.—Flow of Swiftcurrent Creek regulated by Sherburne Lake reservoir, operated by United States Bureau of Reclamation.

ACCURACY.—Stage-discharge relation affected by ice and by shifting control Three rating curves used. Curve October 1 to November 7 well defined between 300 and 4,450 second-feet; May 1 to June 7 well defined between 100 and 500 second-feet; June 8 to September 30 well defined between 350 and 5,000 second-feet. Mean daily gage height October 1 to November 13 and May 1 to September 30 determined by straight-line method or by inspection of water-stage recorder graph. Chain gage read twice daily to hundredths November 14 to April 30. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

COOPERATION.—Maintained in cooperation with the Department of Interior, Canada.

Discharge measurements of St. Mary River near Kimball, Alberta, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 9	A. W. P. Lowrie [a]	3.63	976	Apr. 18	A. W. P. Lowrie	6.21	134
26	G. H. Nettleton [a]	3.66	925	May 5	do	3.90	1,160
Nov. 22	do	4.15	206	13	do	3.75	1,060
30	W. S. McDonald [a]	4.17	234	June 7	do	6.55	5,240
Dec. 21	J. G. Culshaw [a]	6.04	467	27	do	4.48	1,630
Jan. 11	do	6.14	169	July 13	W. A. Lamb	3.90	1,050
28	W. S. McDonald	6.47	183	Aug. 12	do	3.09	497
Feb. 18	do	6.59	122	21	C. Errington [a]	3.54	784
Mar. 8	do	6.03	97	29	do	3.03	478
25	A. W. P. Lowrie	6.21	92	Sept. 15	A. W. P. Lowrie	2.79	371
Apr. 3	do	6.55	162				

[a] Engineer, Dominion Water Power Branch.

NOTE.—Measurement on Aug. 12 made below intake of Alberta Railway & Irrigation canal. Flow in canal added to obtain total flow passing gage.

Daily discharge, in second-feet, of St. Mary River near Kimball, Alberta, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	623	878	250	200	180	125	130	955	3,430	1,520	667	460
2	680	840	275	195	175	130	150	1,070	3,450	1,390	641	455
3	748	761	290	190	175	135	162	995	3,740	1,320	622	438
4	782	642	290	185	170	120	165	1,000	4,220	1,250	641	430
5	848	536	280	175	170	110	160	1,200	4,750	1,250	579	426
6	892	471	265	180	165	100	160	1,200	5,040	1,220	511	430
7	939	430	270	185	165	100	160	1,240	5,250	1,100	480	442
8	923	400	280	190	160	97	160	1,260	5,140	1,210	490	450
9	931	380	265	195	150	100	155	1,200	4,820	1,410	485	426
10	947	365	270	185	140	100	155	1,130	4,560	1,450	495	406
11	947	350	280	169	135	100	155	1,090	4,220	1,270	490	392
12	931	315	290	160	130	100	150	1,070	4,080	1,070	490	378
13	915	290	295	150	130	100	160	1,040	4,100	1,060	480	378
14	900	280	305	145	130	100	165	1,050	4,160	937	465	369
15	878	260	315	145	135	100	160	1,120	4,220	882	465	369
16	862	240	325	145	135	100	155	1,290	4,240	875	460	360
17	826	220	340	150	125	95	145	1,760	4,140	762	572	357
18	826	215	350	150	122	95	137	2,100	4,100	702	762	357
19	804	215	370	155	120	95	160	2,300	4,000	702	800	351
20	848	240	400	160	110	95	260	2,570	3,800	755	800	345
21	900	215	467	160	110	95	300	2,920	3,470	868	792	335
22	908	206	460	170	115	95	250	3,050	2,890	1,030	778	338
23	931	210	440	170	125	95	300	2,730	2,630	1,040	762	322
24	987	215	400	175	130	95	270	2,520	2,400	1,040	732	316
25	1,010	220	350	175	130	92	340	3,000	2,090	1,040	667	314
26	1,000	235	300	185	125	90	535	3,680	1,820	1,040	579	308
27	939	240	250	190	120	90	595	3,890	1,650	1,010	516	304
28	908	235	270	183	120	90	610	4,070	1,620	969	490	312
29	923	235	250	180	-------	90	675	4,180	1,570	921	465	314
30	908	234	230	180	-------	95	1,260	3,870	1,580	808	450	342
31	892	-------	220	180	-------	105	-------	3,560	-------	718	455	-------

NOTE.—Stage-discharge relation affected by ice Nov. 8 to Apr. 30; discharge computed by use of discharge measurements, observer's notes, and temperature records.

Monthly discharge of St. Mary River near Kimball, Alberta, for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,010	623	882	54,200
November	878	206	352	20,900
December	467	220	311	19,100
January	200	145	173	10,600
February	180	110	139	7,720
March	135	90	101	6,210
April	1,260	130	278	16,500
May	4,180	955	2,070	127,000
June	5,250	1,570	3,570	212,000
July	1,520	702	1,050	64,600
August	800	450	583	35,800
September	460	304	374	22,300
The year	5,250	90	826	597,000

ST. MARY CANAL AT INTAKE, NEAR BABB, MONT.

LOCATION.—In NW. ¼ NE. ¼ sec. 27, T. 36 N., R. 14 W., 600 feet below intake of canal on Blackfeet Indian Reservation, 1 mile east of Babb, Glacier County.

RECORDS AVAILABLE.—June 1, 1918, to September 30, 1922.

GAGE.—Gurley printing water-stage recorder in wooden shelter on right bank. Prior to April 17, 1919, a staff gage 300 feet above present gage was read. Both gages were set to read the same but are not at same datum on account of slope in canal between the points.

DISCHARGE MEASUREMENTS.—Made from cable 10 feet above gage. Current is evenly distributed throughout cross section and has a moderate velocity at all stages.

CHANNEL AND CONTROL.—Bed composed of gravel.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge 650 second-feet August 16.

1918–1922: Maximum mean daily discharge 655 second-feet August 8, 1920.

ICE.—Canal not operating during winter.

ACCURACY.—Stage-discharge relation not permanent; affected by puddling of canal below gage which reduced seepage loss and consequently changed the water-surface slope in canal. Two rating curves used, both well defined between 10 and 650 second-feet; one applicable May 20 to July 20; the other July 21 to September 30. Mean daily gage height obtained from record of water-stage recorder. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

COOPERATION.—Maintained in cooperation with the Department of Interior, Canada.

Water is diverted from St. Mary River for irrigation of lands in Milk River Valley east of Havre, Mont. Water may be returned to St. Mary River at St. Mary siphon.

Discharge measurements of St. Mary canal at intake, near Babb, Mont., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
May 24	A. W. P. Lowrie [a]	3.06	163	Aug. 30	C. Errington [a]	4.16	251
June 15	do	3.96	239	Sept. 9	W. A. Lamb	4.15	246
17	W. A. Lamb	3.96	244	19	A. W. P. Lowrie	3.97	228
July 11	A. W. P. Lowrie	5.71	471	28	do	3.97	227
28	do	4.14	246	29	do	3.20	159
Aug. 7	W. A. Lamb	5.79	452	29	do	2.77	114
11	do	6.35	560	30	do	2.30	83
16	S. G. Dawson [b]	7.00	662	30	do	.78	7.1
18	W. A. Lamb	4.47	278				

[a] Engineer, Dominion Water Power Branch.
[b] Engineer, Canadian Reclamation Service.

Daily discharge, in second-feet, of St. Mary canal at intake, near Babb, Mont., for the period May 20 to Sept. 30, 1922

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept
1		220	438	243	248	16		243	474	650	228
2		225	472	242	248	17		247	473	440	228
3		235	477	242	248	18		252	472	318	228
4		231	480	276	248	19		270	467	297	226
5		232	481	368	248	20	17	287	438	295	226
6		236	481	439	248	21	70	286	373	292	225
7		244	483	470	248	22	81	310	255	274	228
8		244	484	492	248	23	122	340	254	258	228
9		241	487	502	248	24	157	344	254	252	228
10		238	456	530	248	25	167	347	258	247	228
11		235	470	560	248	26	170	363	254	243	228
12		243	473	584	242	27	172	398	247	243	228
13		249	472	601	232	28	173	412	246	241	196
14		246	473	614	230	29	173	415	247	238	130
15		243	472	634	228	30	201	435	246	248	75
						31	210		244	247	

Monthly discharge of St. Mary canal at intake, near Babb, Mont., for the period May 20 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 20–31	210	17	143	3,400
June	435	220	284	16,900
July	487	244	397	24,400
August	650	238	374	23,000
September	248	75	226	13,400
The period				81,100

ST. MARY CANAL AT ST. MARY CROSSING, NEAR BABB, MONT.

LOCATION.—In NE. ¼ sec. 30, T. 37 N., R. 13 W. Montana meridian, 250 feet east of outlet of St. Mary River siphon, 10 miles below intake and 9 miles north of Babb, Glacier County.

RECORDS AVAILABLE.—July 6, 1918, to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder in wooden shelter on right bank.

DISCHARGE MEASUREMENTS.—Made from cable 188 feet below gage.

CHANNEL AND CONTROL.—Control is located at head of steel flume 50 feet below gage.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge 480 second-feet August 16.

1918–1922: Maximum mean daily discharge, 480 second-feet August 8, 1920, and August 16, 1922.

ICE.—Canal not operating during winter.

ACCURACY.—Stage-discharge relation affected by shifting control during July. Two rating curves, both well defined, used May 21 to July 21 and July 22 to September 30. Mean daily gage height obtained from graph of water-stage recorder by straight-line method. Daily discharge ascertained by applying mean daily gage height to rating table except on days of considerable fluctuation when hourly discharge method was used. Records good.

COOPERATION.—Maintained in cooperation with the Department of Interior, Canada.

Discharge measurements of St. Mary canal at St. Mary crossing, near Babb, Mont., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
May 23	A. W. P. Lowrie [a]	1.88	82	Aug. 19	S. G. Dawson [b]	3.33	258
24	do	2.32	124	23	do	3.10	227
June 16	Lamb and Lowrie	2.95	197	30	C. Errington [a]	3.04	217
July 12	W. A. Lamb	4.10	405	Sept. 9	W. A. Lamb	3.08	217
28	A. W. P. Lowrie	3.05	210	19	A. W. P. Lowrie	2.98	194
Aug. 11	W. A. Lamb	4.45	426	28	do	2.99	197
14	do	4.67	461	29	do	2.50	136
16	S. G. Dawson [b]	4.78	488	30	do	2.12	100

[a] Engineer, Dominion Water Power Branch.
[b] Engineer, Canadian Reclamation Service.

Daily discharge, in second-feet, of St. Mary canal at St. Mary crossing, near Babb, Mont., for the period May 21 to Sept. 30, 1922

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1		178	377	206	214	16		200	396	480	199
2		180	402	204	216	17		200	396	388	198
3		186	408	204	214	18		203	396	278	198
4		189	406	214	216	19		210	394	253	199
5		192	408	284	214	20		235	372	253	198
6		196	410	337	216	21	4	237	351	250	201
7		201	412	366	217	22	26	259	228	238	204
8		203	414	382	218	23	75	288	216	222	202
9		202	416	392	217	24	121	295	217	214	202
10		197	392	406	217	25	134	306	218	205	201
11		194	400	430	216	26	140	337	218	205	202
12		194	400	446	214	27	141	352	214	202	202
13		205	402	454	204	28	144	354	212	205	194
14		200	398	462	205	29	149	370	211	205	135
15		200	396	473	201	30	162	375	210	211	91
						31	168		208	214	

NOTE.—Discharge interpolated June 4 and 5.

Monthly discharge of St. Mary canal at St. Mary crossing, near Babb, Mont., for the period May 21 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 21-31	168	4	115	2,510
June	375	178	238	14,200
July	416	208	339	20,800
August	480	202	299	18,400
September	218	91	201	12,000
The period				67,900

ST. MARY CANAL AT HUDSON BAY DIVIDE, NEAR BROWNING, MONT.

LOCATION.—In sec. 5, T. 37 N., R. 11 W., 3 miles above canal outlet, 30 miles north of Browning, Glacier County, on Blackfeet Indian Reservation.

RECORDS AVAILABLE.—July 3, 1917, to September 30, 1922.

GAGE.—Stevens water-stage recorder in wooden shelter on right bank 50 feet above control.

DISCHARGE MEASUREMENTS.—Made from cable 500 feet above gage.

CHANNEL AND CONTROL.—Canal uniform in section. Control is a V-shaped notch in the concrete drop just below gage.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge 482 second-feet August 17.

1917–1922: Maximum mean daily discharge that of 1922.

ICE.—Canal not operating during winter.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 20 and 500 second-feet. Mean daily gage height determined from graph of water-stage recorder by straight-line method. Daily discharge ascertained by applying mean daily gage height to rating table except for days of large fluctuation when hourly method was used and for days when inlet pipe was clogged with silt. Records good.

COOPERATION.—Station maintained in cooperation with the Department of Interior, Canada.

The canal diverts water from St. Mary River in NE. ¼ sec. 27, T. 36 N., R. 14 W., and discharges into North Fork of Milk River. The water is used for irrigation of lands in the Milk River valley east of Havre, Mont.

Discharge measurements of St. Mary canal at Hudson Bay divide, near Browning, Mont., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
May 24	A. W. P. Lowrie [a]	3.14	91	Aug. 31	C. Errington [a]	4.36	220
June 17	do	4.24	197	Sept. 10	W. A. Lamb	4.46	219
July 13	do	5.48	390	14	A. W. P. Lowrie	4.36	204
Aug. 5	do	4.49	237	28	S. G. Dawson	4.16	188
12	W. A. Lamb	5.70	429	30	do	3.51	109
24	S. G. Dawson [b]	4.37	217				

[a] Engineer, Dominion Water Power Branch. [b] Engineer, Canadian Reclamation Service.

Daily discharge, in second-feet, of St. Mary canal at Hudson Bay divide near Browning, Mont., for the period May 23 to Sept. 30, 1922

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1		162	353	205	210	16		194	385	474	194
2		170	361	204	210	17		195	383	482	192
3		175	378	203	211	18		192	385	339	191
4		182	383	203	212	19		199	385	274	194
5		179	389	227	214	20		205	380	252	194
6		180	393	287	214	21		227	362	238	191
7		182	399	337	214	22		228	321	238	191
8		190	412	364	215	23	26	249	237	224	189
9		193	422	385	215	24	77	270	216	209	196
10		193	410	399	219	25	119	278	216	205	199
11		192	387	414	221	26	136	291	217	201	196
12		187	387	428	219	27	139	315	216	199	199
13		188	387	438	213	28	147	328	210	195	187
14		196	385	448	208	29	154	339	206	198	166
15		193	385	458	205	30	147	349	206	199	127
						31	155		206	205	

NOTE.—No gage-height record Sept. 1-10, 17-27; discharge estimated.

Monthly discharge of St. Mary canal at Hudson Bay divide, near Browning, Mont., for the period May 23 to Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 23-31	155	26	122	2,180
June	349	162	221	13,200
July	422	206	334	20,500
August	482	195	295	18,100
September	221	127	200	11,900
The period				65,900

SWIFTCURRENT CREEK AT MANY GLACIER, MONT.

LOCATION.—In sec. 12, T. 35 N., R. 16 W., at outlet of McDermott Lake at Many Glacier, Glacier County, in Glacier National Park, 14 miles southwest of Babb.

DRAINAGE AREA.—31.4 square miles (measured on topographic map).

RECORDS AVAILABLE.—June 6, 1912, to September 30, 1922.

GAGE.—Stevens water-stage recorder installed June 15, 1918, in shelter built by park officials and Great Northern Railway, and referred to two staff gages, one inside and one outside the well. Prior to May 23, 1916, a staff gage on left bank opposite present gage was read. May 23, 1916, to June 15, 1918, a vertical staff at same location as present gage. Gage read by C. N. McGillis.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet below gage or by wading. Prior to June 26, 1920, measurements were made from highway bridge above power house. Section at bridge poor.

CHANNEL AND CONTROL.—Limestone outcrop at the outlet of the lake forms control; shifts slightly. Just below the control is a fall and a cataract.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.58 feet at 4 a. m. May 20 (discharge, 868 second-feet); minimum stage, 1.22 feet November 6 and 7 (discharge, 10 second-feet).

1912–1922: Maximum stage recorded, 4.75 feet June 17, 1916 (discharge, 1,550 second-feet); minimum stage, that of November 6 and 7, 1921.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. One curve used October 1 to November 7 well defined between 100 and 1,000 second-feet. Second curve applicable May 9 to August 27, well defined between 100 and 700 second-feet. Third curve used August 28 to September 30, well defined between 40 and 250 second-feet. Mean daily gage height determined from graph of water-stage recorder by straight-line method. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records good.

COOPERATION.—Station maintained in cooperation with Department of Interior, Canada.

Discharge measurements of Swiftcurrent Creek at Many Glacier, Mont., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
June 16	A. W. P. Lowrie [a]	3.25	670	Aug. 30	C. Errington [a]	2.01	101
July 15	W. A. Lamb	2.42	250	31	do	2.02	104
29	A. W. P. Lowrie	2.09	133	Sept. 30	A. W. P. Lowrie	1.70	43
Aug. 16	W. A. Lamb	1.99	105				

[a] Engineer, Dominion Water Power Branch.

Daily discharge, in second-feet, of Swiftcurrent Creek at Many Glacier, Mont., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	May	June	July	Aug.	Sept.
1	76	43			355	145	110
2	72	28			322	151	110
3	72	17			326	160	96
4	72	12			345	163	94
5	72	12			330	157	92
6	68	10			315	151	88
7	70	10			300	139	79
8	55				284	134	73
9	54		115		269	134	64
10	54		131	434	254	136	61
11	54			455	239	134	68
12	53			619	224	139	77
13	53			736	243	126	83
14	51			760	220	107	85
15	53		202	700	252	103	83
16	50		322	683	228	110	79
17	49		642	631	195	103	79
18	54		636	602	179	100	73
19	54		760	546	182	110	66
20	58		802	466	186	120	47
21	151		718	445	179	107	59
22	202			424	166	100	58
23	157			403	157	96	50
24	123			382	157	105	50
25	103			361	154	105	48
26	85			340	148	103	47
27	76			364	131	103	52
28	70			384	131	98	50
29	78			384	136	103	46
30	68			379	136	100	44
31	56				142	108	

NOTE.—No gage-height record June 21–25 and July 5–11; discharge interpolated.

Monthly discharge of Swiftcurrent Creek at Many Glacier, Mont., for the year ending Sept. 30, 1922

[Drainage area, 31.4 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	202	49	76.2	2.43	2.80	4,690
Nov. 1–7	43	10	18.9	.602	.16	262
June 10–30	760	340	500	15.9	12.4	20,800
July	355	131	222	7.07	8.15	13,600
August	163	96	121	3.85	4.44	7,440
September	110	44	70.4	2.24	2.50	4,190

SWIFTCURRENT CREEK AT SHERBURNE, MONT.

LOCATION.—In sec. 35, T. 36 N., R. 15 W., 800 feet below spillway of Sherburne Lake dam, at Sherburne, Glacier County.

DRAINAGE AREA.—64 square miles (measured on topographic map).

RECORDS AVAILABLE.—July 1, 1912, to September 30, 1922.

GAGE.—Stevens water-stage recorder installed May 18, 1921, on left bank 800 feet below spillway of Sherburne Lake dam referred to staff gage at same site installed August 10, 1920. From July 1, 1912, to November 9, 1914,

a vertical staff gage was maintained on left bank near outlet of lake and at a different datum from present gage. November 10, 1914, to August 9, 1920, staff gage on left bank 300 feet below spillway of the Sherburne Lake dam.

DISCHARGE MEASUREMENTS.—Made by wading and from cable 450 feet above gage.

CHANNEL AND CONTROL.—An outcropping limestone ledge, somewhat broken and irregular, forms the control and is subject to slight shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.10 feet at 1 a. m. June 7 (discharge, 1,240 second-feet); minimum stage, 0.01 foot June 26 (discharge, 0.1 second-foot).

1912–1922: Maximum stage recorded, 7.85 feet June 17, 1916 (discharge, 2,280 second-feet); minimum discharge, no flow, when gates were closed in several periods in 1918, 1919, and 1921.

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

DIVERSIONS.—None.

REGULATION.—Flow regulated by gate operations.

ACCURACY.—Stage-discharge relation not permanent, changed during period when affected by ice. Rating curve used October 1 to November 15 well defined; that used from December 9 to September 30 well defined. Mean daily gage height obtained from graph of water-stage recorder by straight-line method October 1 to November 23, May 8 to June 20, and July 11 to September 30. Outside gage read to hundredths twice daily December 9 to May 7 and June 21 to July 10. No gage-height record November 24 to December 8. Daily discharge ascertained by applying mean daily gage height to rating table except for days of considerable fluctuation when hourly method was used and as explained in footnote to table of daily discharge. Records good.

COOPERATION.—Station maintained in cooperation with Department of Interior, Canada.

Discharge measurements of Swiftcurrent Creek at Sherburne, Mont., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 7	A. W. P. Lowrie[a]	4.09	508	July 29	A. W. P. Lowrie	2.94	223
7	do	3.67	384	Aug. 11	W. A. Lamb	3.82	400
May 15	W. A. Lamb	3.27	285	23	S. G. Dawson[b]	4.18	491
June 15	A. W. P. Lowrie	5.50	1,010	Sept. 9	W. A. Lamb	3.25	292
16	W. A. Lamb	5.45	958	16	S. G. Dawson	3.02	227
July 11	A. W. P. Lowrie	.08	.20	18	A. W. P. Lowrie	2.94	221

[a] Engineer, Dominion Water Power Branch.
[b] Engineer, Canadian Reclamation Service.

Daily discharge, in second-feet, of Swiftcurrent Creek at Sherburne, Mont., for the year ending Sept. 30, 1922

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	411	473		97	29	22	22	239	1,020	0.6	218	273
2	458	321		74	7.8	22	22	267	1,020	.4	218	269
3	542	194		73	7.8	13	23	254	1,050	.4	229	267
4	567	59		51	4.2	7.0	24	279	1,070	.4	256	263
5	609	2.6	1.5	48	5.0	7.8	24	326	1,100	.4	243	288
6	623	2.6		43	21	19	27	267	1,150	.4	282	298
7	548	2.4		42	39	26	30	300	1,170	.6	309	292
8	617	2.6		43	40	27	35	279	1,140	.6	374	286
9	662	2.2	127	36	34	23	36	239	1,120	2.6	395	279
10	643	2.2	171	36	34	23	35	237	1,070	1.0	413	271
11	630	1.8	158	33	31	22	34	235	1,030	.8	418	265
12	621	1.4	184	35	30	20	33	242	989	.6	431	258
13	606	1.2	188	37	30	20	31	248	989	.5	444	248
14	587	1.4	188	36	31	20	30	254	993	.4	497	242
15	566	1.4	224	36	13	20	30	284	989	.4	523	237
16	554		220	36	10	20	31	374	977	.5	566	233
17	539		217	36	29	20	30	378	960	52	576	229
18	566		215	34	30	21	30	8.4	932	120	566	224
19	609		206	34	29	21	31	7.4	895	258	550	218
20	646		202	32	28	20	35	255	433	299	541	215
21	627		199	32	26	22	56	386	3.2	410	529	208
22	606		195	31	26	22	76	7.0	4.2	405	520	200
23	587	1.5	188	29	26	23	84	6.6	.6	406	508	188
24	569		213	28	25	23	96	427	.6	455	421	179
25	539		209	9	25	24	100	915	.6	450	302	171
26	518		213	27	24	23	92	919	.1	447	298	188
27	521		206	28	24	22	89	956	.4	442	294	206
28	600		227	32	23	22	105	1,000	.4	436	290	209
29	581		209	32	-------	22	242	1,010	.4	302	286	167
30	536		206	31	-------	22	235	1,020	.6	218	279	94
31	518	-------	184	30	-------	22	-------	1,020	---------	222	277	-------

NOTE.—Stage-discharge relation affected by ice Nov. 16 to Dec. 8; discharge estimated. Braced figures indicate mean discharge for period.
Gates closed Nov. 5 to Dec. 8. June 21 to July 16, flow represents seepage and inflow above gage.

Monthly discharge of Swiftcurrent Creek at Sherburne, Mont., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	662	411	574	35,300
November	473	1.2	36.4	2,170
December	227	----------	147	9,040
January	97	9	38.7	2,380
February	40	4.2	24.4	1,360
March	27	7.0	20.7	1,270
April	242	22	58.9	3,500
May	1,020	6.6	408	25,100
June	1,170	.1	670	39,900
July	455	.4	168	10,300
August	576	218	389	23,900
September	298	94	232	13,800
The year	1,170	.1	232	168,000

CANYON CREEK NEAR MANY GLACIER, MONT.

LOCATION.—At edge of heavy-timber area, half a mile above mouth, in Glacier National Park, 2 miles southeast of Many Glacier, Glacier County.

DRAINAGE AREA.—7.0 square miles (measured on topographic map).

RECORDS AVAILABLE.—July 12, 1918, to September 30, 1922.

GAGE.—Stevens continuous water-stage recorder on left bank.

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

CHANNEL AND CONTROL.—Bed of stream covered with heavy boulders and cobblestones. Control is riffle 20 feet below gage; may shift at high stage. Banks high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.34 feet at 11.30 p. m. May 16 (discarge, 500 second-feet, by extension of rating curve); minimum stage, 0.66 foot at 2 p. m. September 30 (discharge, 7.7 second-feet).

1918–1922: Maximum stage, that of 1922; minimum stage, 0.56 foot October 4, 1919 (discharge, 3.3 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during latter part of year. Rating curve fairly well defined between 5 and 140 second-feet. Mean daily gage heights obtained from graph of water-stage recorder by straight-line method. Daily discharge ascertained by applying mean daily gage height to rating table October 7 to November 7 and May 9 to June 5 except as explained in footnote to table of daily discharge. Indirect method used June 16 and June 19 to September 30. Records fair.

COOPERATION.—Station maintained in cooperation with Department of Interior, Canada.

Discharge measurements of Canyon Creek near Many Glacier, Mont., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 7	A. W. P. Lowrie [a]	1.04	15.2	Aug. 23	S. G. Dawson [b]	0.91	14.2
June 16	Lamb and Lowrie	1.68	86	30	C. Errington [a]	.93	14.2
July 12	W. A. Lamb	1.37	44.0	Sept. 8	W. A. Lamb	.82	12.2
29	A. W. P. Lowrie	1.07	22.0	18	A. W. P. Lowrie	.79	11.8
Aug. 16	W. A. Lamb	.95	14.5	30	do	.66	7.8

[a] Engineer, Dominion Water Branch.
[b] Engineer, Canadian Reclamation Service.

Daily discharge, in second-feet, of Canyon Creek near Many Glacier, Mont., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	May	June	July	Aug.	Sept.
1	25	27	-------	112	52	26	16
2	23	22	-------	140	50	28	16
3	21	18	-------	171	56	28	13
4	19	16	-------	178	64	28	13
5	17	15	-------	153	56	28	13
6	16	15	-------	146	41	26	12
7	15	15	-------	140	54	24	12
8	15	-------	-------	134	60	23	12
9	13	-------	13	128	75	23	11
10	12	-------	12	122	68	24	12
11	12	-------	12	116	54	23	14
12	12	-------	18	110	45	24	15
13	11	-------	20	104	42	19	16
14	11	-------	28	98	45	16	15
15	11	-------	50	92	41	15	14
16	11	-------	173	86	37	15	14
17	10	-------	215	79	30	14	13
18	13	-------	194	72	29	14	12
19	13	-------	224	65	30	18	11
20	54	-------	196	72	30	19	10
21	72	-------	149	77	28	15	10
22	47	-------	104	75	26	14	10
23	21	-------	79	65	25	15	8.7
24	14	-------	114	50	23	16	8.3
25	14	-------	155	50	24	14	8.7
26	14	-------	157	52	20	13	8.7
27	14	-------	95	53	20	14	9.0
28	22	-------	68	52	20	14	10
29	44	-------	49	52	24	14	8.3
30	38	-------	53	52	24	15	7.7
31	32	-------	75	-------	24	16	-------

NOTE.—No record Oct. 1–6, June 6–15, 17, and 18; discharge interpolated.

Monthly discharge of Canyon Creek near Many Glacier, Mont., for the year ending Sept. 30, 1922

[Drainage area, 7.0 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	72	10	21.5	3.07	3.54	1,320
November 1–7	27	15	18.3	2.61	.68	254
May 9–31	224	12	98.0	14.0	11.98	4,470
June	178	50	96.5	13.8	15.40	5,740
July	75	20	39.3	5.61	6.47	2,420
August	28	13	19.2	2.74	3.16	1,180
September	16	7.7	11.8	1.69	1.89	702

RED RIVER AT FARGO, N. DAK.

LOCATION.—At dam half a mile above highway bridge connecting Front Street, Fargo, Cass County, N. Dak., with Moorhead, Minn., 10 miles above mouth of Sheyenne River.

DRAINAGE AREA.—6,420 square miles (revised).

RECORDS AVAILABLE.—May 27, 1901, to September 30, 1922.

GAGE.—Vertical staff attached to tree on left bank 6 rods above dam; vertical staff for convenient comparison attached to upper end of fishway, left end of dam. Gage read by employees of city engineer office of Fargo. Prior to September, 1914, the gage record was kept from a gage attached to breakwater of Front Street bridge pier, which gage is still maintained by the United States Weather Bureau but is not used by the Geological Survey because its low-stage control is unsatisfactory. The datums of the two gages are such that if the dam were completely removed or the stage so high as to completely drown the dam, the Front Street gage readings would be about 10.4 feet greater numerically than on the gage at the dam.

DISCHARGE MEASUREMENTS.—Made from footbridge at gage.

CHANNEL AND CONTROL.—Channel is clay and silt, gradually changing. Control is dam immediately below gage over which the fall, at extremely low stage, is 5 feet. The dam is gradually settling. The present elevation of the lowest part of the crest is at 0.7 foot gage height.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.0 feet April 11 (discharge, 5,200 second-feet); minimum stage, 0.75 foot September 11 (discharge, 9 second-feet).

1901–1922: Maximum stage recorded, 29.8 feet March 30, 1907 (stage-discharge relation affected by ice); maximum open-water stage, 17.34 feet July 11, 1916 (discharge, 7,740 second-feet); minimum stage, that of 1922.

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

DIVERSIONS.—None.

REGULATION.—No power plants or storage above station nearer than 60 miles, and storage is not great enough to noticeably affect discharge at station.

ACCURACY.—Stage-discharge relation permanent, except when affected by ice. Rating curve well defined between 120 and 4,400 second-feet. Gage read once daily to hundredths (except Sundays) and once or twice a week during winter. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records good; other records fair.

COOPERATION.—Gage-height record furnished by city engineer of Fargo.

Discharge measurements of Red River at Fargo, N. Dak., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 15	E. F. Chandler	1.63	145	May 6	E. F. Chandler	3.48	1,020
23	K. H. Oakley	1.31	110	Aug. 17	do	1.10	29

Daily discharge, in second-feet, of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	430	[a]159	35	3,240	1.150	890	498	210	57
2	[a]294	102	37	2,740	1,150	890	[a]486	192	57
3	159	192	38	2,560	1,120	862	475	144	[a]54
4	78	264	39	2,980	1,090	[a]848	452	102	[a]51
5	32	227	39	3,760	1,060	835	430	102	48
6	39	[a]171	39	4,200	1,060	780	386	[a]102	48
7	39	116	45	4,080	[a]1,040	725	365	102	48
8	39	116	51	4,120	1,030	671	365	129	24
9	[a]58	78	57	4,560	1,030	671	[a]365	159	15
10	78	57	102	5,040	1,000	671	365	129	[a]12
11	78	[a]67	129	5,200	1,370	[a]658	365	102	9
12	78	78	116	4,960	1,300	645	386	39	24
13	102	[a]67	102	4,360	1,180	619	344	[a]32	24
14	246	57	175	3,600	[a]1,150	594	283	24	24
15	175	39	264	2,270	1,120	569	283	39	31
16	[a]159	24	430	[a]1,860	1,120	645	[a]264	39	24
17	144	39	1,180	1,440	1,090	835	245	39	[a]24
18	129	78	2,560	1,370	1,090	[a]808	264	102	24
19	129		3,180	1,440	1,060	780	264	78	24
20	192		3,520	1,520	1,060	835	245	[a]63	19
21	291		3,800	1,520	[a]1,060	752	227	48	57
22	209		3,920	1,520	1,060	725	227	48	67
23	[a]143		3,960	[a]1,520	1,060	698	[a]236	39	57
24	78	77	4,000	1,520	1,030	671	245	129	[a]48
25	90		4,320	1,520	1,030	[a]608	245	159	39
26	116		4,520	1,370	1,000	545	245	115	24
27	159		4,600	1,300	972	521	227	[a]69	[a]32
28	227		4,560	1,270	[a]958	521	159	24	39
29	175		4,320	1,240	945	498	192	48	57
30	[a]167		3,960	[a]1,200	945	474	[a]209	57	[a]48
31	159	-------	3,440	-------	918	-------	227	78	-------

[a] Interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 14–30, and Mar. 1–16; discharge estimated.

Monthly discharge of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	430	32	145	8,920
November	264	----------	95.3	5,670
December	----------	----------	[a]70	4,300
January	----------	----------	[a]25	1,540
February	----------	----------	[a]23	1,280
March	4,600	----------	1,860	114,000
April	5,200	1,200	2,640	157,000
May	1,370	918	1,070	65,800
June	890	474	695	41,400
July	498	159	309	19,000
August	210	24	88.4	5,440
September	57	9	37.0	2,200
The year	5,200	----------	590	427,000

[a] Estimated.

RED RIVER AT GRAND FORKS, N. DAK.

LOCATION.—At Northern Pacific Railway bridge between Grand Forks, Grand Forks County, N. Dak., and East Grand Forks, Minn., half a mile below mouth of Red Lake River.

DRAINAGE AREA.—25,500 square miles (revised).

RECORDS AVAILABLE.—May 26, 1901, to September 30, 1922. Gage-height records at same point kept by United States Engineer Corps from 1882 to 1901 and a few discharge measurements made by them in early years.

GAGE.—Vertical staff attached to ice breaker below center pier of bridge. Gages maintained by United States Engineer Corps and United States Weather Bureau at the same point have a gage datum 5 feet higher than gage datum of the Geological Survey and at present are more convenient for use; hence Weather Bureau gage is read and 5 feet added to observations. Gage read by Alex Slattery.

DISCHARGE MEASUREMENTS.—Made from Great Northern Railway bridge one-fourth mile above gage.

CHANNEL AND CONTROL.—Bed composed of clay and silt; changes very slowly.

EXTREMES OF DISCHARGE.—Maximum discharge, 16,600 second-feet April 11; minimum discharge, 263 second-feet January 27 and 28.

1882–1922: Maximum stage recorded, 50.2 feet April 10, 1897 (discharge, 43,000 second-feet); minimum discharge 100 second-feet during early part of February, 1912 (stage-discharge relation affected by ice).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—No power plants above with sufficient storage to cause noticeable variations in flow.

ACCURACY.—Stage-discharge relation affected by shifting control and by ice. Rating curve well defined between 630 and 16,000 second-feet. Gage read once daily to quarter-tenths except during the frozen season when it was read twice a week. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge, and when indirect method for shifting control was used April 1 to June 7. Records for open water good; others fair.

Discharge measurements of Red River at Grand Forks, N. Dak., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 28	Chandler and Oakley	4.40	735	Apr. 15	Chandler and Tilly	25.16	13,200
Nov. 26	Oakley and Tilly	4.23	469	May 15	Johnson and Black	22.96	11,300
Dec. 26	do	5.11	655	31	Black and Diehl	10.60	3,650
Jan. 7	Foster and Oakley	4.47	406	Sept. 21	Chandler and Tilly	4.28	671

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Daily discharge, in second-feet, of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,390	689	558	a 542	320	558	8,600	3,580	3,520	1,690	655	440
2	1,340	689	558	527	a 342	a 574	8,360	3,220	3,400	1,590	655	468
3	1,290	724	558	a 498	364	590	8,360	2,920	3,340	1,490	622	468
4	1,250	724	558	468	388	590	8,520	2,680	3,280	1,390	622	440
5	1,200	760	a 606	a 450	a 400	a 622	9,420	2,500	3,160	1,490	590	468
6	1,160	760	655	a 431	413	655	10,800	2,380	3,040	1,490	590	497
7	1,120	760	a 672	413	a 426	a 672	13,100	2,260	2,980	1,490	590	468
8	1,120	724	689	a 413	440	689	14,800	2,200	2,860	1,490	558	468
9	796	724	a 706	413	a 440	a 706	16,200	2,140	2,740	1,490	558	440
10	760	689	724	a 426	440	724	16,500	2,380	2,620	1,440	527	440
11	724	655	a 724	440	413	724	16,600	4,840	2,440	1,390	527	440
12	689	590	724	a 431	a 400	833	16,200	7,310	2,260	1,340	527	468
13	655	590	a 706	a 422	388	950	15,500	10,100	2,260	1,300	527	468
14	622	590	689	413	a 376	1,070	14,600	11,700	2,320	1,200	527	468
15	590	622	a 689	a 400	364	1,120	13,200	11,300	2,260	1,160	497	468
16	558	622	a 689	388	a 364	1,250	12,100	10,400	2,260	1,120	497	440
17	527	655	689	a 376	364	1,440	10,600	8,760	2,200	1,120	497	440
18	497	622	a 689	364	388	2,440	9,260	7,520	2,320	1,070	468	468
19	527	590	689	a 364	a 400	3,280	7,980	6,750	2,500	1,030	468	468
20	558	558	a 689	a 364	413	3,820	7,170	6,300	2,740	990	468	497
21	590	527	689	364	a 426	4,420	6,490	5,860	3,160	950	468	672
22	590	497	a 689	a 352	440	4,900	5,980	5,620	3,580	910	468	590
23	590	468	a 689	341	a 454	5,380	5,620	5,500	3,820	871	440	724
24	622	468	689	a 320	468	5,920	5,260	5,200	3,580	833	440	724
25	655	468	a 672	300	497	6,040	4,960	4,840	3,340	796	440	655
26	655	468	655	a 282	a 512	6,490	4,720	4,540	2,980	796	440	622
27	655	468	a 638	263	527	7,310	4,540	4,300	2,560	796	440	590
28	724	497	622	263	a 542	8,050	4,420	4,000	2,080	760	413	558
29	655	497	a 590	a 282	-------	8,360	4,300	4,180	1,910	724	413	527
30	622	527	558	300	-------	8,520	4,060	3,820	1,800	689	413	497
31	655	-------	558	a 310	-------	8,680	--------	3,640	-------	689	413	-------

a Interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 11 to Mar. 31; discharge based on gage heights corrected for effect of ice by use of three discharge measurements.

Monthly discharge of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,390	497	787	48,400
November	760	468	607	36,100
December	724	558	655	40,300
January	542	263	385	23,700
February	542	320	418	23,200
March	8,680	558	3,140	193,000
April	16,600	4,060	9,610	572,000
May	11,700	2,140	5,250	323,000
June	3,820	1,800	2,780	165,000
July	1,690	689	1,150	70,700
August	655	413	508	31,200
September	724	440	513	30,500
The year	16,600	263	2,150	1,560,000

BOIS DES SIOUX RIVER NEAR TENNEY, MINN.

LOCATION.—Near center of sec. 22, T. 130 N., R. 47 W., at Soo Railway bridge 5 miles west of Tenney, Wilkin County, and 2 miles east of Fairmount, N. Dak.

DRAINAGE AREA.—1,460 square miles.

RECORDS AVAILABLE.—April 1, 1919, to September 30, 1922.

GAGE.—Vertical staff attached to piling pier of Soo Railway bridge. A staff gage (which in 1922 had been lifted 0.22 foot above its original correct position) is also maintained for comparison underneath the east end of the highway bridge half a mile upstream, which was called the "station near Fairmount" and at which the regular readings were made in 1919. Its datum is 1.05 feet above the datum of gage at Soo Railway bridge. Another gage maintained is a staff on Great Northern Railway bridge half a mile downstream, datum of which is 2.16 feet below the gage datum at Soo Railway bridge. Gage read by Math Schmit.

DISCHARGE MEASUREMENTS.—Made from highway bridge, from railway bridge, or by wading.

CHANNEL AND CONTROL.—Bed composed of silt and fine clay, overgrown with weeds, which clog the channel by an amount varying with the season. No considerable shifts in channel likely because normal velocities insufficient to erode.

EXTREMES OF DISCHARGE.—Maximum discharge, 390 second-feet April 22; minimum discharge, no flow during winter and September 23–30.

1919–1922: Maximum discharge that of 1922; minimum discharge, no flow during several months in 1921 and 1922.

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

DIVERSIONS.—None.

REGULATION.—There are no reservoirs or power plants which affect the flow. The station is 15 miles below the outlet of Lake Traverse with no large tributaries entering between, so that abrupt changes in discharge are unlikely. Very extensive ditching and drainage work in the tributary area during the past 15 years may affect the distribution of flow.

ACCURACY.—Stage-discharge relation affected by heavy growth of aquatic plants at low stages. Rating curve fairly well defined between 5 and 250 second-feet and extended above and below these limits. Gage read to half-tenths once daily. Daily discharge ascertained by indirect method for shifting control throughout the year as indicated by rather frequent discharge measurements and interpolated for days of no gage readings, except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Bois des Sioux River near Tenney, Minn., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 22	K. H. Oakley	1.32	1.0	May 6	K. H. Oakley	5.07	263
Apr. 7	do	5.18	184	June 3	R. V. Tilly	4.04	91
14	E. E. Foster	5.11	284	Aug. 18	E. F. Chandler	1.64	1.3
22	E. F. Chandler	5.68	392				

Daily discharge, in second-feet, of Bois des Sioux River near Tenney, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4	1					43	321	116	a 42	a 13	a 0.3
2	4	a 1					58	a 308	109	40	13	.3
3	a 4	1					61	295	102	a 39	12	.2
4	a 3	a 1					64	a 288	95	a 39	a 12	a .2
5	3	1				0.0	67	282	88	38	11	.2
6	a 3	a 1					102	270	85	38	a 10	a .2
7	a 2	a 1					148	258	82	a 37	9	.2
8	2	a 1					225	a 252	76	36	8	a .2
9	2	a 1				1	225	247	70	a 35	a 7	.2
10	a 2	a 1				2	225	247	70	34	a 7	.2
11	1	a .5				2	236	247	a 67	30	6	a .2
12	a 1	.5				3	247	a 236	64	a 30	5	.2
13	1	.5				4	a 271	225	a 62	a 29	a 4	a .2
14	a 1	.5				10	295	214	a 60	28	2	a .2
15	1	.5			0.0	14	295	a 200	58	a 27	a 2	.2
16	1	.5	0.0	0.0		19	321	204	56	26	a 2	a .2
17	a 1	.5				22	334	a 201	56	a 26	1.8	.2
18	1	.5				26	348	a 197	53	26	1.5	a .2
19	1	.5				a 21	348	194	53	a 25	1.5	.2
20	a 1	.5				16	390	184	a 51	24	1.5	.2
21	a 1	.4				22	376	a 180	a 50	a 23	a 1.5	a .1
22	1	.4				22	390	175	48	22	1.5	.1
23	a 1	.3				26	a 383	a 170	a 49	a 21	1.5	
24	a 1	.3				22	376	166	50	20	1.0	
25	1	.2				22	362	157	43	20	a 1.0	
26	a 1	.2				22	a 355	a 152	43	a 20	.6	.0
27	a 2	.2				22	348	148	a 43	19	.4	
28	2	.1				22	348	132	43	a 19	a .4	
29	a 2	.1				30	334	124	a 43	19	.3	
30	a 1	.1				34	334	a 121	43	14	.2	
31	a 1					38		a 119		a 14	a .2	

a Interpolated.

NOTE.—Gage not read Nov. 13 to Mar. 8 and Sept. 23–30. No flow Dec. 1 to Mar. 8 and Sept. 23–30. Discharge estimated Nov. 13–30 and Mar. 9–15.

Monthly discharge of Bois des Sioux River near Tenney, Minn., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	4.0	1.0	1.7	104
November	1.0	.1	.6	36
December	.0	.0	.0	0
January	.0	.0	.0	0
February	.0	.0	.0	0
March	38	.0	13.6	836
April	390	43	264	15,700
May	321	119	210	12,900
June	116	43	64.3	3,830
July	42	14	27.7	1,700
August	13	.2	4.4	270
September	.3	.0	.1	6
The year	390	.0	48.9	35,400

MUSTINKA RIVER ABOVE WHEATON, MINN.

LOCATION.—On line between secs. 7 and 8, T. 127 N., R. 46 W., 1 mile upstream from Chicago, Milwaukee & St. Paul Railway bridge, 1½ miles northeast of Wheaton, Traverse County, and 8 miles above Lake Traverse into which river discharges.

DRAINAGE AREA.—776 square miles.

RECORDS AVAILABLE.—March 23 to September 30, 1917, and June 25, 1919, to September 30, 1922. June 7 to September 30, 1916, at a point 3½ miles downstream.

GAGE.—Chain gage attached to bridge; read by Vernon Heggen. A staff gage is at railway bridge for convenient comparison, datum of which is so placed that readings on staff gage are 10 feet greater numerically than on chain gage.

DISCHARGE MEASUREMENTS.—Made from highway bridge near Chicago, Milwaukee & St. Paul Railway bridge, from highway bridge at chain gage, or from highway bridge midway between them.

CHANNEL AND CONTROL.—Natural bed was composed of clay and silt, but in 1914 the channel was dredged several feet deeper, until the bottom is now in or near hardpan and almost permanent. The slope of the river from lowest stage at the gage to ordinary stage of Lake Traverse is only about 5 feet, so that in exceptional cases flood stage in the lake may affect the stage at gage.

EXTREMES OF DISCHARGE.—Maximum discharge, 1,290 second-feet March 23; minimum discharge, no flow August 28–31, September 30.

1917 and 1919–1922: Maximum stage recorded, 14.7 feet April 1, 1917 (discharge, 2,340 second-feet); minimum stage, that of 1922.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 4 and 2,400 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Mustinka River above Wheaton, Minn., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 22	K. H. Oakley	1.41	1.7	June 4	R. V. Tilly	1.95	10.5
Apr. 8	do	10.51	1,090	4	do	1.95	8.1
15	E. E. Foster	4.21	118	4	do	1.92	7.8
May 7	K. H. Oakley	2.46	39	5	do	1.93	9.0
7	do	2.46	40	Aug. 18	E. F. Chandler	1.06	.0

Daily discharge, in second-feet, of Mustinka River above Wheaton, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	[a] 2.0					1	252	51	10.0	1.4	0.2	[a] 0.1
2	[a] 1.9					1	263	45	9.0	1.2	[a] .2	.1
3	1.8					4	380	45	8.0	1.0	.1	[a] .1
4	[a] 1.5					10	466	39	7.0	1.0	[a] .1	[a] .1
5	1.1					7	350	36	6.7	1.0	.1	[a] .1
6	[a] 1.4					5	785	36	4.0	1.2	[a] .1	.1
7	1.6					4	1,220	33	3.7	1.0	.1	[a] .1
8	[a] 1.6					4	992	36	3.7	1.1	[a] .1	[a] .1
9	[a] 1.5					8	581	36	4.0	.9	[a] .1	.1
10	[a] 1.5					12	350	36	4.0	.8	.1	[a] .1
11	[a] 1.4					20	311	33	3.7	.8	.1	[a] .1
12	1.4					40	252	33	3.6	.7	.0	[a] .1
13	[a] 1.5					73	200	28	3.6	.6	.0	.1
14	[a] 1.7					154	172	28	3.4	.5	.0	[a] .1
15	1.8	1.4	1.0	0.7	0.5	181	154	26	3.4	.5	.0	[a] .1
16	[a] 2.2					190	146	26	5.7	.5	.0	.1
17	[a] 2.5					581	138	23	3.1	.4	.0	[a] .1
18	2.9					1,060	130	23	3.1	.3	.0	[a] .1
19	[a] 2.8					1,080	122	21	3.7	.3	.0	[a] .1
20	[a] 2.7					845	122	23	3.4	.3	.0	[a] .1
21	[a] 2.5					1,240	122	23	2.5	.6	.1	.1
22	2.4					1,260	114	21	2.3	.5	.1	[a] .1
23	[a] 2.2					1,290	107	18	2.1	.5	[a] .1	.1
24	[a] 2.1					1,060	86	16	2.0	.5	.1	[a] .1
25	[a] 2.0					800	79	16	1.9	.5	[a] .1	[a] .1
26	1.8					600	72	13	1.8	.4	[a] .1	[a] .1
27	[a] 1.7					400	66	11	1.6	.3	[a] .1	[a] .1
28	[a] 1.7					300	63	9	1.4	.3	.0	[a] .1
29	1.6				-------	200	57	11	1.6	.2	.0	.1
30	[a] 1.6				-------	150	54	11	1.5	.3	.0	.0
31	[a] 1.6	-------		-------	-------	220	-------	10	-------	.2	.0	-------

[a] Interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 1 to Mar. 13 Discharge estimated from temperature and precipitation records and comparisons with records for other stations in the Red River basin. Discharge Mar. 14–24 and 31 obtained by indirect method; estimated Mar. 25–30.

Monthly discharge of Mustinka River above Wheaton, Minn., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	2.9	1.1	1.9	117
November	-------	-------	[a] 1.4	83
December	-------	-------	[a] 1.0	61
January	-------	-------	[a] .7	43
February	-------	-------	[a] .5	28
March	1,290	1	381	23,400
April	1,220	54	274	16,300
May	51	9	26.3	1,620
June	10	1.4	3.8	226
July	1.4	.2	.6	37
August	.2	.0	.1	6
September	.1	.0	.1	6
The year	1,290	.0	57.9	41,900

[a] Estimated.

RED LAKE RIVER AT THIEF RIVER FALLS, MINN.

LOCATION.—In sec. 33, T. 154 N., R. 43 W., one-third mile below dam at Thief River Falls, Pennington County, and 1 mile below mouth of Thief River entering on right.

DRAINAGE AREA.—3,430 square miles.

RECORDS AVAILABLE.—July 1, 1909, to September 30, 1918, and March 25, 1920, to September 30, 1922.

GAGE.—Inclined staff gage on right bank, installed August 19, 1920; read by Dedrick Knutson.

DISCHARGE MEASUREMENTS.—Made from cable near gage.

CHANNEL AND CONTROL.—Gravel and small boulders; nearly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.7 feet, April 13 (discharge, 4,200 second-feet); minimum stage, 3.14 feet, August 13 (discharge, 31 second-feet).

1909–1918 and 1920–1922: Maximum open-water stage recorded, 12.2 feet. April 19–21, 1916 (discharge, 7,040 second-feet); minimum discharge, no flow July 17 and August 27, 1911; caused by regulation.

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

REGULATION.—One-third mile above station at dam are the plants of Hanson & Barzen Milling Co. and city lighting plant, operated ordinarily in daytime and night, respectively. These plants sometimes cause large sudden fluctuations in flow at the gage, but it is the purpose to take gage opservations at such times of the day that these effects will be compensating and the monthly averages accurate.

ACCURACY.—Stage-discharge relation permanent except when affected by ice. Rating curve well defined. Gage read to half-tenths once daily and two or three times weekly during winter. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for open water; others fair.

Discharge measurements of Red Lake River at Thief River Falls, Minn., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 6	K. H. Oakley	4.35	403	Apr. 20	K. H. Oakley	6.39	1,280
Dec. 10	do	[a] 4.53	368	May 15	do	8.52	2,980
27	do	[a] 5.50	310	June 13	do	5.21	607
Jan. 28	do	[a] 5.50	244	Aug. 25	E. F. Chandler	4.67	450
Apr. 20	do	6.34	1,240				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second feet, of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept
1	169	357	263	99	227	213	650	650	740	306	274	180
2	227	357	268	70	237	199	740	650	695	306	306	212
3	258	393	274	73	248	184	740	a 650	695	472	306	a 212
4	323	375	605	75	258	169	790	650	790	340	274	212
5	307	357	605	78	274	197	1,050	605	840	306	242	153
6	323	357	534	200	290	204	1,360	650	790	340	194	180
7	a 340	290	464	323	306	212	1,570	695	940	375	274	212
8	357	197	393	290	323	220	2,110	740	995	340	242	242
9	323	169	281	306	323	227	2,550	840	890	274	180	227
10	323	169	169	323	323	173	2,370	a 1,520	1,050	306	306	212
11	357	131	206	323	323	119	2,640	2,200	995	431	242	274
12	357	119	242	323	323	221	3,200	3,900	840	412	274	242
13	340	131	242	260	323	323	4,200	3,900	650	340	31	212
14	323	119	242	197	306	258	2,370	a 3,450	740	306	180	180
15	323	119	237	197	290	393	1,360	3,000	a 765	274	180	106
16	290	143	232	197	290	290	1,360	1,230	790	212	a 166	106
17	357	131	227	197	290	357	1,500	a 1,200	695	274	153	a 333
18	393	143	890	197	290	258	1,360	1,170	650	212	180	560
19	169	143	840	197	290	258	1,300	1,500	695	274	180	537
20	340	143	679	197	290	291	1,300	2,030	a 650	340	a 154	452
21	357	143	518	197	290	324	1,300	1,500	605	274	129	452
22	323	143	358	188	290	357	1,170	a 1,570	a 650	274	129	375
23	323	143	197	178	290	357	1,050	1,640	695	212	242	306
24	a 358	156	169	169	290	357	1,050	1,720	790	274	212	212
25	393	169	169	191	290	382	995	2,110	452	452	340	153
26	393	183	246	213	258	406	940	1,950	306	306	242	180
27	431	169	323	236	243	431	695	1,230	340	242	242	129
28	393	144	267	258	228	452	740	1,360	375	306	212	a 141
29	357	119	212	242	-------	472	a 718	890	452	274	212	153
30	357	258	156	227	-------	494	695	995	538	212	194	180
31	323	-------	127	227	-------	515	-------	890	-------	242	212	-------

a Gage not read; discharge interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 20 to Apr. 9; discharge estimated by use of three discharge measurements, temperature records, and interpolation.

Monthly discharge of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	431	169	329
November	393	119	199
December	890	127	343
January	323	70	208
February	323	227	286
March	515	119	300
April	4,200	650	1,460
May	3,900	605	1,520
June	1,050	306	703
July	472	212	307
August	340	31	216
September	560	106	244
The year	4,200	31	510

RED LAKE RIVER AT CROOKSTON, MINN.

LOCATION.—In sec. 30, T. 150 N., R. 46 W., at Sampson's Addition highway bridge in Crookston, Polk County, a quarter mile below dam and power house of Crookston Light, Water & Power Co. No tributaries above or below for several miles.

DRAINAGE AREA.—5,320 square miles.

RECORDS AVAILABLE.—May 19, 1901, to September 30, 1922.

GAGE.—Chain gage attached to bridge at midspan, installed July 1, 1909, and used thereafter until September, 1911, and 1920–1922. Prior to July 1, 1909, the gage was at the former wooden highway bridge 300 feet above the present bridge; this gage read the same as the present gage at ordinary stages. From September, 1911, to September, 1919, a Barrett and Lawrence water-stage recorder, located on right abutment of bridge, was in operation.

DISCHARGE MEASUREMENTS.—Made from highway bridge at gage.

CHANNEL AND CONTROL.—Bed composed of silt, gravel, and small boulders; control not well defined. Channel shifts slightly during long intervals. Flow confined to one channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.0 feet May 13 (discharge, 7,100 second-feet); minimum stage, 3.1 feet August 11 (discharge, 125 second-feet).

1901–1922: Maximum discharge, 14,700 second-feet, July 5, 1919; minimum discharge, 10 second-feet, recorded by discharge measurement made January 27, 1912, but the flow is controlled to such an extent that this has no bearing on the minimum natural flow.

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

REGULATION.—In some seasons, especially if the river is very low, comparatively large diurnal fluctuations in gage height are caused by the operation of power plant immediately above station and another 8 miles farther upstream. The nearer plant has very little storage, but the more distant plant uses storage equivalent to only one or two days natural flow of the stream; hence the controlled mean monthly flow is very nearly equal to the natural monthly flow.

ACCURACY.—Stage-discharge relation changed during the winter. Rating curves used before and after the change are well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records good; other records fair.

Discharge measurements of Red Lake River at Crookston, Minn., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 13	K. H. Oakley	3.49	126	June 13	K. H. Oakley	5.18	1,220
Dec. 28	do	5.30	353	Aug. 22	E. F. Chandler	3.21	155
Apr. 22	do	7.34	2,190				

105449—25†—WSP 545——4

Daily discharge, in second-feet, of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	436	515					900	1,560	1,500	600	280	865
2	555	515					1,000	1,380	1,440	600	280	280
3	515	515					1,100	1,320	1,440	650	280	280
4	475	515					1,200	1,200	1,380	600	320	280
5	595	515					1,400	1,080	1,440	500	280	365
6	585	515					1,800	1,080	1,320	500	280	240
7	575	515					2,500	1,030	1,260	550	280	280
8	565	515					4,550	1,140	810	550	240	240
9	555	515					3,990	1,380	865	550	240	755
10	515	515					5,400	1,620	810	600	320	280
11	515	397					4,980	3,050	810	550	125	280
12	515	218					4,470	5,820	865	550	320	280
13	515	218					4,800	7,100	865	550	280	600
14	515	218					3,590	6,160	1,030	755	500	320
15	475	218			350		3,510	5,480	1,030	755	280	280
16	515	397	440	300		380	2,620	4,550	1,080	755	365	280
17	515	436					2,210	4,390	810	865	280	320
18	555	475					3,280	2,980	810	550	410	455
19	515	515					2,900	2,830	1,030	280	280	700
20	635	500					2,550	2,620	975	500	240	865
21	397	450					2,340	3,120	975	550	240	920
22	595	450					2,210	2,830	810	600	200	755
23	515	400					1,950	2,690	700	280	200	810
24	555	400					1,950	2,280	755	320	200	755
25	475	400					2,020	2,140	700	280	200	700
26	515	350					1,880	2,210	700	320	280	700
27	475	350					2,480	2,140	810	550	280	600
28	475	350					865	1,380	500	280	320	455
29	475	350			-------		1,200	1,620	600	455	365	160
30	475	350			-------		1,500	1,560	755	280	280	240
31	555	-------			-------		------	1,500	-------	320	280	-------

NOTE.—Stage-discharge relation affected by ice Nov. 20 to Apr. 7; discharge estimated by use of one discharge measurement, weather records, and comparison with records of flow at adjoining station. No records Oct. 6–8 and 28; discharge interpolated. Figures in brackets show mean discharge for periods indicated.

Monthly discharge of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	635	397	521
November	515	218	420
December	----------	----------	440
January	----------	----------	300
February	----------	----------	350
March	----------	----------	380
April	5,400	865	2,570
May	7,100	1,030	2,620
June	1,500	500	962
July	865	280	518
August	500	125	281
September	920	160	478
The year	7,100	125	821

PEMBINA RIVER AT NECHE, N. DAK.

LOCATION.—At Great Northern Railway bridge, two-thirds mile north of Neche, Pembina County.

DRAINAGE AREA.—2,960 square miles (revised).

RECORDS AVAILABLE.—May 1, 1903, to September 30, 1915, and April 1, 1919, to September 30, 1922.

GAGE.—Vertical staff bolted to concrete abutment at north end of railway bridge. At low stages this gage is sometimes not reached by the water, and readings are then made on sections of vertical staff attached to abutment and piling at north end of highway bridge.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Channel consists of clay and silt, shifting slightly. Control, Great Northern dam, one-third mile below gage.

EXTREMES OF DISCHARGE.—Maximum discharge, 1,300 second-feet April 10; minimum stage, 3.4 feet August 27 to September 4 (discharge, 5 second-feet).

1903–1915 and 1919–1922: Maximum stage recorded, 20.9 feet May 2 1904 (discharge, 3,870 second-feet); minimum stage, 1.3 feet September 15, 16, 18, 19, and 21–24, 1911 (discharge, 1.0 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—Water is raised at low stages from 1 to 2 feet at the gage by a loose-rock dam about 3 feet high, one-third mile below, constructed to give sufficient depth of water for the intake of the Great Northern Railway water tank. There is considerable leakage through the dam, but no permanent determination of the effect of the dam can be made because it is liable to be somewhat disturbed at its crest by ice run or spring floods in any year. There are no reservoirs or power plants that affect the flow.

ACCURACY.—Stage-discharge relation permanent except when affected by ice. Rating curve well defined between 1.5 and 4,000 second-feet. Gage read once daily to tenths. Daily discharge ascertained by applying daily gage height to rating table, except as explained in footnote to table of daily discharge. Records poor.

The following discharge measurement was made by E. F. Chandler:

August 16, 1922: Gage height, 3.53 feet; discharge, 7.0 second-feet.

Daily discharge, in second-feet, of Pembina River at Neche, N. Dak., for the year ending September 30, 1922

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	62	77		77	205	165	62	18	5
2	110	77		77	205	165	62	18	5
3	110	77	4.5	77	205	165	47	13	5
4	110	77		491	205	165	47	13	5
5	110	77	4.5	1,060	205	165	47	13	6
6	110	77		1,110	205	165	35	13	6
7	110	77		1,300	205	165	35	13	9
8	110	77		1,240	205	165	25	13	13
9	128	62	4.5	1,060	205	165	25	13	18
10	146	62		909	247	165	25	9	18
11	146	47		777	247	165	25	9	18
12	146	47	4.5	425	290	165	25	9	18
13	128		4.5	380	733	165	25	9	25
14	128		18	357	402	165	25	9	25
15	128		62	335	380	146	25	9	25
16	128		128	312	380	146	18	9	25
17	110		35	312	290	146	18	9	47
18	110		18	312	268	128	18	9	47
19	110		18	290	268	128	18	9	47
20	110		25	290	226	128	18	9	62
21	93	43	47	268	205	128	18	9	62
22	93		62	247	205	128	18	6	77
23	93		77	247	185	128	18	6	77
24	93		110	247	185	110	18	6	77
25	93		146	247	185	110	18	6	77
26	93		77	226	165	110	18	6	77
27	77		77	205	165	93	18	5	77
28	77		77	205	165	93	18	5	77
29	77		77	205	165	77	18	5	62
30	77		77	205	165	77	18	5	62
31	77	------	77	------	165	------	18	5	------

NOTE.—Stage-discharge relation affected by ice Nov. 11 to Apr. 6; discharge Nov. 11–30 and Mar. 1 to Apr. 6 estimated from gage heights and weather records.

Monthly discharge of Pembina River at Neche, N. Dak., for the year ending September 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	146	62	106	6,520
November	------	------	53.6	3,190
December	------	------	[a] 30	1,840
January	------	------	[a] 8	492
February	------	------	[a] 4.5	250
March	146	------	40.9	2,510
April	1,300	77	450	26,800
May	733	165	243	14,900
June	165	77	140	8,330
July	62	18	26.5	1,630
August	18	5	9.4	578
September	77	5	38.5	2,290
The year	1,300	------	95.7	69,300

[a] Estimated.

ROSEAU RIVER AT CARIBOU, MINN.

LOCATION.—In sec. 34, T. 164 N., R. 45 W., at highway bridge at Caribou, Kittson County, 1 mile south of international boundary and 3 miles upstream from crossing of boundary line by river.

DRAINAGE AREA.—1,650 square miles (revised).

RECORDS AVAILABLE.—April 1 to October 6, 1917; April 12, 1920, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of bridge, 60 feet from left abutment; read by James A. McKibbin.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Channel is artificial, of trapezoidal cross-section, about 100 feet wide and 10 feet deep. Bed composed of hardpan with a few scattered large boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.4 feet May 25 and 26 (discharge, 1,360 second-feet); minimum stage, 3.4 feet August 31 and September 1 (discharge, 31 second-feet).

1917; 1920–1922: Maximum discharge, 1,980 second-feet April 11, 1921; minimum discharge, 4 second-feet September 10–12, 29, and 30, 1917.

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

DIVERSIONS.—No diversions involving storage or loss of water. A small channel 3½ miles long was dredged some years ago from a point 4 miles above station to a point 1 mile below station. At all stages above a height of about 6 feet water flows in this channel and is measured and included with all measurements of the main channel.

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 explained in footnote to table of daily discharge. Open-water records good; winter records fair.

Discharge measurements of Roseau River at Caribou, Minn., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 5	K. H. Oakley	3.57	46	June 12	K. H. Oakley	5.57	304
Apr. 19	do	7.45	742	Aug. 24	E. F. Chandler	3.43	34
May 14	do	8.57	920				

Daily discharge, in second-feet, of Roseau River at Caribou, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	86	50					35	394	1,260	76	55	31
2	81	50					40	355	1,190	76	60	36
3	76	50					40	336	1,120	76	60	40
4	65	50					50	336	1,020	60	60	48
5	60	50					81	318	835	60	60	58
6	55	50					92	318	723	70	60	103
7	55	45					138	300	594	86	65	126
8	50	45					234	283	523	98	65	190
9	50	40					336	266	478	114	65	234
10	50	40					374	283	414	126	65	266
11	50	40					570	546	355	150	60	283
12	50	36					894	778	300	190	55	266
13	45	36					894	1,020	266	197	50	250
14	45	36					894	1,080	250	183	40	234
15	45	36			15		864	1,120	250	163	40	219
16	40	36	20	18		20	835	1,150	234	132	40	197
17	40	36					778	1,150	234	114	40	183
18	40	36					750	1,150	234	98	36	183
19	40	36					723	1,220	250	86	36	197
20	45	31					723	1,220	234	70	36	212
21	45	27					696	1,260	219	65	36	234
22	50	27					670	1,290	183	60	36	234
23	50	23					619	1,290	163	55	36	219
24	55	23					594	1,330	138	60	36	197
25	55	23					570	1,360	132	65	36	176
26	50	20					570	1,360	120	70	40	163
27	50	20					523	1,330	108	70	40	150
28	50	20					500	1,330	103	65	40	132
29	50	20			-------		456	1,330	98	65	36	114
30	50	20			-------		414	1,290	92	60	36	108
31	50	-------			-------		-------	1,290	-------	55	31	-------

NOTE.—Stage-discharge relation affected by ice Nov. 18 to Apr. 11; discharge estimated from weather records and by a comparison with discharge in other drainage basins.

Monthly discharge of Roseau River at Caribou, Minn., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	86	40	52.4
November	50	20	35.1
December	-------	-------	20
January	-------	-------	18
February	-------	-------	15
March	-------	-------	20
April	894	35	499
May	1,360	266	906
June	1,260	92	404
July	197	55	94
August	65	31	46.8
September	283	31	169
The year	1,360	-------	190

MOUSE RIVER AT MINOT, N. DAK.

LOCATION.—At Anne Street footbridge, northeast of Great Northern Railway roundhouse, at Minot, Ward County.

DRAINAGE AREA.—10,270 square miles (revised.)

RECORDS AVAILABLE.—May 5, 1903, to September 30, 1922.

GAGE.—Vertical staff gages attached to piers of Anne Street bridge. From December, 1903, to December, 1909, the gage was a vertical staff similarly placed on a footbridge then existing about 20 rods above Anne Street. All gages at same datum. Gage read by Ephraim Cox.

DISCHARGE MEASUREMENTS.—Made from Anne Street bridge or other bridges downstream and by wading.

CHANNEL AND CONTROL.—Bed composed of clay and silt; permanent. Dam of Minneapolis, St. Paul & Sault Ste. Marie Railway forms low-water control. At higher stages dam is submerged, causing a reversal in rating curve.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.1 feet April 21, 22 (discharge, 2,570 second-feet); minimum stage, 3.95 feet September 18–20 and 26–30 (discharge, 2 second-feet).

1903–1922: Maximum stage recorded, 21.9 feet April 20, 1904 (discharge estimated, 12,000 second-feet); minimum stage, 1.8 feet February 28, 1913 (discharge, 0.1 second-foot).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—No regulation sufficient to cause appreciable effect at station.

ACCURACY.—Stage-discharge relation changed March 31; also affected by ice. Rating curve used October 1 to March 31 is well defined; curve used April 1 to September 30 fairly well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records fair; winter records poor.

The following discharge measurement was made by E. F. Chandler:
August 8, 1922: Gage height, 4.29 feet; discharge, 20.6 second-feet.

Daily discharge, in second-feet, of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14	18	12	230	648	270	34	30	5
2	14	18	12	240	563	250	26	26	7
3	14	18	12	424	648	178	30	26	7
4	14	18	12	518	314	134	26	21	7
5	12	18	12	648	303	141	21	21	5
6	12	------	12	690	326	148	26	26	5
7	12	------	12	648	292	148	26	26	10
8	12	------	12	606	270	141	30	26	13
9	12	------	18	944	260	134	30	21	13
10	14	------	68	1,100	260	148	39	21	13
11	14	------	164	1,200	270	148	30	17	13
12	14	------	322	1,320	281	141	30	13	17
13	14	------	517	1,440	270	148	26	13	5
14	14	------	563	1,560	250	134	26	10	5
15	14	------	444	1,660	212	128	26	10	5
16	14	------	362	1,730	194	134	44	10	5
17	14	------	296	1,840	170	122	110	13	5
18	12	------	164	2,170	162	122	148	13	2
19	12	------	82	2,310	178	128	122	10	2
20	12	------	34	2,470	230	128	86	10	2
21	12	------	18	2,570	270	134	74	10	5
22	12	------	82	2,570	281	141	64	13	5
23	14	------	248	2,430	292	134	54	13	5
24	14	------	272	2,350	314	128	49	10	5
25	12	------	226	2,140	375	122	44	10	5
26	12	------	204	1,840	375	115	34	10	2
27	12	------	184	1,730	375	74	30	7	2
28	12	------	174	1,350	375	54	30	7	2
29	12	------	164	1,100	375	44	34	5	2
30	14	------	155	880	350	39	39	5	2
31	14	------	164	------	314	------	34	5	------

NOTE.—Stage-discharge relation affected by ice Nov. 6 to Mar. 8; discharge Mar. 1–8 estimated.

Monthly discharge of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1922

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	14	12	13.0	799
November	----------	----------	[a] 15	892
December	----------	----------	[a] 12	738
January	----------	----------	[a] 12	738
February	----------	----------	[a] 12	666
March	563	12	162	9,960
April	2,570	230	1,420	84,500
May	648	162	316	19,400
June	270	39	134	7,970
July	148	21	45.9	2,820
August	30	5	14.8	910
September	17	2	6.03	359
The year	2,570	[a] 2	180	130,000

[a] Estimated.

UPPER MISSISSIPPI RIVER BASIN.

MISSISSIPPI RIVER AT ELK RIVER, MINN.

LOCATION.—In sec. 3, T. 121 N., R. 23 W., at highway bridge in Elk River, Sherburne County, 2,500 feet below mouth of Elk River.

DRAINAGE AREA.—14,500 square miles.

RECORDS AVAILABLE.—July 22, 1915, to September 30, 1922.

GAGE.—Chain gage bolted to handrail of bridge, downstream side near right bank; read by Reynard Ebner.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; control not well defined. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.1 feet at 7.10 a. m. April 10 (discharge, 24,600 second-feet); minimum discharge estimated because of ice, 1,360 second-feet January 26.

1915–1922: Maximum open water stage recorded, 10.8 feet April 7, 1916 (discharge, 27,000 second-feet); minimum discharge, that of 1922.

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

REGULATION.—Nearest dam above station is at St. Cloud, 40 miles upstream. An observed systematic diurnal fluctuation at the gage of about 0.1 foot is doubtless due to the regulation at St. Cloud, but most of the effect of regulation is equalized before reaching the station. The flow of the river is controlled by Government dams on the upper river for the purpose of increasing the low-water open-season flow in the interests of navigation.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 2,000 and 14,000 second-feet and fairly well defined between 14,000 and 26,300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records excellent; winter records fair.

COOPERATION.—Gage records furnished by United States Engineer Corps.

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

June 21, 1922: Gage height, 3.87 feet; discharge, 4,320 second-feet.

Daily discharge, in second-feet, of Mississippi River at Elk River, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,030	3,400	2,920	1,750	1,630	1,600	12,100	11,800	6,100	4,620	4,080	4,080
2	3,210	3,210	2,980	1,870	1,720	2,100	11,400	11,400	6,100	4,340	4,340	4,620
3	2,860	3,400	2,800	1,930	1,440	2,440	11,100	10,500	5,500	4,620	4,340	4,340
4	2,860	3,210	2,590	1,850	1,650	2,100	10,800	10,800	5,200	4,620	4,620	3,840
5	3,210	3,400	2,640	1,800	1,760	1,750	14,700	10,200	4,620	4,080	4,340	3,840
6	3,400	3,030	2,800	1,820	1,680	1,780	13,000	9,840	4,620	4,340	3,840	3,840
7	3,400	2,860	2,710	1,800	1,670	1,790	14,300	9,840	4,620	3,610	3,610	3,840
8	2,860	3,210	2,770	1,850	1,700	1,720	18,800	10,200	4,910	4,080	4,080	4,620
9	2,550	3,400	2,610	1,810	1,700	1,840	23,500	9,840	5,200	4,340	3,610	4,620
10	2,860	3,030	2,510	1,730	1,680	1,840	24,600	9,520	5,500	4,340	3,840	4,080
11	3,030	3,030	2,640	1,730	1,730	1,900	24,600	9,840	5,200	4,080	3,840	4,080
12	3,030	3,210	2,410	1,700	1,690	1,650	23,900	9,840	4,080	3,840	3,840	4,080
13	3,210	3,210	2,860	1,870	1,700	1,920	23,200	10,800	4,080	4,080	3,840	4,620
14	3,400	3,030	2,550	1,840	1,740	3,130	22,200	10,500	4,080	3,610	3,610	3,840
15	3,210	2,860	2,690	1,700	1,560	2,030	20,800	10,200	4,910	3,840	3,840	4,080
16	3,400	2,420	2,710	1,770	1,790	2,280	19,800	10,500	5,200	3,840	3,610	4,080
17	3,210	2,550	2,170	1,660	2,110	2,640	19,100	9,840	4,620	3,610	3,840	4,340
18	3,400	2,860	1,800	1,770	1,810	2,700	18,800	9,840	4,620	3,840	4,080	4,080
19	3,610	2,390	1,700	1,730	2,000	2,840	18,100	9,840	5,200	4,620	3,840	4,340
20	3,610	1,830	1,730	1,670	1,880	2,980	17,700	9,840	5,500	4,080	3,610	4,340
21	3,610	1,620	2,020	1,780	1,910	3,060	17,400	9,520	4,620	4,910	4,080	4,340
22	3,610	1,760	1,800	1,620	1,740	3,770	16,700	8,880	4,620	4,340	3,610	4,080
23	3,400	1,890	1,960	1,640	1,660	3,150	16,400	8,880	4,910	4,080	3,400	4,080
24	3,400	1,750	1,890	1,670	1,550	4,560	15,700	8,880	4,910	3,840	4,080	4,340
25	3,400	2,420	1,790	1,680	1,650	6,540	15,400	8,240	4,910	3,840	3,610	4,080
26	3,210	2,560	1,780	1,360	1,700	9,960	14,700	7,930	4,910	3,610	3,610	4,080
27	3,610	2,830	2,020	1,800	1,590	12,600	14,000	6,700	4,910	4,080	3,840	4,340
28	3,400	2,750	1,620	1,620	1,580	16,000	13,700	7,000	4,340	4,340	4,080	4,340
29	3,610	2,600	1,920	1,480	-------	16,700	12,700	6,700	4,340	4,080	3,610	4,080
30	3,210	2,820	2,000	1,650	-------	17,400	12,700	6,700	4,620	4,080	3,840	4,080
31	3,400	-------	1,860	1,700	-------	17,700	-------	6,700	-------	3,840	4,080	-------

NOTE.—Stage-discharge relation affected by ice Nov. 19 to Mar. 27; discharge based on computed flow at Coon Creek power plant of Northern States Power Co.

Monthly discharge of Mississippi River at Elk River, Minn., for the year ending Sept. 30, 1922

[Drainage area, 14,500 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	3,610	2,550	3,260	0.225	0.26
November	3,400	1,620	2,750	.190	.21
December	2,980	1,620	2,300	.159	.18
January	1,930	1,360	1,730	.119	.14
February	2,110	1,440	1,720	.119	.12
March	17,700	1,600	4,980	.343	.40
April	24,600	10,800	17,100	1.18	1.32
May	11,800	6,700	9,390	.648	.75
June	6,100	4,080	4,900	.338	.38
July	4,910	3,610	4,110	.283	.33
August	4,620	3,400	3,890	.268	.31
September	4,620	3,840	4,180	.288	.32
The year	24,600	1,360	5,030	.347	4.72

MISSISSIPPI RIVER AT ST. PAUL, MINN.

LOCATION.—At Chicago Great Western Railway bridge near foot of Robert Street, St. Paul, Ramsey County, 6 miles below mouth of Minnesota River.

DRAINAGE AREA.—35,700 square miles.

RECORDS AVAILABLE.—March 22, 1887, to September 30, 1922. Observation of stage was begun in 1873 by United States Signal Service and continued by United States Weather Bureau. Many discharge measurements made prior to 1900 by the United States Engineer Corps.

GAGE.—Chain gage installed May 9, 1913, on handrail, downstream side, of Chicago Great Western Railway bridge near foot of Robert Street; read by United States Weather Bureau employees. From 1911 to May 9, 1913, a vertical staff gage attached to piling on left bank of river 800 feet upstream from present gage. Prior to 1911 a vertical staff gage on Diamond Joe Line wharf, at foot of Jackson Street, 400 feet below chain gage, was used. The datum of all three gages is the same, allowance being made for the slight slope in the river between them.

DISCHARGE MEASUREMENTS.—Up to 1915 made from Chicago, St. Paul, Minneapolis & Omaha Railway bridge, 2 miles above station; in November, 1915, and April, 1916, measurements were made from Chicago Great Western Railway bridge to which gage is attached. Since 1916 measurements have been made from Wabasha Street highway bridge 1,000 feet above station.

CHANNEL AND CONTROL.—Channel fairly permanent. Control not well defined. Banks moderately high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.6 feet April 13 and 14 (discharge, 46,000 second-feet); minimum stage, −0.9 foot November 21 (discharge, 2,720 second-feet).

1887–1922: Maximum stage recorded, 18.0 feet April 6, 1897 (discharge, 80,800 second-feet); highest known discharge occurred July 22, 1867, and amounted to 117,000 second-feet. Minimum discharge, 1,060 second-feet February 4, 1895.

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

REGULATION.—During extremely low water regulation of flow through turbines at nearest dam in Minneapolis may cause diurnal fluctuation of stage at St. Paul. Flow is regulated by Government reservoirs on headwaters at Lake Winnebigoshish, Leach Lake, Pokegama Lake, Sandy Lake, Pine River, and Gull Lake to increase the low-water open-season flow in interests of navigation, but the effect of this regulation is very gradual at St. Paul.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table, except as explained in footnote, to table of daily discharge. Records fair.

COOPERATION.—Gage-height record furnished by United States Weather Bureau.

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

June 19, 1922: Gage height, 2.37 feet; discharge, 7,560 second-feet.

Daily discharge, in second-feet, of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,230	4,220	3,840				32,600	20,800	9,910	5,910	4,770	4,090
2	4,920	4,220	3,840				30,000	19,900	9,180	5,910	4,630	4,220
3	4,490	4,220	3,840			3,300	29,600	18,900	9,180	5,560	4,630	4,490
4	4,630	4,350	3,600				29,200	18,600	8,500	5,390	4,770	3,840
5	4,490	4,220	3,600				28,800	17,900	8,060	5,560	4,920	4,090
6	4,220	4,090	3,720			3,360	30,000	17,000	7,640	5,070	4,770	3,840
7	4,490	4,630	3,840			2,820	30,400	16,700	7,430	5,390	4,090	3,840
8	4,630	4,350	3,720			2,820	31,700	16,400	7,230	5,070	3,960	3,960
9	4,090	3,960	3,600			2,820	34,900	15,800	8,280	5,390	4,350	4,220
10	3,720	4,090	3,600			3,130	40,800	16,400	9,180	5,070	4,220	4,220
11	4,490	3,960	3,600			3,720	43,300	16,400	8,500	5,390	4,220	3,600
12	4,350	3,960	3,720			4,350	44,600	15,800	7,850	5,230	4,090	4,090
13	3,960	3,720	3,600			5,560	46,000	16,100	8,060	4,920	4,220	3,960
14	4,090	3,240	3,840			8,720	46,000	16,700	7,230	4,920	4,090	3,960
15	4,490	3,130	3,720		3,050	12,000	45,300	15,800	6,640	4,920	4,090	3,960
16	4,350	3,240	3,840	2,850		13,700	43,900	16,100	7,640	4,630	4,220	3,960
17	4,220	3,240	3,020			14,300	42,600	15,800	7,640	4,490	4,220	4,090
18	4,350	3,240	2,920			14,000	40,200	15,500	7,030	4,770	4,090	4,090
19	4,220	3,480	2,920			15,200	38,400	15,800	7,230	4,630	4,090	3,960
20	4,090	3,360	2,920			14,900	37,300	15,200	7,430	5,070	3,960	4,090
21	4,490	2,720				20,800	35,300	14,600	6,830	4,920	3,840	4,350
22	4,350	3,130				17,600	33,500	14,600	6,270	5,390	4,490	4,350
23	4,220	3,130				16,400	31,700	14,000	6,090	5,070	4,090	4,090
24	4,350	3,130				16,400	29,600	13,400	6,270	4,630	3,960	4,090
25	4,220	2,920				18,300	28,400	13,400	6,450	4,920	3,960	3,960
26	4,090	3,360	2,950			20,800	26,400	12,600	6,270	4,490	4,090	3,840
27	3,960	3,480				25,000	25,000	11,800	6,830	4,490	4,220	3,960
28	4,490	3,720				25,300	23,900	10,700	5,910	4,490	3,480	3,840
29	4,220	3,720				29,600	23,200	10,700	5,730	4,920	4,090	3,960
30	3,960	3,600				30,400	21,200	10,200	6,090	4,770	3,720	3,960
31	3,960					30,000		10,200		4,220	3,840	

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Mar. 5; discharge estimated from comparison with discharge of Mississippi River at Elk River.

Monthly discharge of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1922

[Drainage area, 35,700 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	5,230	3,720	4,320	0.121	0.14
November	4,630	2,720	3,660	.103	.11
December	3,840		3,350	.094	.11
January			2,850	.080	.09
February			3,050	.085	.09
March	30,400	2,820	12,500	.350	.40
April	46,000	21,200	34,100	.955	1.07
May	20,800	10,200	15,300	.429	.49
June	9,910	5,730	7,420	.208	.23
July	5,910	4,220	5,020	.141	.16
August	4,920	3,480	4,200	.118	.14
September	4,490	3,600	4,030	.113	.13
The year	46,000		8,320	.233	3.16

MINNESOTA RIVER NEAR MONTEVIDEO, MINN.

LOCATION.—In sec. 17, T. 117 N., R. 40 W., at highway bridge 1 mile south of Montevideo, Chippewa County, 500 feet below mouth of Chippewa River.

DRAINAGE AREA.—6,300 square miles.

RECORDS AVAILABLE.—July 22, 1909, to September 30, 1922.

GAGE.—Chain gage attached to upstream handrail of bridge near left bank; read by Esther Hendricks. Datum of gage lowered 2 feet September 16, 1909, and 1 foot more July 29, 1910, to avoid negative readings. All gage heights referred to latest datum.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of heavy gravel and sand; permanent. There is a slight riffle just below gage, but control section is not well defined. The banks are medium height, and subject to overflow at a stage of 14 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.08 feet at 8 a.m. March 25 (discharge, 6,530 second-feet); minimum stage, 1.82 feet afternoon of September 29 and 30 (discharge, 52 second-feet).

1909–1922: Maximum stage recorded about 18.85 feet June 25, 1919 (discharge, about 22,000 second-feet); minimum discharge, 6.8 second-feet measured by current meter February 9, 1912.

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

REGULATION.—No regulation on Minnesota River above station. The regulation of Chippewa River at the plant of the Chippewa Milling Co. in Montevideo produces a slight fluctuation in stage of Minnesota River at gage.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined. Gage read to hundredths twice daily except during winter when it was read twice a week. Daily discharge ascertained by applying mean daily gage heights to rating table except as explained in footnote to table of daily discharge. Records good.

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

June 22, 1922: Gage height, 3.86 feet; discharge, 367 second-feet.

Daily discharge, in second-feet, of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	386	207	162	-------	5,390	1,960	906	316	225	73
2	338	207	207	-------	5,050	1,920	876	254	216	67
3	316	216	234	-------	4,760	1,820	817	234	207	68
4	338	198	180	-------	4,400	1,820	759	207	189	64
5	294	180	216	-------	4,300	1,740	759	198	189	62
6	294	154	225	-------	4,200	1,740	731	198	162	63
7	284	154	234	-------	4,110	1,650	675	189	189	75
8	294	171	234	-------	4,110	1,650	675	189	146	65
9	264	189	254	-------	4,030	1,740	647	138	138	70
10	254	216	244	-------	4,030	1,780	619	189	130	64
11	254	216	216	-------	3,950	1,690	592	154	123	62
12	244	216	216	-------	3,880	1,690	619	138	130	53
13	234	216	234	386	3,810	1,690	566	138	130	60
14	216	207	-------	514	3,690	1,610	540	138	123	62
15	198	207	-------	846	3,630	1,610	514	123	115	59
16	189	207	-------	1,530	3,520	1,530	540	138	105	70
17	198	216	-------	2,610	3,460	1,490	540	123	103	64
18	207	225	-------	3,020	3,300	1,530	488	116	98	59
19	207	244	-------	3,180	3,240	1,490	488	105	88	71
20	198	235	-------	3,240	3,080	1,410	462	111	87	69
21	198	226	-------	3,130	2,910	1,340	462	96	79	67
22	180	216	-------	3,350	2,810	1,300	386	91	96	65
23	198	207	-------	3,810	2,660	1,250	362	104	88	60
24	207	162	-------	5,390	2,610	1,200	362	146	98	62
25	198	154	-------	6,310	2,510	1,230	338	316	123	64
26	198	146	-------	5,590	2,410	1,160	316	362	123	59
27	189	146	-------	5,810	2,320	1,100	294	316	96	54
28	171	146	-------	6,310	2,230	1,060	284	274	94	56
29	171	154	-------	6,310	2,140	998	254	294	97	53
30	189	162	-------	6,050	2,050	998	254	244	82	53
31	198	-------	-------	5,810	-------	936	-------	244	70	-------

NOTE.—Stage-discharge relation affected by ice Nov. 20–22, and Dec. 14 to Mar. 12. Discharge interpolated for the three days in November; discharge not determined for the remainder of the winter period.

Monthly discharge of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1922

[Drainage area, 6,300 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	386	171	236	0.037	0.04
November	244	146	193	.031	.03
December 1–13	254	162	220	.035	.02
March 13–31	6,310	386	3,850	.611	.43
April	5,390	2,050	3,490	.554	.62
May	1,960	936	1,490	.237	.27
June	906	254	538	.085	.10
July	362	91	190	.030	.03
August	225	70	127	.020	.02
September	75	53	63.1	.010	.01

MINNESOTA RIVER AT MANKATO, MINN.

LOCATION.—In sec. 7, T. 108 N., R. 26 W., at new Main Street highway bridge in Mankato, Blue Earth County, 2 miles below mouth of Blue Earth River.

DRAINAGE AREA.—14,600 square miles.

RECORDS AVAILABLE.—March 15 to September 30, 1922, at present site; May 20, 1903, to October 19, 1921, at Sibley Park 2 miles upstream. Drainage area practically the same at the two sites.

GAGE.—Chain gage attached to downstream side of bridge over center of left channel; read by J. J. Pihale.

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

CHANNEL AND CONTROL.—Bed composed of sand and light gravel; shifts badly during high stages. Banks moderately high and not subject to overflow. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.5 feet March 16; minimum stage, 3.3 feet September 22–30.

1903–1922: Maximum stage recorded, 21.2 feet at old site at Sibley Park, June 26, 1908 (discharge, 43,800 second-feet); minimum discharge, August 31 and September 1 and 2, 1911 (discharge, 89 second-feet). The highest known stage of this river occurred in 1881, and is shown in Mankato by a well-marked line, which was approximately 27 feet above the zero of the Sibley Park gage. This stage is corroborated by Mr. M. B. Haynes, city engineer of Mankato, who states that the high water occurred after the ice went out and was not caused by backwater. The corresponding discharge estimated 65,000 second-feet.

ICE.—No records available during winter.

REGULATION.—The nearest dam on Minnesota River is at Minnesota Falls, 140 miles upstream. A dam on Blue Earth River at Rapidan, a few miles above the mouth, controls the flow of that river, which is approximately 20 per cent of that at Mankato station, and produces considerable daily fluctuation at gage amounting at times to over 1 foot.

ACCURACY.—Rating curve not developed.

COOPERATION.—Gage-height record furnished by United States Weather Bureau

Discharge measurements of Minnesota River at Mankato, Minn., during the year ending Sept. 30, 1922

[Made by S. B. Soulé]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
June 23	4.60	1,020
23	4.56	876

Daily gage height, in feet, of Minnesota River at Mankato, Minn., for the year ending Sept. 30, 1922

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1	------	10.6	7.8	5.8	4.2	4.3	3.5
2	------	10.9	8.0	5.7	4.2	4.3	3.5
3	------	11.1	8.7	5.7	4.1	4.2	3.5
4	------	11.2	8.9	5.5	4.1	4.1	3.5
5	------	11.3	7.6	5.3	4.0	4.1	3.5
6	------	11.3	7.7	5.2	4.0	4.0	3.5
7	------	11.1	7.3	5.2	4.1	4.0	3.5
8	------	11.0	7.3	5.2	4.0	3.9	3.5
9	------	11.0	7.2	5.3	4.1	3.9	3.5
10	------	11.4	7.2	5.2	4.0	3.8	3.4
11	------	11.7	7.2	5.1	4.0	3.8	3.4
12	------	12.3	7.3	5.0	4.2	3.9	3.4
13	------	12.3	7.1	5.2	4.1	3.8	3.4
14	------	12.7	7.0	5.1	4.1	3.8	3.4
15	11.8	12.8	7.0	5.0	4.0	3.7	3.4
16	13.5	12.7	6.9	5.3	3.9	3.7	3.3
17	11.4	12.6	6.9	5.0	3.9	3.6	3.4
18	10.8	12.4	6.9	5.0	3.9	3.5	3.4
19	10.6	11.9	6.8	4.8	4.0	3.5	3.5
20	9.8	11.1	6.7	4.8	4.0	3.5	3.4
21	9.6	10.8	6.6	4.8	3.9	3.8	3.4
22	9.8	10.2	6.6	4.7	3.8	3.7	3.3
23	10.1	9.9	6.5	4.7	3.7	3.7	3.3
24	10.8	9.4	6.3	4.7	3.8	3.7	3.3
25	10.9	9.3	6.3	4.5	3.8	3.7	3.3
26	10.4	9.2	6.3	4.4	3.7	3.6	3.3
27	10.1	8.8	6.2	4.4	3.8	3.5	3.3
28	10.1	8.6	6.2	4.3	4.1	3.5	3.3
29	10.3	8.4	6.1	4.3	4.3	3.5	3.3
30	10.1	8.2	5.9	4.3	4.3	3.4	3.3
31	10.5	------	5.8	------	4.3	3.4	------

ST. CROIX RIVER AT SWISS, WIS.

LOCATION.—In sec. 33, T. 42 N., R. 15 W., at highway bridge near Swiss, Burnett County, 2 miles above point where St. Croix River becomes boundary line between Wisconsin and Minnesota, 10 miles northeast of Danbury, Wis., on Minneapolis, St. Paul & Sault Ste. Marie Railway. Namakagon River enters from left 3½ miles above station.

DRAINAGE AREA.—1,550 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—March 13, 1914, to September 30, 1922.

GAGE.—Chain gage attached to dowstream side of bridge on May 16, 1918; prior to that date a cast iron staff gage bolted to concrete pier at left end of bridge was used. Both gages at same datum and read by Capt. Richard Goldschmidt.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of gravel, smooth. Aquatic plants during summer may cause a small amount of backwater. Left bank high and not subject to overflow; right bank of medium height and may possibly be overflowed during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.15 feet at 6.30 p. m. April 11 (discharge, 7,380 second-feet); minimum discharge estimated during period when stage-discharge relation was affected by ice, 630 second-feet November 14–21.

1914–1922: Maximum stage recorded, 6.73 feet April 22, 1916 (discharge, 8,480 second-feet); minimum discharge of 630 second-feet was estimated November 14–21, 1921.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined. Gage read to quarter-tenths twice daily except during winter when it was read twice a week. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of St. Croix River at Swiss, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 13	A. O. Olson	[a] 1.94	721
Feb. 9	S. B. Soulé	[a] 2.64	852
Aug. 14	E. E. Foster	.67	818

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of St. Croix River at Swiss, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	905	810	810	725	675	870	2,430	2,230	1,210	1,090	840	810
2	870	810	810	725	730	905	2,630	2,040	1,170	1,050	810	810
3	870	810	810	725	780	940	2,730	2,130	1,130	1,010	810	810
4	870	810	810	725	795	940	2,840	2,430	1,050	975	810	780
5	840	810	810	725	810	975	3,390	2,630	1,010	940	840	810
6	840	810	810	725	840	1,010	4,120	2,630	975	905	905	975
7	810	810	810	725	870	1,050	5,070	2,530	940	905	905	1,010
8	810	810	810	725	860	1,090	5,520	2,430	940	870	870	1,050
9	810	780	810	725	850	1,130	6,340	2,530	940	940	870	1,010
10	810	780	810	725	840	1,170	7,080	2,430	1,010	1,050	840	975
11	870	725	810	725	840	1,210	7,280	2,430	1,050	975	810	940
12	870	650	810	725	840	1,250	7,080	2,330	1,010	975	810	905
13	840	650	810	720	840	1,290	7,080	2,230	1,010	1,010	810	870
14	840	630	810	700	870	1,330	6,700	2,040	1,010	975	810	840
15	810	630	810	710	870	1,370	6,000	1,950	1,010	975	780	840
16	810	630	810	725	870	1,410	5,370	1,860	1,290	1,050	750	810
17	810	630	810	710	870	1,410	5,070	1,860	1,540	1,130	750	840
18	840	630	780	700	870	1,410	4,650	2,040	1,540	1,130	750	905
19	870	630	750	700	870	1,410	4,250	2,130	1,540	1,050	725	940
20	840	630	750	700	870	1,460	3,990	2,130	1,500	1,050	725	940
21	840	630	750	700	870	1,540	3,750	2,130	1,370	1,010	750	905
22	810	650	725	700	870	1,590	3,510	1,950	1,370	1,050	750	870
23	810	650	725	700	870	1,680	3,280	1,860	1,250	1,010	750	870
24	810	675	725	700	870	1,720	3,170	1,770	1,130	1,010	725	840
25	840	675	725	690	870	1,770	3,060	1,640	1,090	975	750	810
26	840	700	725	675	870	1,860	2,840	1,540	1,050	940	750	810
27	840	700	725	690	870	1,950	2,730	1,410	1,010	940	750	780
28	810	725	725	700	870	2,040	2,630	1,330	975	905	725	780
29	810	750	725	690	-------	2,130	2,430	1,210	975	870	750	750
30	810	780	725	675	-------	2,230	2,330	1,210	1,050	870	750	780
31	810	-------	725	675	-------	2,330	-------	1,210	-------	840	750	-------

NOTE.—Stage-discharge relation affected by ice Nov. 13 to Apr. 2; discharge based on gage heights corrected for effect of ice by discharge measurements, observer's notes, and weather records.

Monthly discharge of St. Croix River at Swiss, Wis., for the year ending Sept. 30, 1922

[Drainage area, 1,550 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	905	810	834	0.538	0.62
November	810	630	714	.461	.51
December	810	725	776	.501	.58
January	725	675	708	.457	.53
February	870	675	844	.545	.57
March	2,330	870	1,430	.923	1.06
April	7,280	2,330	4,310	2.78	3.10
May	2,630	1,210	2,010	1.30	1.50
June	1,540	940	1,140	.735	.82
July	1,130	840	983	.634	.73
August	905	725	788	.508	.59
September	1,050	750	869	.561	.63
The year	7,280	630	1,280	.826	11.24

ST. CROIX RIVER NEAR ST. CROIX FALLS, WIS.

LOCATION.—In sec. 18, T. 34 N., R. 18 W., at power plant of Minneapolis General Electric Co., on Wisconsin side of St. Croix River near St. Croix Falls, Polk County, 50 miles above mouth of river. Apple River, draining an area wholly in Wisconsin, enters from left 20 miles below station; Snake River, draining an area in Minnesota, enters from right 35 miles above station.

DRAINAGE AREA.—5,930 square miles.

RECORDS AVAILABLE.—January 1, 1910, to September 30, 1922. Data for 1903 published in Water-Supply Paper 98, pages 176–177, under St. Croix River near Taylors Falls, Minn. Daily and monthly discharge January 10, 1902, to June 30, 1905, and monthly estimates July, 1905, to December, 1909, published in the "Report of water resources investigations of Minnesota, 1909–1912" by the Minnesota State Drainage Commission.

DISCHARGE.—Determinations of discharge based on kilowatt output of dynamo and exciters plus flow over dam and spillway considered as a weir.

EXTREMES OF DISCHARGE.—Maximum daily discharge recorded during year 18,600 second-feet April 10 and 11; minimum daily discharge 760 second-feet November 13.

1902–1922: Maximum discharge recorded, 35,800 second-feet March 26, 1920; minimum discharge, 75 second-feet July 17, 1910 (caused by regulation).

REGULATION.—Low-water flow controlled by operation of gates of power plant and by storage and release of water at Never's dam several miles upstream.

ACCURACY.—Records probably reliable; they have not been checked, nor have discharge measurements been made by engineers of United States Geological Survey.

COOPERATION.—Records furnished by the Minneapolis General Electric Co.

Daily discharge, in second-feet, of St. Croix River near St. Croix Falls, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,720	1,860	2,180	1,100	2,480	1,410	13,600	6,880	3,000	2,460	2,220	1,670
2	1,380	2,070	1,810	1,270	1,560	1,520	12,100	6,100	2,860	1,510	1,920	1,470
3	2,270	2,070	1,550	1,540	1,440	1,600	11,200	6,000	2,580	1,850	1,780	1,820
4	2,200	1,820	1,300	1,590	1,520	2,150	15,100	6,140	2,380	1,920	1,720	1,140
5	2,190	1,650	1,800	1,500	1,720	1,250	15,200	6,900	2,240	2,480	1,840	1,720
6	2,160	1,020	1,840	1,740	1,750	1,850	14,900	10,100	2,180	2,800	1,770	1,650
7	1,980	2,230	2,000	1,590	1,800	2,160	17,500	10,400	2,140	2,210	1,850	1,690
8	1,520	2,080	1,520	1,180	1,620	2,070	17,700	8,140	2,130	1,990	1,680	1,810
9	2,500	1,910	1,790	1,720	1,590	1,760	18,400	7,990	1,870	2,620	1,740	1,880
10	1,380	1,600	1,560	1,800	1,360	1,870	18,600	8,020	2,290	2,190	1,540	1,950
11	2,130	870	1,830	1,750	890	2,400	18,600	9,720	1,560	2,460	1,660	1,930
12	1,870	1,350	2,030	1,850	1,100	1,720	17,100	9,780	2,260	2,460	1,980	1,780
13	1,810	760	1,560	1,620	1,460	2,500	16,100	9,660	2,180	2,860	1,820	1,790
14	2,130	1,380	1,760	1,540	1,060	2,400	15,100	5,540	2,390	2,770	1,580	1,560
15	1,220	2,040	1,920	940	1,820	2,460	14,800	4,960	2,250	2,440	1,820	1,700
16	1,430	1,290	1,890	1,750	1,880	2,660	11,500	4,520	3,280	2,640	1,920	1,900
17	2,030	1,100	1,670	1,680	1,310	2,700	11,700	4,380	3,700	2,360	1,760	1,500
18	2,590	1,220	1,910	1,710	2,230	2,130	11,100	4,300	3,360	2,690	1,620	1,880
19	1,770	1,470	1,830	1,710	1,330	1,830	10,400	4,700	3,600	2,450	1,300	1,960
20	1,620	1,130	2,320	1,870	1,630	4,070	10,500	5,060	3,890	2,800	2,180	2,250
21	1,860	1,380	2,520	1,480	1,730	5,210	10,400	3,350	4,100	2,230	1,920	2,500
22	1,550	1,410	1,930	800	1,580	4,290	10,400	4,040	3,960	2,130	1,400	2,320
23	930	1,700	1,960	1,510	1,430	4,540	10,500	4,430	3,880	3,250	1,320	1,300
24	2,640	1,190	990	1,260	1,570	5,340	11,400	4,340	4,020	1,750	1,440	1,410
25	2,020	1,980	1,520	1,810	1,700	5,690	10,500	4,140	3,030	2,170	1,260	1,560
26	1,530	1,700	940	1,510	1,280	6,750	8,720	4,160	3,370	1,770	1,360	1,540
27	1,950	780	1,680	1,610	1,260	7,290	9,420	4,170	3,530	2,060	1,360	1,690
28	1,860	2,150	1,810	1,390	1,340	9,340	7,440	3,880	3,150	2,140	1,280	1,660
29	1,790	2,330	1,630	1,080	-------	9,750	6,840	3,580	2,740	2,020	1,500	1,860
30	790	1,920	1,380	1,590	-------	10,900	7,000	2,850	2,700	2,010	1,540	1,620
31	2,070	-------	1,540	1,400	-------	10,900	-------	3,140	-------	1,960	920	-------

Monthly discharge of St. Croix River near St. Croix Falls, Wis., for the year ending Sept. 30, 1922

[Drainage area, 5,930 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,640	790	1,840	0.310	0.36
November	2,330	760	1,580	.266	.30
December	2,520	940	1,740	.293	.34
January	1,870	800	1,510	.255	.29
February	2,480	890	1,550	.261	.27
March	10,900	1,250	3,950	.666	.77
April	18,600	6,840	12,800	2.16	2.41
May	10,400	2,850	5,850	.987	1.14
June	4,100	1,560	2,890	.487	.54
July	3,250	1,510	2,300	.388	.45
August	2,220	920	1,650	.278	.32
September	2,500	1,140	1,750	.295	.33
The year	18,600	760	3,280	.553	7.52

NOTE.—Computed by U. S. Geol. Survey.

NAMAKAGON RIVER AT TREGO, WIS.

LOCATION.—In sec. 35, T. 40 N., R. 12 W., at Chicago & Northwestern Railway bridge at Trego, Washburn County, 20 miles above confluence of Namakagon and Totogatic rivers.

DRAINAGE AREA.—420 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch = 6 miles).

RECORDS AVAILABLE.—March 11, 1914, to September 30, 1922.

GAGE.—Enameled staff fastened to retaining wall on left bank of river just above railroad bridge; read by Patrick Lawton.

DISCHARGE MEASUREMENTS.—Made from lower chords of railroad bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; free from vegetation. Banks medium high and not subject to overflow. Small island downstream with rapids on each side form the control. Channel permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.60 feet at 10.45 a. m. April 11 (discharge, 1,810 second-feet); minimum discharge, estimated, 260 second-feet January 16 (stage-discharge relation affected by ice).

1914–1922: Maximum stage recorded, that of 1922. Minimum discharge, estimated, 235 second-feet December 19, 1916.

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

ACCURACY.—Stage-discharge relation permanent except when affected by ice. Rating curve well defined between 330 and 1,330 second-feet. Gage read to hundredths once daily; except during winter when it was read twice a week. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Namakagon River at Trego, Wis., during the year ending September 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 11	A. O. Olson	[a]2.39	268
Feb. 15	do	[a]2.57	281
Aug. 14	E. E. Foster	1.55	353

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Namakagon River at Trego, Wis., for the year ending September 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	393	369	320	290	310	330	733	803	532	444	369	369
2	393	369	330	290	315	330	803	733	502	393	369	369
3	369	369	330	285	320	330	803	803	472	417	369	369
4	369	369	330	280	320	350	873	838	444	393	369	369
5	369	369	330	285	320	350	1020	873	444	369	369	369
6	369	369	330	290	320	350	1170	908	417	350	393	472
7	369	369	330	280	320	370	1410	944	417	350	393	444
8	369	369	350	270	320	370	1570	873	417	369	369	444
9	369	332	350	270	320	370	1730	733	417	369	369	472
10	369	369	350	270	315	395	1810	838	472	350	393	417
11	393	393	350	270	310	415	1810	803	472	417	369	417
12	393	393	350	270	300	445	1730	803	472	502	369	393
13	369	393	350	270	290	470	1570	768	472	444	369	369
14	369	393	350	270	285	530	1490	733	472	369	350	369
15	369	393	350	265	280	565	1330	733	444	369	350	369
16	369	393	350	260	275	597	1250	698	564	417	332	369
17	369	369	350	265	270	532	1170	768	597	502	332	369
18	369	369	320	270	275	532	1170	768	630	369	332	393
19	369	350	310	275	280	502	1250	838	597	393	332	417
20	369	330	300	280	280	472	1170	803	564	393	332	417
21	369	320	300	285	280	472	1170	768	532	417	332	393
22	369	310	300	290	285	500	1090	733	502	369	332	393
23	369	310	300	300	290	530	1020	664	444	393	332	393
24	369	310	300	310	305	532	1020	664	417	444	332	393
25	369	310	300	305	320	532	944	630	417	369	332	369
26	369	310	300	300	325	944	944	597	444	369	332	369
27	369	310	290	300	330	838	944	472	417	444	332	369
28	369	310	290	300	330	944	908	532	393	417	332	350
29	393	310	290	300	-------	1090	873	502	393	393	350	350
30	393	320	290	300	-------	803	873	532	444	369	332	369
31	393	-------	290	305	-------	733	-------	564	-------	369	332	-------

NOTE.—Stage discharge relation affected by ice Nov. 20 to Mar. 15 and Mar. 22 and 23; discharge based on gage heights corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records.

Monthly discharge of Namakagon River at Trego, Wis., for the year ending September 30, 1922

[Drainage area, 420 square miles]

Month	Discharge in second-feet				Run-off, in inches
	Maximum	Minimum	Mean	Per square mile	
October	393	369	374	0.890	1.03
November	393	310	352	.838	.94
December	350	290	322	.767	.88
January	310	260	284	.676	.78
February	330	270	303	.721	.75
March	1,090	330	533	1.27	1.46
April	1,810	733	1,190	2.83	3.16
May	944	472	733	1.75	2.02
June	630	393	474	1.13	1.26
July	502	350	398	.948	1.09
August	393	332	352	.838	.97
September	472	350	391	.931	1.04
The year	1,810	260	475	1.13	15.38

APPLE RIVER NEAR SOMERSET, WIS.

LOCATION.—In sec. 21, T. 31 N., R. 19 W., at power plant of St. Croix Power Co., 3½ miles below Somerset, St. Croix County, 2 miles above mouth of river.

DRAINAGE AREA.—550 square miles (measured on map issued by Wisconsin Geological and Natural History Survey edition of 1911; scale, 1 inch equals 6 miles).

RECORDS AVAILABLE.—January, 1901, to September 30, 1922.

GAGE.—Vertical staff gages are used for determining the head on the wheel from the power output of which the discharge is computed.

DISCHARGE.—The discharge of the turbines in second-feet corresponding to the number of kilowatts is determined for each hour during the day from a record of the number of wheels in operation and the load; the sum of the discharge divided by 24 gives the average discharge through the turbines. To this quantity is added the leakage through the average number of wheels idle each day, the sum giving the daily flow through the power house. Water is seldom wasted over the spillway of the dam, but when it is so wasted the quantity is computed from weir formulas and added to the flow through the plant. There is a constant leakage through the gate and flashboards amounting to 3 second-feet. This quantity has not been taken into consideration in computing the published records.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during year, 1,420 second-feet April 11. Minimum discharge, 90 second-feet September 24.

1904–1922: Maximum discharge recorded, 2,280 second-feet in June, 1905. Minimum discharge, 20 second-feet June 26, 1921. Owing to regulation the minimum discharge has no bearing on the natural minimum flow. No maximum and minimum records are available for 1901–1903.

REGULATION.—There are a number of power plants on Apple River above the station. The pondage of these plants is small, and though the daily flow may be controlled to some extent, the mean monthly flow probably corresponds closely to the natural flow.

ACCURACY.—From 1901 to 1909 the discharge through the plant was determined from tables computed from data collected at tests on one of the turbines made at the flume of the Holyoke Water Power Co. Holyoke, Mass. In the summer of 1909 engineers of the St. Croix Power Co. made tests on the water flowing through all the wheels as actually installed, by means of a sharp-crested weir 710 inches long located 60 feet below power house. These tests gave results 3 per cent larger than the Holyoke tests, and tables based on them have been used in determining the discharge through the plant from 1909 to September, 1920. In May, 1914, a series of current-meter measurements were made by the Wisconsin Railroad Commission and United States Geological Survey, and a rating curve for the tailrace was developed. Twelve tests were then run with different wheels and loads. It was found that the discharge as determined by the current meter and the discharge as computed by the company agree very closely, the percentage difference for the 12 tests ranging from −6.4 per cent to +1.8 per cent, with an average of −2 per cent; the discharge as determined by the company being 2 per cent less than that determined by the current meter. During 1919 three current meter measurements were made to check the accuracy of the published records. These measurements showed that the power-plant records were about 5 per cent less than the measured discharge, due probably to increased leakage through the wheels. The records, as published for 1919 and 1920, are the power-plant records increased by 5 per cent. In September, 1920, another series of tests was made by the power company by means of a sharp-crested weir, from which the tables used in computing the flow through the power house were corrected. The records, as published for 1921 and 1922, are the power-plant records as furnished by the company without change.

COOPERATION.—Records furnished by the St. Paul Gas Light Co., of St. Paul, Minn., D. W. Flowers, engineer. No discharge measurements were made at this station during the year.

Daily discharge, in second-feet, of Apple River near Somerset, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	263	217	241	198	207	201	799	338	291	481	187	177
2	199	224	227	154	190	191	834	398	274	366	200	243
3	268	223	243	178	218	218	805	421	224	409	192	184
4	245	212	181	211	200	218	779	361	198	337	198	114
5	241	238	230	171	202	222	800	421	239	271	217	178
6	226	213	203	193	199	259	838	351	206	288	205	191
7	228	208	247	214	182	323	951	388	213	299	184	204
8	232	221	199	202	213	275	1,110	506	217	268	204	222
9	184	227	213	211	226	245	1,220	353	253	393	203	371
10	356	210	224	207	217	274	1,270	432	305	379	170	179
11	232	195	190	206	183	292	1,420	433	380	319	198	227
12	222	239	230	205	187	272	1,320	479	389	313	196	231
13	243	170	213	194	176	356	1,350	461	276	287	216	223
14	267	234	234	207	196	469	1,230	367	242	273	164	249
15	224	201	229	193	218	453	1,090	495	330	362	204	314
16	230	226	218	199	214	375	972	441	633	219	173	143
17	188	210	226	210	192	368	666	327	922	248	196	186
18	227	219	106	213	200	385	748	374	1,220	257	192	198
19	216	254	239	182	205	379	682	402	1,020	242	221	226
20	221	112	143	214	194	515	637	425	925	279	231	291
21	243	171	177	176	189	492	474	370	805	240	116	207
22	226	173	203	175	186	454	589	367	746	239	167	221
23	233	248	240	200	193	512	409	349	523	224	178	287
24	231	254	160	193	193	545	636	266	480	224	182	90
25	226	256	212	186	167	691	490	285	472	212	162	234
26	199	267	170	210	179	872	370	376	553	195	216	229
27	229	210	182	200	194	539	427	303	610	212	141	210
28	222	222	185	212	180	936	870	173	497	220	183	194
29	279	240	204	183	-------	936	408	285	348	229	156	205
30	211	221	219	183	-------	909	418	321	322	207	133	314
31	210	-------	199	202	-------	849	-------	278	-------	171	162	-------

NOTE.—See paragraph on "Discharge" in station description for method by which these records are obtained.

Monthly discharge of Apple River near Somerset, Wis., for the year ending Sept. 30, 1922

[Drainage area, 550 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	356	184	233	0.424	0.49
November	267	112	217	.395	.44
December	247	106	206	.375	.43
January	214	154	196	.356	.41
February	226	167	196	.356	.37
March	936	191	452	.822	.95
April	1,420	370	820	1.49	1.66
May	506	173	372	.676	.78
June	1,220	198	470	.855	.95
July	481	171	279	.507	.58
August	231	116	185	.336	.39
September	371	90	218	.396	.44
The year	1,420	90	320	.582	7.89

CHIPPEWA RIVER AT BISHOPS BRIDGE, NEAR WINTER, WIS.

LOCATION.—In sec. 23, T. 39 N., R. 6 W., at highway bridge, 4 miles by road northwest of Winter, Sawyer County. East Fork of Chippewa River enters on left 3 miles above station.

DRAINAGE AREA.—775 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch = 6 miles).

RECORDS AVAILABLE.—February 23, 1912, to September 30, 1922.

GAGE.—Chain gage attached to bridge used since May 23, 1916; read by John Edberg. Gages previously used as follows: February 23, 1912, to January 27, 1914, a wooden staff gage fastened to a wooden pier on the right bank just above bridge; datum 3.44 feet above that for chain gage. January 27, 1914, to May 28, 1916, a vertical cast iron staff gage fastened to the same pier; datum same as for chain gage.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge.

CHANNEL AND CONTROL.—Bed composed of gravel, free from vegetation, and remained permanent from time of estabiishment until the summer of 1921 when a shift occurred. Control is head of rapids 1,000 feet below gage. One channel at all stages. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 9.23 feet at 9.30 a. m. April 12 (discharge, 5,910 second-feet); minimum discharge estimated because of ice 155 second-feet, January 23–27.

1912–1922: Maximum stage recorded, 9.56 feet April 22, 1916 (discharge, 6,940 second-feet); minimum discharge, that of January 23–27, 1922.

REGULATION.—Flow modified to some extent by operation of storage reservoir, sec. 14, T. 41 N., R. 6 W., 16 miles above station. This reservoir has a capacity of 550 million cubic feet, and is used in connection with reservoirs on Upper Flambeau River, for purpose of regulating flow of Chippewa River.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined between 270 and 6,820 second-feet. Gage read to hundredths twice daily except during winter when it was read twice weekly. Daily discharge determined by use of indirect method and as explained in footnote to table of daily discharge. Open-water records fair; winter records poor.

Discharge measurements of Chippewa River at Bishops Bridge, near Winter, Wis., during the year ending Sept. 30, 1922.

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	Sec.-ft.
Oct. 14	A. O. Olson	4.40	268	Apr. 26	A. O. Olson	7.35	2,870
Jan. 9	do	[a] 5.10	220	Aug. 15	Foster and Schneider	4.34	217
Feb. 13	do	[a] 5.67	261	16	E. E. Foster	4.33	212
Mar. 16	do	[a] 6.24	475				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Chippewa River at Bishops Bridge, near Winter, Wis., for the year ending Sept. 30, 1922.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	322	270	455	225	200	340	1,200	2,440	610	455	254	238
2	304	287	405	225	225	340	1,150	2,310	610	455	254	238
3	287	270	480	225	225	340	1,200	2,310	610	455	254	254
4	287	270	530	225	255	340	1,300	2,310	610	405	238	254
5	287	270	580	225	265	350	1,740	2,570	580	380	238	270
6	270	270	610	225	270	360	2,310	2,700	555	380	238	304
7	270	254	610	225	270	370	2,980	2,700	505	340	238	304
8	254	254	675	225	270	380	3,400	2,700	480	360	223	380
9	270	285	710	220	265	395	4,250	2,700	480	360	238	480
10	270	254	530	220	255	405	4,920	2,700	455	380	238	530
11	270	254	480	225	255	405	5,850	2,440	430	380	238	580
12	270	285	405	225	255	405	5,850	2,310	430	380	238	610
13	270	285	455	225	255	420	5,850	2,180	405	360	238	610
14	270	254	455	225	240	430	5,280	1,920	405	360	223	580
15	270	254	453	225	240	455	4,920	1,740	405	340	223	555
16	270	254	455	225	240	480	4,570	1,570	640	340	208	530
17	270	360	430	225	235	480	4,410	1,400	710	340	194	505
18	270	455	430	210	225	480	4,100	1,460	750	340	180	480
19	287	480	405	195	235	480	4,100	1,400	750	322	180	480
20	287	430	380	195	240	480	3,960	1,300	710	322	180	455
21	287	480	305	195	240	480	3,820	1,250	640	360	180	430
22	287	555	255	175	240	505	3,680	870	610	360	194	405
23	287	610	240	155	250	505	3,400	915	580	340	194	380
24	287	710	240	155	255	530	3,120	1,100	530	322	194	360
25	287	750	240	155	280	530	2,980	1,050	505	304	180	340
26	287	790	240	155	305	580	2,840	915	480	304	180	340
27	287	710	225	155	325	610	2,700	830	455	287	180	322
28	287	610	225	165	340	675	2,700	710	430	287	180	322
29	287	455	225	170	-------	790	2,570	640	405	270	194	364
30	287	480	225	170	-------	870	2,440	640	430	270	180	287
31	270	-------	225	170	-------	960	-------	640	-------	254	194	-------

NOTE.—Stage-discharge relation affected by ice Nov. 9, 12, 13, 22, 26, Dec. 3, 6, and Dec. 13 to Apr. 1; discharge based on gage heights corrected for effect of ice by means of three discharge measurements, observer's notes, and weather records.

Monthly discharge of Chippewa River at Bishops Bridge, near Winter, Wis., for the year ending Sept. 30, 1922

[Drainage area, 775 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	322	254	280	0.361	0.42
November	790	254	405	.523	.58
December	710	225	406	.524	.60
January	225	155	201	.259	.30
February	340	200	256	.330	.34
March	960	340	489	.631	.73
April	5,850	1,150	3,450	4.45	4.96
May	2,700	640	1,700	2.19	2.52
June	750	405	540	.697	.78
July	455	254	349	.450	.52
August	254	180	212	.274	.32
September	610	238	404	.521	.58
The year	5,850	155	723	.933	12.65

CHIPPEWA RIVER NEAR BRUCE, WIS.

LOCATION.—In sec. 4, T. 35 N., R. 7 W., at Minneapolis, St. Paul & Sault Ste. Marie Railway bridge 1 mile east of Bruce, Rusk County. Thornapple River enters from left immediately above station, and Flambeau River from left 21 miles below.

DRAINAGE AREA.—1,600 square miles (Measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—December 31, 1913, to September 30, 1922.

GAGE.—Chain gage, attached to downstream side of bridge; read by H. C. Gardner and M. Pavlok.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and small gravel, free from vegetation; first channel from the west fairly permanent; third channel nearest east bank has a tendency to fill with sand worked in by Thornapple River. Flow except during extremely high stages is confined within the banks.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.7 feet at 4.30 p. m. April 10 (discharge, 14,900 second-feet); minimum discharge February 4, estimated 255 second-feet (stage-discharge relation affected by ice).

1914–1922: Maximum stage recorded that of 1922; minimum discharge, that of 1922. Minimum open-water stage recorded, 1.15 feet morning and afternoon reading August 21, 1918 (discharge, about 260 second-feet) caused by regulation.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Flow modified to some extent by reservoir on West Fork of Chippewa River, in sec. 14, T. 41 N., R. 6 W. Reservoir has a capacity of 550 million cubic feet, and is used in connection with reservoirs on the Upper Flambeau River for the purpose of regulating the flow of Chippewa River. No diurnal fluctuation is observed.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control and by ice. Rating curve fairly well defined. Gage read to quarter-tenths once daily except during winter when it was read twice a week. Daily discharge ascertained by indirect method for shifting control except as explained in footnote to table of daily discharge. Open-water records good; winter records fair.

Discharge measurements of Chippewa River near Bruce, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 11	A. O. Olson	1.70	588	Mar. 15	S. B. Soulé	[a] 4.12	1,020
Jan. 6	do	[a] 2.48	395	Apr. 27	A. O. Olson	5.65	3,730
Feb. 11	do	[a] 3.00	429	Aug. 16	E. E. Foster	1.63	430

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Chippewa River near Bruce, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	690	515		405	300	480	4,420	3,000	1,190	1,430	515	410
2	655	515		400	290	515	4,640	2,800	1,110	1,270	515	550
3	655	515		400	270	550	5,320	3,320	1,110	1,150	480	515
4	620	515		400	255	585	6,550	4,420	1,080	1,000	480	480
5	585	515		400	280	620	8,400	5,080	1,000	900	480	445
6	585	515		400	305	620	9,240	5,800	935	830	480	515
7	550	515		390	330	655	11,200	6,040	865	830	515	585
8	550	480		385	355	690	12,300	5,320	795	830	515	760
9	550	515	515	375	380	760	11,900	5,200	760	865	480	935
10	550	515		370	405	795	14,600	4,860	865	935	480	970
11	585	515		360	430	830	13,900	4,200	830	865	480	935
12	585	515		350	430	865	12,100	3,760	795	830	480	935
13	585	515		345	440	935	10,600	3,430	795	760	445	970
14	585	515		340	440	970	9,240	2,900	760	725	445	935
15	585	515		340	445	1,020	8,140	2,500	760	690	445	900
16	550	550		360	445	1,080	7,620	2,300	5,320	690	445	865
17	550	585	480	375	445	1,190	7,230	2,120	10,100	795	410	830
18	515	620	475	365	450	1,310	6,810	3,100	6,940	725	410	795
19	515	620	460	355	450	1,390	6,040	3,320	5,320	655	410	830
20	515	585	445	350	460	1,510	5,800	2,900	3,760	725	410	795
21	515	585	430	350	460	1,670	5,320	2,500	2,300	935	380	760
22	515	550	415	350	460	1,850	5,080	1,940	1,850	900	380	725
23	515	550	410	350	465	2,120	4,640	1,590	1,670	830	380	690
24	515		410	340	465	2,400	4,310	1,430	1,430	760	350	655
25	515		410	330	475	3,540	4,090	1,430	1,270	690	350	620
26	515	515	410	320	475	5,080	3,870	1,430	1,040	655	350	585
27	515		410	310	480	7,070	3,760	1,270	1,080	620	350	550
28	515		405	305	480	8,820	3,540	1,190	1,000	585	350	550
29	515		405	300	-------	7,980	3,100	1,040	935	550	350	515
30	515		405	305	-------	6,810	3,000	970	1,000	550	350	515
31	515	-------	405	310	-------	5,440	-------	1,110	-------	515	350	-------

NOTE.—Stage-discharge relation affected by ice Nov 20 to Mar. 27; discharge based on gage heights corrected for effect of ice by means of three discharge measurements, observer's notes, and weather records.

Monthly discharge of Chippewa River near Bruce, Wis., for the year ending Sept. 30, 1922

[Drainage area, 1,600 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	690	515	556	0.348	0.40
November	620	480	531	.332	.37
December	515	405	471	.294	.34
January	405	300	356	.222	.26
February	480	255	406	.254	.26
March	8,820	480	2,260	1.41	1.63
April	14,600	3,000	7,220	4.51	5.03
May	6,040	970	2,980	1.86	2.14
June	10,100	760	1,960	1.22	1.36
July	1,430	515	809	.506	.58
August	515	350	428	.268	.30
September	970	410	704	.440	.49
The year	14,600	255	1,550	.972	13.16

105449—25†—WSP 545——5

CHIPPEWA RIVER AT CHIPPEWA FALLS, WIS.

LOCATION.—In SE. ¼ sec. 6, T. 28 N., R. 8 W., at highway bridge at Chippewa Falls, Chippewa County, 2,500 feet below mouth of Duncan Creek coming in from right.

DRAINAGE AREA.—5,600 square miles.

RECORDS AVAILABLE.—June 22, 1888, to September 30, 1922. Gage was originally established by the Chippewa Lumber & Boom Co., which has kept a continuous record since 1889. Since 1904 the United States Weather Bureau has obtained gage readings during the flood season of each year. On June 1, 1906, the United States Geological Survey began making measurements and maintaining gage readings.

GAGE.—On July 27, 1916, a Gurley graph water-stage recorder replaced Friez water-stage recorder which was installed January, 1914, on web between caisson piers supporting first right hand span and about 10 feet upstream from the gage formerly used by the United States Weather Bureau; gage referred to original datum.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of heavy gravel; fairly permanent. Banks high and are seldom overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.5 feet at 6 a. m. April 11 (discharge, 66,800 second-feet); minimum stage of −0.4-foot occurred frequently during the winter (discharge, 350 second-feet). Sunday, January 15, this stage persisted nearly the full day, giving a mean daily discharge of 458 second-feet. Minimum discharge caused by regulation and does not represent natural flow.

1888–1922: Maximum stage recorded, 26.03 feet December 6, 1896; September 10, 1884, a stage of 26.94 feet was reached. It is believed that the extreme high stages in 1884 and 1896 were caused in part by backwater from log jams and that the volume of discharge was considerably less than the stage would indicate if the channel had been unobstructed. Exclusive of these floods, the maximum stage recorded was 17 feet, March 27, 1920 (discharge, 78,000 second-feet); minimum discharge recorded, approximately 40 second-feet February 4, 1917.

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

REGULATION.—Flow past the station controlled to a considerable extent by the operation of the Wissota power plant of the Wisconsin-Minnesota Light & Power Co. Large diurnal fluctuation.

ACCURACY.—Stage-discharge relation changed March 27. Rating curves used October 1 to March 27 and March 28 to September 30, are well defined between 2,000 and 56,200 second-feet, and fairly well defined between 500 and 2,000 second-feet. Operation of water-stage recorder satisfactory, except as noted in footnote to table of daily discharge. Daily discharge ascertained by means of discharge integrator. Records good.

Discharge measurements of Chippewa River at Chippewa Falls, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Dec. 29	Soulé and Olson	1.43	3,430
Aug. 11	E. E. Foster	1.00	2,660

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,660	2,700	1,200	682	1,300	1,710	23,700	12,200	3,870	3,720	2,350	2,050
2	1,440	2,730	1,180	790	1,280	1 630	17,600	10,000	6,050	2,370	1,890	1,740
3	2,430	2,340	1,260	925	1,050	1,780	21,500	10,300	5,780	4,660	2,020	1,460
4	2,210	2,240	1,300	1,360	1,100	1,430	24,400	11,800	5,240	2,620	1,960	1,430
5	2,280	1,960	1,460	1,520	830	790	25,900	15,600	4,670	3,630	1,670	1,900
6	2,190	1,390	1,430	1,520	980	890	29,000	16,000	5,460	3,600	1,490	1,870
7	2,150	1,880	2,250	1,520	920	970	37,800	18,000	4,670	4,020	1,930	1,920
8	1,540	1,750	2,300	1,060	1,150	2,280	40,900	20,800	4,500	3,190	2,020	2,060
9	2,100	1,960	2,230	1,060	1,180	1,880	46,100	18,300	1,860	1,820	2,010	1,880
10	1,770	1,960	1,680	1,310	1,210	1,960	60,900	18,300	2,520	3,600	1,950	1,370
11	1,700	1,350	485	1,310	1,210	1,650	60,400	16,600	3,420	4,310	2,000	2,160
12	1,730	1,510	2,140	1,310	850	777	54,800	16,300	5,010	4,720	1,790	2,760
13	1,800	1,050	2,250	1,310	1,110	1,530	46,700	14,700	2,720	2,280	1,420	2,980
14	1,820	1,870	2,570	844	1,560	3,360	37,300	10,600	5,020	4,030	1,730	3,500
15	1,810	1,710	2,580	458	1,420	4,680	32,100	9,820	4,780	4,470	1,840	3,390
16	1,240	1,800	2,460	1,220	1,630	6,690	28,600	7,370	2,820	1,690	1,870	3,350
17	1,800	3,170	2,730	1,610	1,210	6,690	25,900	11,100	5,020	3,320	2,030	1,540
18	2,100	3,050	1,300	1,530	1,880	4,490	23,700	8,400	19,400	3,490	1,860	4,000
19	2,130	3,040	2,530	1,420	925	4,290	23,300	8,200	20,800	2,770	1,730	3,050
20	2,560	1,000	2,830	1,220	1,200	7,300	21,100	9,660	19,200	2,850	1,470	2,430
21	2,580	3,130	2,870	1,060	1,290	5,780	19,400	7,980	15,300	3,060	2,000	1,880
22	2,550	2,400	2,920	907	1,120	5,770	19,000	9,840	7,400	2,490	2,050	2,160
23	1,380	4,170	2,980	2,040	1,380	6,200	16,900	7,480	6,730	1,670	2,020	2,140
24	2,470	1,160	2,970	2,130	3,770	7,000	17,600	6,410	6,810	2,950	2,010	1,410
25	2,740	1,410	1,050	1,640	2,090	5,130	16,700	7,210	5,050	2,530	2,000	2,370
26	2,680	1,490	925	1,220	1,080	6,160	15,300	6,950	5,980	2,610	1,880	1,930
27	2,840	875	1,510	1,140	2,650	17,000	14,000	6,160	7,100	2,600	1,590	2,060
28	2,980	1,360	1,970	1,100	2,720	27,800	8,850	2,890	6,200	2,320	2,000	2,120
29	2,640	1,500	2,660	817	-------	27,600	10,300	5,800	6,340	2,080	2,040	2,280
30	1,540	1,300	1,560	2,670	-------	27,000	7,980	4,050	5,590	1,510	2,110	2,300
31	2,640	-------	1,030	2,690	-------	27,700	--------	6,320	--------	2,180	1,910	-------

NOTE.—Water-stage recorder not in perfect operation Nov. 20–26, Dec. 18–24, May 15–20, and 25–27, June 2, 3, 5, and 16; discharge estimated.

Monthly discharge of Chippewa River at Chippewa Falls, Wis., for the year ending Sept. 30, 1922

[Drainage area, 5,600 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,980	1,240	2,150	0.384	0.44
November	4,170	875	1,980	.354	.40
December	2,980	485	1,960	.350	.40
January	2,690	458	1,340	.239	.28
February	3,770	830	1,430	.255	.27
March	27,800	777	7,090	1.27	1.46
April	60,900	7,980	27,600	4.93	5.50
May	20,800	2,890	10,800	1.93	2.22
June	20,800	1,860	6,840	1.22	1.36
July	4,720	1,510	3,010	.538	.62
August	2,350	1,420	1,890	.338	.39
September	4,000	1,370	2,250	.402	.45
The year	60,900	458	5,690	1.02	13.79

FLAMBEAU RIVER NEAR BUTTERNUT, WIS.

LOCATION.—In lot 10, sec. 28, T. 41 N., R. 1 E., 6 miles southeast of Butternut, Ashland County, and 7 miles upstream from Park Falls.

DRAINAGE AREA.—660 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—July 30, 1914, to September 30, 1922.

GAGE.—Chain gage supported by a built-up cantilever, attached to post set in right bank of river; installed May 26, 1916; read by Edwin Schultz. Vertical staff gage at same site and datum used July 30, 1914, until taken out by ice in spring of 1916.

DISCHARGE MEASUREMENTS.—Made from cable 1,500 feet downstream from gage.

CHANNEL AND CONTROL.—Bed of stream at gage composed of mud and rock. Left bank is low and subject to overflow; right bank slopes back gradually to high-water mark. At cable site the bed is rock and banks are high. Control is at head of Schultz Rapids, 1,700 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.11 feet 5 p. m. April 9 (discharge, 3,580 second-feet); minimum discharge of 220 second-feet was estimated because of ice on February 4.

1914–1922: Maximum stage recorded, 9.0 feet April 22 and 23, 1916 (discharge, 5,430 second-feet); minimum stage, 0.90 foot August 27 and 28, 1920 (discharge, 204 second-feet).

REGULATION.—Storage reservoirs, having an effective capacity of 1.15 billion cubic feet, are maintained by the Chippewa & Flambeau Improvement Co. on the headwaters of Flambeau River.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 350 and 3,480 second-feet. Gage read twice daily to quarter-tenths except during winter when it was read twice a week. Daily discharge ascertained by applying mean daily gage height to rating table except for periods as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Flambeau River near Butternut, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet.	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 7	A. O. Olson	a 1.98	308	Mar. 16	S. B. Soulé	a 3.29	532
Feb. 12	do	a 2.41	294	Aug. 19	E. E. Foster	1.57	349

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Flambeau River near Butternut, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	316	316	340	330	245	290	1,680	2,070	1,030	716	432	483
2	342	329	340	330	230	305	1,870	2,000	1,030	716	416	554
3	356	316	340	330	225	305	1,940	2,280	985	716	432	554
4	385	316	355	330	220	305	2,000	2,420	940	716	483	518
5	356	329	355	315	230	315	2,070	2,490	895	716	483	518
6	329	316	355	315	240	330	2,140	2,490	895	632	449	632
7	356	329	355	305	245	340	2,630	2,420	850	632	466	632
8	370	292	370	280	250	340	3,160	2,350	716	632	483	850
9	385	269	370	270	265	355	3,570	2,210	673	673	432	895
10	370	248	370	260	280	370	3,480	2,140	673	716	400	940
11	356	238	385	260	290	400	3,320	2,070	673	673	400	895
12	342	229	385	260		415	3,240	2,070	632	632	416	805
13	370	229	400	260		450	3,080	2,000	592	632	416	760
14	370	238	400	255		485	3,000	1,870	592	592	416	716
15	370	248	400			520	2,920	1,620	592	554	400	632
16	385	258	400			530	2,840	1,500	716	518	370	592
17	370	269	400			590	2,700	1,380	985	483	370	554
18	370	274	400	250		630	2,630	1,330	985	483	356	518
19	370	280	400			675	2,630	1,330	940	483	316	554
20	356	280	385		295	715	2,560	1,280	850	518	304	518
21	356	280	385			760	2,420	1,220	940	518	316	518
22	342	280	370	255		805	2,420	1,170	895	483	329	518
23	342	280	355	260		895	2,350	1,120	895	466	316	483
24	356	274	340	255		940	2,350	1,120	895	449	342	466
25	356	269	340	250		1,120	2,350	1,030	940	432	342	449
26	342	269	340	255		1,140	2,210	985	850	432	356	449
27	342	269	340	260		1,170	2,280	985	805	466	356	432
28	329	280	340	255		1,220	2,350	895	760	449	370	432
29	329	292	340	250	-------	1,280	2,280	850	716	432	385	416
30	329	330	340	255	-------	1,390	2,140	895	716	466	432	432
31	316	-------	330	260	-------	1,500	-------	940	-------	449	449	-------

NOTE.—Stage-discharge relation affected by ice Nov. 30 to Mar. 24; discharge based on gage heights corrected for effect of ice by means of three discharge measurements, observer's notes, and weather records. Gage not read Nov. 14, 16, 18, 20, 22, 24, 26, 28, Mar. 26, 28, 30, Apr. 1, 3, and 5; discharge interpolated.

Monthly discharge of Flambeau River near Butternut, Wis., for the year ending Sept. 30, 1922

[Drainage area, 660 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	385	316	354	0.536	0.62
November	330	229	281	.426	.48
December	400	330	365	.553	.64
January	330	250	271	.411	.47
February	295	220	276	.418	.44
March	1,500	290	674	1.02	1.18
April	3,570	1,680	2,550	3.86	4.31
May	2,490	850	1,630	2.47	2.85
June	1,030	592	822	1.25	1.40
July	716	432	564	.855	.99
August	483	304	395	.598	.69
September	940	416	590	.894	1.00
The year	3,570	220	731	1.11	15.07

FLAMBEAU RIVER NEAR LADYSMITH, WIS.

LOCATION.—In SE. ¼ sec. 20, T. 35 N., R. 5 W., at H. J. Cornelissen's farm, 6 miles by road northeast of Ladysmith, Rusk County, 21 miles below mouth of South Fork of Flambeau River, entering from left, and 28 miles above mouth of river.

DRAINAGE AREA.—1,940 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 2, 1914, to September 30, 1922. From February 15, 1903, to December 2, 1906, records were collected at a station in Ladysmith, three-fourths of a mile south of Minneapolis, St. Paul & Sault Ste. Marie Railway station, half a mile below dam of Menasha Pulp Co., and 6 miles below present station.

GAGE.—Chain fastened to a cantilever arm supported by two posts on left bank of river, on farm of H. J. Cornelissen; read by H. J. Cornelissen.

DISCHARGE MEASUREMENTS.—Made from cable 200 feet below gage.

CHANNEL AND CONTROL.—Bed composed of gravel and sand; free from vegetation and fairly permanent. At gage section, channel is divided by a small sandy island; at the cable section the river flows in one channel; banks are medium high, wooded, and not subject to overflow. Control not well defined, formed by channel below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.2 feet April 11 (discharge, 19,500 second-feet); minimum discharge, 440 second-feet, January 25 (stage-discharge relation affected by ice).

1903–1906 and 1914–1922: Maximum stage recorded, that of 1922; minimum discharge, 350 second-feet February 8, 1921.

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

REGULATION.—The Chippewa & Flambeau Improvement Co. operates storage reservoirs in the headwaters having an effective capacity of 1.15 billion cubic feet. Weekly fluctuations at the gage are caused by operation of power plants at Park Falls and storage reservoirs; no daily fluctuation has been observed.

ACCURACY.—The stage-discharge relation not permanent; affected by ice and shifting control. Rating curve well defined between 500 and 6,000 second-feet. Gage read to quarter-tenths once every other day. Daily discharge ascertained by applying gage height to rating table except for periods as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Flambeau River near Ladysmith, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 12	A. O. Olson	2.35	906	Mar. 14	S. B. Soulé	*4.20	1,020
Jan. 5	do	*3.20	651	Aug. 18	E. E. Foster	2.03	756
Feb. 10	do	*3.51	734				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Flambeau River near Ladysmith, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	a 1,320	620		655	550	610	4,840	a 4,320	2,030	a 1,980	a 840	1,040
2	1,290	a 652		655	565	630	5,020	3,800	a 2,030	2,390	840	a 1,020
3	a 1,020	685		650	550	680	5,210	4,140	2,030	a 2,210	a 940	1,000
4	740	a 762		650	540	730	a 5,720	a 5,070	a 1,910	2,030	1,040	a 1,000
5	a 850	840	880	650	550	705	6,220	6,000	1,790	a 1,800	a 960	1,000
6	960	a 762		590	560	680	a 8,610	a 6,570	a 1,640	1,560	880	a 1,080
7	a 882	685		530	540	715	11,000	7,140	1,500	a 1,560	a 900	1,160
8	805	a 662		570	515	750	a13,300	a 6,570	a 1,420	1,560	920	a 1,390
9	a 842	640	840	605	625	855	a15,700	6,000	1,340	a 1,620	a 1,020	1,620
10	880	a 640	840	590	735	960	18,000	5,600	1,240	1,670	1,120	a 1,760
11	920		840	580	730	920	19,500	5,600	a 1,200	a 1,670	a 1,080	1,910
12	a 940		840	580	720	880	a17,000	a 5,220	1,160	1,670	1,040	a 1,850
13	960		805	580	700	940	14,500	4,840	a 1,180	a 1,640	a 1,020	1,790
14	a 960		805	605	680	1,000	a12,600	4,840	1,200	1,620	1,000	a 1,680
15	960		770	630	700	1,040	10,700	3,180	a 2,670	a 1,590	a 1,000	1,560
16	a 920		770	575	715	1,120	a 9,420	2,900	4,140	1,560	1,000	a 1,360
17	880		740	520	710	1,160	8,140	a 2,840	a 5,290	a 1,400	a 947	1,160
18	a 920	710	710	560	710	1,240	a 8,270	2,770	6,440	1,240	a 893	a 1,160
19	960		690	595	660	1,400	8,400	a 2,770	a 5,730	a 1,220	840	1,160
20	a 920		675	590	610	1,500	a 7,650	2,770	5,020	1,200	a 840	a 1,140
21	880		675	585	610	1,670	6,900	a 2,580	a 4,250	a 1,220	840	1,120
22	a 920		675	550	615	1,910	6,000	2,390	3,480	1,240	a 840	a 1,100
23	960		670	510	610	2,030	a 5,800	a 2,330	a 3,190	a 1,200	840	1,080
24	a 960		670	475	610	2,270	5,600	2,270	2,900	1,160	a 790	a 1,000
25	960	740	670	440	605	2,510	a 5,700	a 2,210	a 2,460	a 1,080	740	920
26	a 856	805	665	470	600	2,900	5,800	2,150	2,030	1,000	a 749	a 880
27	752	840	665	495	595	3,480	a 5,410	2,030	a 2,030	1,000	758	840
28	a 761	840	665	550	590	4,140	5,020	a 1,820	2,030	a 902	a 679	a 840
29	770	880	660	610	-------	4,480	a 4,930	1,620	a 1,800	805	600	840
30	a 770	880	660	570	-------	4,660	4,840	a 1,760	1,560	a 822	a 720	a 840
31	770	-------	655	530	-------	4,840	-------	1,910	-------	840	840	-------

a Interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 11 to Apr. 2. Discharge based on gage heights corrected for effect of ice by means of three discharge measurements, observer's notes, and weather records. Indirect method for shifting control used Oct. 1 to Nov. 10.

Monthly discharge of Flambeau River near Ladysmith, Wis., for the year ending Sept. 30, 1922

[Drainage area, 1,940 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,320	740	913	0.471	0.54
November	880	620	729	.376	.42
December	880	655	764	.394	.45
January	655	440	572	.295	.34
February	735	515	625	.322	.34
March	4,840	610	1,720	.887	1.02
April	19,500	4,840	8,860	4.57	5.10
May	7,140	1,620	3,740	1.93	2.22
June	6,440	1,160	2,560	1.32	1.47
July	2,390	805	1,430	.737	.85
August	1,120	600	888	.458	.53
September	1,910	840	1,210	.624	.70
The year	19,500	440	2,000	1.03	13.98

JUMP RIVER AT SHELDON, WIS.

LOCATION.—In sec. 26, T. 33 N., R. 5 W., at highway bridge in Sheldon, Rusk County, 11 miles above mouth of river.

DRAINAGE AREA.—510 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—July 22, 1915, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of bridge.

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

CHANNEL AND CONTROL.—Bed composed of heavy gravel, free from vegetation. Right bank high and not subject to overflow; left bank may be overflowed occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.3 feet 5 p. m. April 10 (discharge, 8,400 second-feet); minimum discharge, 15 second-feet March 1–4 (stage-discharge relation affected by ice).

1915–1922: Maximum stage recorded, 11.48 feet March 26, 1920 (discharge, 12,800 second-feet). Minimum discharge, 15 second-feet February 3–7, 1918, and February 1–4, 1922. (Stage-discharge relation affected by ice.)

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 45 and 5,200 second-feet. Gage read to quarter-tenths twice daily except during winter, when it was read twice a week. Daily discharge ascertained by applying mean daily gage height to rating table except for period as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Jump River at Sheldon, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 4	A. O. Olson	[a] 3.75	46.9	Mar. 14	S. B. Soulé	[a] 4.77	166.0
Feb. 9	do	[a] 4.27	53.8	Aug. 17	E. E. Foster	[b] 2.87	50.0

[a] Stage-discharge relation affected by ice.
[b] Section rough.

Daily discharge, in second-feet, of Jump River at Sheldon, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	70	68	60	50	30	15	2,650	280	240	280	50	30
2	65	62	84	50	30	15	2,510	280	255	430	45	30
3	65	65	108	50	25	15	4,040	280	240	355	50	30
4	65	62	108	50	20	15	4,540	380	190	255	50	30
5	65	65	108	40	20	20	4,710	610	148	210	50	33
6	50	62	108	35	25	20	4,710	760	122	166	58	45
7	50	65	108	40	30	25	5,220	1,020	105	122	65	58
8	58	58	108	40	40	60	5,570	1,110	98	122	50	380
9	45	58	108	40	45	90	6,290	1,300	88	148	50	840
10	50	62	117	40	40	100	8,200	1,200	112	205	50	840
11	65	62	126	40	40	105	7,230	1,110	160	280	50	540
12	88	68	126	45	40	100	5,050	840	220	230	50	380
13	98	77	126	35	40	90	3,880	575	205	180	45	280
14	98	70	135	25	40	165	3,100	430	190	172	50	242
15	88	62	144	30	40	180	2,950	355	172	133	45	190
16	105	66	138	30	40	230	2,800	280	205	112	50	148
17	77	70	133	30	40	270	2,510	280	430	112	45	133
18	65	74	140	35	35	305	2,110	280	645	105	45	122
19	50	77	120	35	30	355	1,620	485	610	88	50	122
20	50	77	105	35	30	405	1,200	540	540	133	45	105
21	65	77	90	40	30	485	1,110	540	380	160	50	105
22	98	104	80	40	30	575	1,020	330	280	172	50	77
23	88	130	70	40	30	680	930	280	240	220	45	65
24	70	121	70	45	25	930	760	255	180	220	33	58
25	65	112	65	40	20	1,400	680	220	148	172	33	58
26	70	121	65	40	20	2,370	575	172	112	133	30	58
27	65	130	60	40	20	4,200	540	148	98	112	30	58
28	65	130	60	35	20	3,880	485	140	88	70	33	58
29	70	130	60	30	-------	4,040	405	122	88	45	30	58
30	70	95	60	30	-------	4,040	330	148	112	50	33	45
31	77	-------	55	30	-------	2,650	-------	190	-------	50	30	-------

NOTE.—Stage-discharge relation affected by ice Dec. 18 to Mar. 26; discharge based on gage heights corrected for effect of ice by means of three discharge measurements, observer's notes, and weather records. Gage not read November 14, 16–18, 20, 22, 24, 26, 28, 30, Dec. 2, 4, 6, 8, 10, 12, 14, 16, and July 5 and 6; discharge interpolated.

Monthly discharge of Jump River at Sheldon, Wis., for the year ending Sept. 30, 1922

[Drainage area, 510 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	105	45	70.0	0.137	0.16
November	130	58	82.7	.162	.18
December	144	55	98.2	.193	.22
January	50	25	38.2	.075	.09
February	45	20	31.2	.061	.06
March	4,200	15	898	1.76	2.03
April	8,200	330	2,920	5.73	6.39
May	1,300	122	482	.946	1.09
June	645	88	223	.437	.49
July	430	45	169	.331	.38
August	65	30	44.8	.088	.10
September	840	30	174	.341	.38
The year	8,200	15	435	.853	11.57

EAU CLAIRE RIVER NEAR AUGUSTA, WIS.

LOCATION.—In sec. 12, T. 26 N., R. 6 E., at Trouble Water Bridge, 7 miles northeast of Augusta, Eau Claire County. South Fork of Eau Claire River enters from left 4 miles above station.

DRAINAGE AREA.—500 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—July 16, 1914, to September 30, 1922.

GAGE.—Chain gage on downstream side of bridge; read by Albert Wagner.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading at control 500 feet downstream from bridge.

CHANNEL AND CONTROL.—Bed of stream at bridge and above is sandy and shifting; a short distance below the gage the channel narrows and a rock outcrop overlain with large boulders forms the control. Banks are high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.5 feet 1 p. m. April 10 (discharge, 7,070 second-feet); minimum discharge, 30 second-feet January 31 (stage-discharge relation affected by ice).

1914–1922: Maximum open-water stage recorded, 11.98 feet March 27 1920 (discharge, 8,720 second-feet); minimum open-water discharge, 40 second-feet September 2, 1916. A discharge of 3.5 second-feet occurred January 27, 1918, by discharge measurement made through complete ice cover.

ACCURACY.—Stage-discharge relation changed during summer. Rating curve well defined. Gage read to quarter-tenths once daily except during winter when it was read twice a week. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Eau Claire River near Augusta, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Dec. 28	A. O. Olson	[a]0.58	39.4
Feb. 7	do	[a]1.58	68.6
Aug. 10	S. B. Soulé	.18	82

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Eau Claire River near Augusta, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	58	58		45	40	90	1,020	217	164	305	88	72
2	58	58		50	50	90	1,220	212	152	365	88	75
3	54	58		55	55	95	2,220	212	145	275	79	65
4	54	58		55	60	100	3,100	245	129	195	75	70
5	54	54	80	60	60	115	2,080	305	129	145	70	70
6	54	54		60	55	120	1,630	335	118	129	140	61
7	54	54		65	70	140	1,690	535	114	177	177	54
8	54	61		70	75	155	1,810	535	102	380	140	54
9	54	58		70	80	175	2,940	675	108	320	108	58
10	61	75	75	75	85	195	7,070	890	675	588	98	54
11	70	61	75	70		220	3,620	605	4,180	535	79	49
12	65	61	70	70		255	1,690	448	2,430	350	75	54
13	70	61	70	80		305	2,940	365	975	260	65	61
14	61	61	65	85		335	2,570	305	2,220	190	61	70
15	61	61	60	100		395	1,510	269	1,330	164	54	70
16	61	61	60	95		465	1,020	245	805	164	61	74
17	61	65	60	90		550	765	239	675	157	56	70
18	65	70	60	85		675	675	350	588	152	54	85
19	70	70	55	80		745	605	675	448	147	50	70
20	65	70	50	80	90	890	552	605	335	133	56	74
21	65	70	45	75		1,150	535	430	275	133	54	79
22	61	70	45	75		1,470	518	305	275	133	54	79
23	61	70	45	70		2,080	518	239	350	140	54	70
24	61	70	45	65		2,500	465	251	305	129	54	70
25	61	70		60		3,020	395	395	217	118	54	70
26	58	75		60		3,530	365	335	177	108	54	66
27	58	80	40	55		4,280	320	275	190	104	50	61
28	58	80		45		3,990	290	204	212	92	50	61
29	61	80		40	-------	2,780	260	169	185	88	50	61
30	58	80		35	-------	1,690	239	152	152	85	50	85
31	58	-------		30	-------	1,220	-------	164	-------	79	46	-------

NOTE.—Stage-discharge relation affected by ice Nov. 20 to Mar. 24; discharge based on gage height corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records. Discharge July 16 to Sept. 30, computed by indirect method for shifting control.

Monthly discharge of Eau Claire River near Augusta, Wis., for the year ending Sept. 30, 1922

[Drainage area, 500 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	70	54	60.1	0.120	0.14
November	80	54	65.8	.132	.15
December	80	40	60.6	.121	.14
January	100	30	66.1	.132	.15
February	90	40	80.4	.161	.17
March	4,280	90	1,090	2.18	2.51
April	7,070	239	1,490	2.98	3.32
May	890	152	361	.722	.83
June	4,180	102	605	1.21	1.35
July	588	79	205	.410	.47
August	177	46	72.4	.145	.17
September	85	49	67.1	.134	.15
The year	7,070	30	352	.704	9.55

RED CEDAR RIVER NEAR COLFAX, WIS.

LOCATION.—In sec. 27, T. 30 N., R. 11 W., at highway bridge 4½ miles north of Colfax, Dunn County. Hay River enters from right 11 miles below, and Trout Creek, also from right, 3½ miles above station.

DRAINAGE AREA.—1,100 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale 1 inch=6 miles).

RECORDS AVAILABLE.—March 19, 1914, to September 30, 1922.

GAGE.—Chain gage attached to downstream side of bridge; read by Andrew Lundequam.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; small amount of aquatic growth during summer. Left bank high and not subject to overflow; right bank medium high and may be overflowed during extremely high water; low-water control formed by Colfax dam.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.30 feet at 10 a. m. April 11 (discharge, 4,870 second-feet); minimum stage, 0.61 foot at 10 a. m. December 18 (discharge, 233 second-feet).

1914–1922: Maximum stage recorded, 6.95 feet. March 26, 1920 (discharge, 7,610 second-feet); minimum stage, that of December 18, 1921.

REGULATION.[2]— The following dams and reservoirs are used to regulate flow in Red Cedar River. Owing to operation of these reservoirs, the flow at the station is not natural.

Reservoirs used to regulate flow of Red Cedar River

Dam	Location	Capacity (millions of cubic feet)
Long Lake	Sec. 24, T. 37 N., R. 11 W.	400
Cedar Lake	Sec. 21, T. 36 N., R. 10 W.	400
Birch Lake	Sec. 25, T. 37 N., R. 10 W.	475
Bear Lake	Sec. 7, T. 36 N., R. 11 W.	150
		1,425

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 300 and 5,000 second-feet. Gage read to quarter-tenths twice daily, except during winter when it was read twice a week. Daily discharge ascertained by applying mean daily gage height to rating table except for period as explained in footnote to table of daily discharge. Open-water records fair; winter records subject to considerable error.

Discharge measurements of Red Cedar River near Colfax, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 29	A. O. Olson	[a] 1.84	392	Aug. 11	S. B. Soulé	1.50	594
Feb. 8	do	[a] 2.95	629	12	do	1.42	541

[a] Stage-discharge relation affected by ice.

[2] From data on file in Engineering Department of Railroad Commission of Wisconsin.

Daily discharge, in second-feet, of Red Cedar River near Colfax, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	495	445	660	585	585	720	1,650	820	860	1,400	642	610
2	580	445	635	520	640	735	2,200	942	745	1,350	675	642
3	422	470	635	450	690	750	3,380	1,450	675	1,250	675	610
4	610	470	635	495	675	800	3,380	1,550	610	1,160	580	495
5	550	470	522	535	660	855	3,510	1,400	550	1,030	550	1,070
6	550	445	642	500	660	890	4,170	1,550	550	820	610	782
7	550	400	642	410	660	925	3,770	1,650	522	900	580	675
8	580	495	642	410	690	925	4,030	1,160	550	900	550	745
9	642	470	942	410	720	925	4,310	1,300	745	1,030	580	710
10	610	495	675	410	665	890	4,730	1,550	1,120	1,200	580	820
11	550	422	642	440	610	855	4,870	1,400	1,200	1,120	610	745
12	610	445	675	470	540	840	4,170	1,300	1,030	900	550	675
13	610	422	675	490	470	820	3,640	1,550	900	900	550	820
14	495	400	675	510	530	910	3,250	1,070	1,160	860	495	745
15	495	550	642	520	585	1,000	3,250	860	1,250	900	550	550
16	522	675	610	535	560	1,120	3,000	900	2,420	1,030	580	675
17	445	550	470	560	535	1,210	2,530	942	4,730	900	580	675
18	445	550	242	585	550	1,300	2,420	1,650	4,730	900	675	690
19	495	610	353	540	560	1,340	1,870	1,760	3,380	900	550	710
20	550	660	380	490	600	1,390	1,760	1,650	3,000	942	550	730
21	445	710	380	540	635	1,350	1,760	1,550	2,810	900	550	745
22	445	785	470	585	635	1,350	1,450	1,650	2,610	860	710	745
23	495	785	450	560	635	1,250	1,070	1,160	2,420	745	550	675
24	422	785	435	535	620	1,650	1,120	1,070	2,200	550	550	580
25	495	750	430	550	610	1,760	1,070	1,200	1,550	642	642	550
26	550	750	415	560	620	1,760	1,120	1,160	1,450	675	550	610
27	522	720	410	535	635	2,880	985	985	1,650	710	610	745
28	642	690	400	510	680	3,380	1,070	985	1,550	675	495	710
29	610	690	395	490	-------	3,120	942	745	1,250	675	495	710
30	580	660	370	470	-------	2,880	900	942	1,250	675	522	710
31	400	-------	380	530	-------	2,420	-------	820	-------	495	550	-------

NOTE.—Stage-discharge relation affected by ice Nov. 22 to Dec. 4 and Dec. 22 to Mar. 20; discharge based on gage heights corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records. Gage not read Nov. 20, June 21, 22, and Sept. 18 to 20; discharge interpolated.

Monthly discharge of Red Cedar River near Colfax, Wis., for the year ending Sept. 30, 1922

[Drainage area, 1,100 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	642	400	529	0.481	0.55
November	785	400	574	.522	.58
December	942	242	533	.485	.56
January	585	410	507	.461	.53
February	720	470	616	.560	.58
March	3,380	720	1,390	1.26	1.45
April	4,870	900	2,580	2.35	2.62
May	1,760	745	1,250	1.14	1.31
June	4,730	522	1,650	1.50	1.67
July	1,400	495	903	.821	.95
August	710	495	579	.526	.61
September	1,070	495	698	.635	.71
The year	4,870	242	982	.893	12.12

RED CEDAR RIVER AT CEDAR FALLS, WIS.

LOCATION.—In sec. 6, T. 28 N., R. 12 W., at highway bridge near Cedar Falls, Dunn County, immediately below power plant of Wisconsin-Minnesota Light & Power Co., 4½ miles above crossing of Chicago, St. Paul, Minneapolis & Omaha Railway.

DRAINAGE AREA.—1,680 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—April 1, 1909, to September 30, 1922.

GAGE.—Staff, fastened to bridge pier; read by R. D. Wilsey.

DISCHARGE MEASUREMENTS.—No discharge measurements have been made at this station, which is maintained to determine fluctuation in stage.

CHANNEL AND CONTROL.—Channel rough and rocky, straight, and free from vegetation. Banks high and not subject to overflow.

EXTREMES OF STAGE.—Maximum stage recorded during year, 5.70 feet at noon April 8; minimum stage, 0.90 foot October 2, 9, 16, 23, 30, November 6, 13, and December 4.

1909–1922: Maximum stage recorded, 7.2 feet March 25, 26, 1920; minimum stage, 0.0 foot March 11, 1917. Minimum stages are caused by closing gates and wheels at power plant above station.

REGULATION.—The operation of storage reservoirs in the headwaters of the river (see "Regulation" in station description for Red Cedar River at Colfax, Wis.), together with storage at the power plant above the gaging station, regulates the flow.

ACCURACY.—Daily-discharge records are not computed or published for this station. To the best of knowledge the stage-discharge relation is permanent. Gage is read twice daily to nearest tenth. There is considerable fluctuation, so that mean daily gage height as published probably does not represent the average daily gage height.

COOPERATION.—Gage-height record furnished by Wisconsin-Minnesota Light & Power Co.

Daily gage height, in feet, of Red Cedar River at Cedar Falls, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.90	2.05	2.60	1.22	2.58	2.62	4.65	2.90	3.45	3.35	3.70	2.70
2	.90	2.10	2.68	2.00	2.60	2.58	4.45	2.75	3.48	2.65	3.50	2.70
3	2.25	2.05	2.70	2.45	2.60	2.72	5.20	2.90	3.40	2.92	3.35	2.05
4	2.25	2.00	.90	2.52	2.50	2.85	5.30	3.70	2.10	2.75	3.30	2.90
5	2.35	2.00	2.60	2.50	1.90	1.80	5.55	3.75	3.60	3.00	3.35	2.85
6	2.30	.90	2.68	2.42	2.85	2.80	5.50	3.75	3.50	2.92	1.85	3.05
7	2.30	2.62	2.65	2.45	2.65	2.72	5.60	1.30	3.45	3.05	3.05	3.10
8	2.20	2.60	2.60	2.05	2.60	3.22	5.65	3.75	3.50	3.20	3.05	3.10
9	.90	2.70	2.70	2.40	2.62	3.25	4.50	3.65	3.65	2.55	3.05	3.30
10	2.20	2.68	2.60	2.25	2.70	3.30	5.52	3.45	3.80	3.35	3.05	1.80
11	2.25	2.60	1.80	2.20	2.58	3.25	5.45	3.40	2.65	3.25	3.20	3.40
12	2.15	2.60	2.70	2.25	1.70	1.90	5.35	3.30	4.05	3.35	3.20	3.45
13	2.20	.90	2.78	2.25	2.52	3.10	5.35	3.35	3.90	3.42	1.75	3.40
14	2.10	2.55	2.70	2.40	2.62	3.25	5.25	1.65	3.80	3.50	2.55	3.55
15	2.15	2.55	2.72	1.65	2.62	3.30	5.05	3.65	3.85	3.55	2.65	3.80
16	.90	2.50	2.70	2.40	2.55	3.40	2.90	3.75	3.75	2.65	2.80	3.90
17	2.10	2.62	2.70	2.45	2.55	3.52	4.85	3.85	3.85	3.78	2.60	3.05
18	2.15	2.60	2.50	2.35	2.50	3.52	4.65	3.75	4.30	3.80	2.65	3.00
19	2.15	2.60	2.60	2.28	1.65	2.10	4.45	3.60	4.90	3.75	2.60	3.35
20	2.15	1.92	2.55	2.20	2.52	3.75	4.25	3.60	4.70	3.80	1.90	3.70
21	2.15	2.70	2.42	2.32	2.50	3.90	3.90	1.75	4.60	3.75	2.85	3.65
22	2.20	2.75	2.40	1.80	2.45	4.10	3.65	3.75	4.55	3.72	2.80	3.65
23	.90	2.68	2.32	2.35	2.48	4.05	1.80	3.80	4.35	2.40	2.85	3.05
24	2.30	1.75	2.35	2.42	2.45	4.45	3.60	3.75	4.15	3.70	2.80	2.75
25	2.25	1.85	1.35	2.40	2.45	4.55	3.50	3.62	3.70	3.70	2.85	3.25
26	2.10	2.80	2.30	2.45	1.65	2.80	3.25	3.60	3.60	3.60	2.70	3.30
27	2.00	1.00	2.42	2.58	2.45	4.80	3.20	3.55	3.50	3.45	2.75	2.80
28	2.00	2.70	2.45	2.58	2.55	5.10	3.10	1.20	3.60	3.45	2.90	3.20
29	2.15	2.68	2.40	2.10	-------	5.25	3.00	3.60	3.55	3.40	2.80	3.25
30	.90	2.68	2.42	2.58	-------	3.60	1.10	3.55	3.40	2.75	2.75	3.10
31	2.00	-------	2.48	2.50	-------	4.55	-------	3.50	-------	3.55	2.80	-------

RED CEDAR RIVER AT MENOMONIE, WIS.

LOCATION.—In sec. 26, T. 28 N., R. 13 W., 900 feet below power house of Wisconsin-Minnesota Light & Power Co., Menomonie, Dunn County, 13 miles above mouth of river. Wilson Creek discharges from right into service reservoir just above station.

DRAINAGE AREA.—1,810 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—June 17, 1907, to September 3, 1908; May 9, 1913, to September 30, 1922.

GAGE.—Barrett & Lawrence water-stage recorder installed May 9, 1913, in wooden shelter on right bank of the river 1 mile above site of old gage attached to a highway bridge 200 rods west of Chicago & Northwestern Railway station west of Menomonie, which was read from June 17, 1907, to September 3, 1908. No relation between data of the two gages. Gage inspected by Ed. Kausrud.

DISCHARGE MEASUREMENTS.—Made from highway bridge 1 mile below gage.

CHANNEL AND CONTROL.—Bed at gage composed of heavy gravel. Left bank high and not subject to overflow; right bank of medium height will be overflowed at flood stages. Bed at measuring section sandy and subject to shift. Banks high at measuring section and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.35 feet at noon April 11 (discharge, 6,880 second-feet); minimum stage, 1.85 feet from 9 a. m. October 30 to 6 a. m. October 31 (discharge, 290 second-feet).

1907–8 and 1913–1922: Maximum discharge, 14,000 second-feet March 26, 1920; minimum discharge, 100 second-feet November 8, 1907. Minimum discharge is due to regulation and does not represent the natural flow.

REGULATION.—Considerable diurnal fluctuation in stage at gage section is caused by the operation of power plants of the Wisconsin-Minnesota Light & Power Co. at Menomonie and Cedar Falls. (See also "Regulation" in station description for Red Cedar River at Colfax, Wis.)

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

ACCURACY.—Stage-discharge relation not permanent, affected by a gradual shift in control. Rating curve well defined between 650 and 3,460 second-feet; and fairly well defined above. Operation of water-stage recorder satisfactory. Daily discharge ascertained by means of discharge integrator with applied corrections for shifting control. Records fair.

Discharge measurements of Red Cedar River at Menomonie, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Dec. 28	A. O. Olson	2.32	673
Aug. 12	E. E. Foster	2.68	1,210
12	S. B. Soulé	2.68	1,180

Daily discharge, in second-feet, of Red Cedar River at Menomonie, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,150	783	1,270	627	778	796	3,150	1,610	1,530	2,170	1,120	1,110
2	829	870	1,020	732	988	774	2,740	2,060	1,500	1,980	1,000	1,090
3	950	712	1,140	1,380	784	852	4,970	2,040	1,460	1,620	890	554
4	990	870	740	1,120	820	870	5,260	2,100	810	968	915	810
5	900	713	750	1,160	502	830	5,530	2,260	1,230	1,680	920	1,440
6	742	520	800	1,160	527	870	4,900	2,260	1,360	1,680	660	1,460
7	792	484	930	974	728	995	5,810	2,230	1,350	1,600	850	1,160
8	900	765	910	1,030	808	1,160	5,760	2,060	1,130	1,320	1,050	890
9	402	668	930	988	780	925	5,750	2,160	1,180	888	1,040	830
10	688	830	1,280	959	800	1,120	6,000	2,040	1,000	1,350	1,100	890
11	839	623	980	846	778	1,040	5,970	1,650	860	1,650	1,010	768
12	950	682	870	898	839	982	5,660	1,920	1,460	1,590	842	925
13	910	530	788	815	846	1,300	5,060	1,980	1,500	1,470	825	868
14	940	615	850	900	824	1,200	4,600	1,660	1,580	1,270	1,370	1,100
15	990	781	920	688	959	1,770	4,200	1,790	1,470	1,200	1,250	890
16	410	678	880	805	830	1,590	3,630	1,780	1,470	910	1,220	835
17	960	680	690	1,020	778	1,710	3,650	1,810	2,400	1,100	1,190	640
18	1,040	730	638	981	942	1,560	2,600	1,920	3,510	1,230	1,180	1,420
19	950	730	630	984	941	1,740	2,380	2,720	3,630	1,570	914	1,160
20	870	755	648	822	1,050	1,800	2,620	2,160	3,820	1,280	654	1,220
21	910	745	709	928	982	2,120	3,030	2,480	3,110	1,260	1,010	892
22	890	731	657	836	872	2,140	2,730	2,320	2,380	1,160	922	880
23	555	725	701	882	732	2,540	2,770	1,910	3,120	785	1,160	1,450
24	765	734	716	832	779	2,700	2,860	1,720	3,050	920	1,160	1,090
25	804	735	600	809	1,010	3,260	1,500	1,480	2,270	1,220	1,100	1,540
26	970	748	538	738	829	3,830	1,680	1,150	2,710	1,230	985	1,830
27	900	748	642	810	932	5,560	1,790	1,220	2,320	1,200	722	1,760
28	970	733	744	730	911	5,820	1,730	1,190	1,920	1,140	935	1,180
29	702	680	672	678	-------	5,760	1,660	1,240	2,460	1,000	1,080	1,020
30	409	1,030	706	910	-------	5,150	1,330	1,170	2,320	735	990	838
31	342	-------	510	1,020	-------	4,160	-------	1,560	-------	858	1,100	-------

Monthly discharge of Red Cedar River at Menomonie, Wis., for the year ending Sept. 30, 1922

[Drainage area, 1,810 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,150	342	820	0.453	0.52
November	1,030	484	721	.398	.44
December	1,280	510	802	.443	.51
January	1,380	627	905	.500	.58
February	1,050	502	834	.461	.48
March	5,820	774	2,160	1.19	1.37
April	6,000	1,330	3,710	2.05	2.29
May	2,720	1,170	1,860	1.03	1.19
June	3,820	810	2,000	1.10	1.23
July	2,170	735	1,290	.713	.82
August	1,370	654	1,010	.558	.64
September	1,830	554	1,080	.597	.67
The year	6,000	342	1,430	.790	10.74

BLACK RIVER AT NEILLSVILLE, WIS.

LOCATION.—In sec. 15, T. 24 N., R. 2 W., at lower highway bridge in Neillsville Clark County. O'Neill Creek enters from left 1 mile above gage, and Cunningham Creek, also from left, 1½ miles below.

DRAINAGE AREA.—774 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch= 6 miles).

RECORDS AVAILABLE.—April 6, 1905, to March 31, 1909; December 11, 1913, to September 30, 1922.

GAGE.—Chain gage attached to downstream side of highway bridge; read by A. Bissell.

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

CHANNEL AND CONTROL.—Bed composed of heavy gravel and rock. Control at head of rapids, a few hundred feet below gage. Banks high and rocky; water will not overflow the banks at gage section.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.5 feet at 5 p. m. April 9 (discharge, 13,600 second-feet); minimum discharge, 25 second-feet December 27–30 and January 1 and 2 (stage-discharge relation affected by ice).

1905–1909 and 1913–1922: Maximum stage recorded, 19.8 feet June 6, 1905 (discharge about 29,400 second-feet). It is probable that the maximum discharge which occurred October 6, 1911, exceeded 29,000 second-feet, although data are not available regarding the stage at the gage section during this flood; minimum stage, during open-water periods, 1.9 feet August 28 1920 (discharge approximately 26 second-feet); an estimated minimum discharge of 5 second-feet during frozen periods, February, 1918. Minimum stage previously reported 2.4 feet October 9, 1905 (discharge approximately 20 second-feet) is considered very much in error and is to be replaced by above.

REGULATION.—Several dams on Black River and tributaries upstream from Neillsville are used to create a head for developing power. The operation of these plants causes a slight diurnal fluctuation at gage, especially during winter when the flow is at a minimum.

ACCURACY.—Stage-discharge relation permanent, except as affected by ice. Rating curve well defined between 26 and 18,400 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for period as explained in footnote to table of daily discharge. Open-water records fair to good, except at extremely low stages, for which they are poor; winter records poor.

Discharge measurements of Black River at Neillsville, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 27	A. O. Olson	[a] 2.67	26.6	Apr. 5	A. O. Olson	9.81	[b] 5,410
Feb. 6	do	[a] 4.30	64.0	Aug. 10	E. E. Foster	2.32	42

[a] Stage-discharge relation affected by ice.
[b] Made above mouth of O'Neil Creek; represents flow from 92 per cent of drainage area at gage.

Daily discharge, in second-feet, of Black River at Neillsville, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	56	56	55	25	55	85	3,160	244	78	334	42	57
2	54	47	50	25	65	90	4,290	213	102	104	33	43
3	50	56	50	30	50	95	6,940	225	110	87	35	37
4	47	47	50	30	65	100	7,280	254	118	76	37	33
5	40	47	50	35	55	115	6,440	395	104	65	37	33
6	39	43	50	35	65	140	5,800	585	104	68	68	31
7	42	49	50	40	65	165	5,960	830	87	260	87	31
8	40	64	50	40	65	190	5,640	1,010	76	228	43	56
9	42	45	50	45	65	215	12,500	1,430	70	770	37	47
10	43	47	50	40	65	220	11,400	1,430	890	1,080	35	35
11	48	47	50	35	65	230	7,450	1,290	3,910	890	35	32
12	47	45	50	40	65	240	5,480	1,010	1,360	610	37	36
13	53	45	50	40	65	255	5,480	685	2,760	395	38	33
14	58	45	50	35	65	260	4,850	560	2,070	260	37	31
15	63	45	50	35	70	295	3,570	416	890	192	43	33
16	63	45	50	80	70	355	2,560	334	710	144	35	32
17	65	50	50	45	70	395	1,890	296	585	104	31	32
18	73	50	45	40	70	460	1,500	395	395	81	30	33
19	76	45	40	35	70	535	1,220	710	296	63	30	45
20	70	45	40	35	75	610	1,010	1,150	244	64	38	37
21	69	40	35	40	75	710	890	950	184	76	33	41
22	69	40	35	40	80	830	890	660	147	104	38	40
23	64	40	30	45	80	950	890	438	142	86	33	39
24	68	40	30	40	85	1,150	830	296	100	87	30	37
25	57	40	30	30	85	1,290	635	244	86	70	30	33
26	54	40	30	45	85	1,500	560	213	69	60	28	38
27	57	45	25	55	85	1,720	485	165	68	56	28	32
28	63	50	25	35	85	1,890	416	154	70	53	28	30
29	57	50	25	30	-------	2,160	334	110	60	47	34	30
30	58	55	25	40	-------	2,460	278	104	54	37	31	32
31	59	-------	30	45	-------	2,760	-------	94	-------	48	29	-------

NOTE.—Stage-discharge relation affected by ice Nov. 12 to Mar. 31; discharge based on gage heights corrected for effect of ice by means of two discharge measurements; observer's notes, and weather records.

Monthly discharge of Black River at Neillsville, Wis., for the year ending Sept. 30, 1922

[Drainage area, 774 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	76	39	56.3	0.073	0.08
November	64	40	46.8	.060	.07
December	55	25	41.9	.054	.06
January	80	25	39.0	.050	.06
February	85	50	70.0	.090	.09
March	2,760	85	725	.937	1.08
April	12,500	278	3,690	4.77	5.32
May	1,430	94	545	.704	.81
June	3,910	54	531	.686	.77
July	1,080	37	213	.275	.32
August	87	28	37.1	.048	.06
September	57	30	36.6	.047	.05
The year	12,500	25	499	.645	8.77

LA CROSSE RIVER NEAR WEST SALEM, WIS.

LOCATION.—In sec. 32, T. 17 N., R. 6 W., at highway bridge 2 miles west of West Salem, La Crosse County, and 10 miles above mouth of river. Dutch Creek enters from right 6 miles above station.

DRAINAGE AREA.—412 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—December 22, 1913, to September 30, 1922.

GAGE.—Chain attached to concrete guardrail on upstream side of bridge; read by Henry Schucht.

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

CHANNEL AND CONTROL.—Bed, heavy gravel and rock. Right bank high and not subject to overflow; left bank above gage low, and subject to overflow at flood stages. Channel free from vegetation; control for low stages a rocky riffle with a fall of 6 inches. Control is apparently drowned out at a stage of 2.2 feet as shown by a reversal in the rating curve.

EXTREMES OF DISCHARGE.—Maximum open-water stage recorded during year, 6 feet at 7 a. m. June 12 (discharge, 2,010 second-feet). There was an estimated discharge, during a period when the channel was obstructed by ice, of 2,830 second-feet February 24; this estimate may be considerably in error. Minimum stage 0.80 foot at 6 p. m. October 2 (discharge, 102 second-feet.

1913–1922: Maximum stage recorded, 8.45 feet March 16, 1919 (discharge about 3,620 second-feet); minimum stage, 0.75 foot September 3, 1921 (discharge, 96 second-feet).

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

REGULATION.—Diurnal fluctuation at gage amounting at low stages from 0.10 to 0.40 foot, is caused by operation of power plants, especially at Neshonock dam a few miles above station.

ACCURACY.—Stage-discharge relation not permanent, changed gradually during summer. Rating curve well defined between 180 and 2,300 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for periods indicated in footnote to table of daily discharge. Records fair.

Discharge measurements of La Crosse River near West Salem, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 15	A. O. Olson	[a] 1.91	152
Feb. 8	S. B. Soulé	[a] 2.41	219
Aug. 9	E. E. Foster	1.69	294

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of La Crosse River near West Salem, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	175	203	226	136	210	515	350	328	268	216	230	170
2	132	212	212	166	195	438	308	288	288	230	209	121
3	168	190	200	149	175	394	371	308	268	230	196	131
4	175	190	179	164	230	132	416	288	226	166	196	160
5	187	200	206	173	160	528	371	288	288	200	438	120
6	187	149	200	166	240	1,120	394	230	248	212	308	112
7	200	241	209	196	235	2,360	394	288	241	288	268	142
8	193	190	200	160	220	1,700	461	288	219	328	230	134
9	142	206	173	190	175	889	715	288	241	328	200	131
10	181	219	164	170	235	889	889	328	506	394	193	146
11	193	206	134	164	235	1,000	972	268	1,060	308	187	177
12	193	226	181	156	209	1,060	835	288	1,700	288	200	200
13	177	158	223	166	216	715	889	268	1,120	268	151	187
14	177	219	212	165	235	862	779	241	779	216	170	179
15	181	223	190	155	162	835	715	288	638	230	187	206
16	155	206	219	115	153	678	528	268	461	181	187	212
17	181	219	177	155	156	573	461	288	371	350	177	177
18	181	237	187	165	160	484	416	328	308	484	177	184
19	190	268	187	185	128	461	416	371	288	484	173	200
20	177	187	162	180	151	528	416	371	268	350	127	184
21	200	200	248	205	181	484	461	308	288	248	187	206
22	158	200	113	155	1,060	438	371	350	288	308	179	209
23	155	195	177	170	1,900	484	288	328	308	230	162	200
24	193	185	114	105	2,830	506	328	328	268	350	179	212
25	193	195	160	250	1,430	551	350	328	248	328	162	212
26	168	190	164	175	835	551	328	328	288	268	181	206
27	177	166	160	150	715	551	328	308	248	226	149	170
28	179	212	146	205	616	438	288	248	248	216	170	196
29	187	209	151	130	-------	416	268	308	237	203	179	193
30	147	206	248	180	-------	394	241	268	203	179	168	162
31	219	-------	147	210	-------	371	-------	288	-------	268	120	-------

NOTE.—Stage-discharge relation affected by ice Nov. 22–25 and Dec. 18 to Mar. 15; discharge based on gage height corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records. Discharge June 16 to Sept. 30 computed by indirect method for shifting control.

Monthly discharge of La Crosse River near West Salem, Wis., for the year ending Sept. 30, 1922

[Drainage area, 412 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	219	132	178	0.432	0.50
November	268	149	204	.495	.55
December	248	113	183	.444	.51
January	250	105	168	.408	.47
February	2,830	128	480	1.17	1.22
March	2,360	132	689	1.67	1.92
April	972	241	478	1.16	1.29
May	371	230	300	.728	.84
June	1,700	203	414	1.00	1.12
July	484	166	277	.672	.77
August	438	120	195	.473	.55
September	212	112	175	.425	.47
The year	2,830	105	310	.752	10.21

UPPER IOWA RIVER NEAR DECORAH, IOWA.

LOCATION.—In sec. 13, T. 98 N., R. 8 W., 500 feet above highway bridge in Freeport, 3 miles below Decorah, Winneshiek County, and 4 miles above upper power plant of Interstate Power Co. Nearest tributary, Trout Run, enters from right 1 mile above station.

DRAINAGE AREA.—560 square miles (measured on United States Geological Survey base map; scale, 1:500,000).

RECORDS AVAILABLE.—August 27, 1913, to November 21, 1914; May 12, 1919, to September 30, 1922.

GAGE.—Gurley graph water-stage recorder on left bank 500 feet above highway bridge, inspected by Mrs. W. D. Gross. Prior to August 28, 1920, chain gage used, attached to highway bridge.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—A rock ledge probably forms a permanent control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.42 feet at 2 p. m., February 22 (discharge, 14,700 second-feet). Minimum discharge occurred during winter.

1913–14 and 1919–1922: Maximum discharge, that of February 22, 1922; minimum discharge, 37 second-feet, September 10, 13–16, 1913.

ICE.—Stage-discharge relation affected by ice for short periods during extremely cold weather.

REGULATION.—Several mills in Decorah may cause slight diurnal fluctuations.

ACCURACY.—Stage-discharge relation changed during high water of March. Rating curve used October 1 to March 6, and curve used March 7 to September 30 are well defined between 100 and 12,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying rating table to mean daily gage height obtained by inspection of recorder-graph except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Upper Iowa River near Decorah, Iowa, during the year ending Sept. 30, 1922

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Apr. 25	2.57	412
Sept. 10	1.65	95.2

Daily discharge, in second-feet, of Upper Iowa River near Decorah, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	195	146	112	87	326	331	388	217	242	130	157	84
2	191	134	109	87	269	308	365	234	224	130	138	74
3	183	127	94	84	231	313	352	920	227	118	135	72
4	172	127	70	87	211	815	356	1,090	217	113	133	68
5	164	123	131	87	153	2,610	374	692	213	113	128	70
6	168	120	112		127	4,600	325	524	187	125	118	74
7	195	120	112		112	3,020	374	440	197	157	111	82
8	176	142	94		94	1,690	460	402	187	138	106	93
9	168	134	87		105	1,270	1,020	430	187	445	102	106
10	153	116	98		187	1,460	1,200	430	194	238	104	91
11	153	116	105		219	1,610	1,530	430	217	152	102	84
12	153	98	102	65	168	1,400	1,690	496	181	141	106	88
13	146	109	105		123	1,200	1,730	356	317	128	102	84
14	138	116	98		116	1,050	1,340	356	234	123	102	86
15	146	120	91		102	900	1,060	360	204	135	97	86
16	142	120	105		91	750	860	325	213	213	91	95
17	153	146	98		131	600	770	425	172	292	95	84
18	195	149	51		105	674	552	450	166	231	88	108
19	161	134	60		180	860	480	360	157	213	84	111
20	142	84	70		203	860	455	330	152	207	88	104
21	134	102	65		187	758	455	288	154	184	106	99
22	138	87	60		3,130	716	480	276	144	181	102	95
23	131	105	55		4,480	704	480	272	144	194	93	95
24	131	120	60	50	1,270	680	430	338	135	166	95	95
25	127	112	70		880	674	455	296	133	149	91	93
26	123	131	80		587	656	284	272	133	157	84	88
27	123	116	98		503	608	234	256	130	163	84	86
28	120	112	102		313	579	264	249	123	166	82	86
29	153	116	105	80	-------	491	321	245	130	163	72	88
30	164	109	98	100	-------	455	374	242	128	160	70	88
31	153	-------	91	150	-------	397	-------	292	-------	166	84	-------

NOTE.—Stage-discharge relation affected by ice Dec. 19–26, Jan. 6–31, also no gage-height record Mar. 12–17; discharge estimated by use of observer's notes and weather records. Braced figures show mean daily discharge for periods indicated.

Monthly discharge of Upper Iowa River near Decorah, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 560 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	195	120	155	0.277	0.32
November	149	84	120	.214	.24
December	131	51	89.9	.160	.18
January	-------	-------	68.9	.123	.14
February	4,480	91	522	.932	.97
March	4,600	308	1,070	1.91	2.20
April	1,730	234	649	1.16	1.29
May	1,090	217	397	.709	.82
June	317	123	181	.323	.36
July	445	113	174	.311	.36
August	157	70	102	.182	.21
September	111	68	88.6	.158	.18
The year	4,600	-------	300	.536	7.72

WISCONSIN RIVER AT WHIRLPOOL RAPIDS, NEAR RHINELANDER, WIS.

LOCATION.—In sec. 4, T. 35 N., R. 8 E., at head of Whirlpool Rapids, 1 mile below mouth of outlet of Crescent Lake, coming in from right, and 3 miles downstream from power station of Rhinelander Power Co., 10 miles southwest of Rhinelander, Lincoln County.

DRAINAGE AREA.—1,160 square miles (measured on map issued by Wisconsin Geological and Natural History Survey edition of 1911; scale, 1 inch= 6 miles).

RECORDS AVAILABLE.—September 15, 1915, to September 30, 1922; December 1, 1905, to September 30, 1915, records were collected at a station 3 miles upstream.

GAGE.—Stevens continuous water-stage recorder on right bank, in wooden shelter.

DISCHARGE MEASUREMENTS.—Made from cable 150 feet above gage.

CHANNEL AND CONTROL.—Bed of stream heavy gravel and rock. Banks medium high and not subject to overflow. Control is head of rapids, 100 feet below gage; well defined, permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.18 feet at 11 a. m. April 12 (discharge, 4,490 second-feet); minimum stage, 0.72 foot at 8 p. m. September 24 (discharge, 186 second-feet).

1905–1922: Maximum stage recorded, 5.61 feet April 22, 1916 (discharge, 5,250 second-feet); minimum discharge no flow at old location during August and September, 1907, and June and July, 1908. The minimum flow is caused almost entirely by regulation and at present location probably some discharge will always occur. Minimum stage at present location 0.65 foot July 7, 1918 (discharge, 165 second-feet).

REGULATION.—Above the station are 14 reservoirs [3] which are operated by the Wisconsin Valley Improvement Co. for the purpose of regulating flow of Wisconsin River. The aggregate capacity of these reservoirs is 2.8 billion cubic feet during summer and 3.6 billion cubic feet during winter.

In addition to above reservoirs there are on Wisconsin River above this station three power plants. Owing to operation of these various storage reservoirs and service reservoirs in connection with power plants, the flow at station is not natural.

ACCURACY.—Stage-discharge relation permanent except as affected by ice; rating curve well defined between 210 and 5,500 second-feet. Operating of water-stage recorder satisfactory except as indicated in footnote to table of daily discharge. Daily discharge ascertained by use of discharge integrator, except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Wisconsin River at Whirlpool Rapids, near Rhinelander, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 29	S. R. Collins	[2] 2.02	590	Feb. 13	S. R. Collins	[2] 2.06	810
Jan. 30	do	[2] 2.16	610	Aug. 25	E. E. Foster	2.70	1,330

[2] Stage-discharge relation affected by ice.

[3] Information concerning these reservoirs, based on maps and data furnished by W. E. Brooks, manager of the Wisconsin Valley Improvement Co. and data collected by the engineering department of the Railroad Commission of Wisconsin, is contained in United States Geological Survey Water-Supply Paper 405, p. 127.

Daily discharge, in second-feet, of Wisconsin River at Whirlpool Rapids, near Rhinelander, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.
1	970	550	605	575	500	850	1,300	1,440	1,070	990	970	720
2	920	520	740	390	530	635	1,400	1,180	1,100	1,180	1,060	985
3	1,000	580	730	555	565	825	1,520	970	970	990	1,050	600
4	1,000	675	685	545	575	685	1,500	1,300	515	965	1,020	640
5	910	750	660	540	525	840	1,750	1,320	680	955	1,040	660
6	930	500	670	610	420	1,340	2,220	1,540	720	1,000	980	700
7	870	490	618	575	560	600	2,660	1,750	730	1,040	930	725
8	590	615	670	565	550	910	2,780	1,640	680	1,410	1,100	1,200
9	500	690	635	415	490	1,160	3,150	1,180	680	1,400	1,090	1,400
10	440	735	625	595	505	630	3,780	1,220	730	1,180	1,000	1,470
11	635	745	535	665	515	625	3,560	1,340	510	1,140	1,000	1,330
12	800	750	680	595	545	650	4,120	1,690	550	1,120	960	1,300
13	660	465	695	750	565	535	3,780	2,440	700	1,210	540	1,280
14	440	460	730	550	530	1,210	3,540	2,360	665	1,180	500	1,260
15	460	570	670	600	515	1,060	3,450	1,910	630	1,160	680	1,260
16	600	725	690	490	545	1,000	3,370	1,380	890	740	640	1,320
17	460	720	720	515	540	990	3,450	1,870	1,060	780	710	1,000
18	710	790	570	575	565	1,010	2,690	1,200	1,020	1,120	940	880
19	600	1,060	745	575	560	875	2,730	1,010	1,020	1,060	1,050	1,200
20	680	615	740	535	410	930	2,780	1,030	1,160	900	600	1,160
21	720	620	735	460	570	900	2,560	1,020	1,100	870	600	1,160
22	600	730	875	430	620	880	2,580	1,200	1,170	1,030	950	1,190
23	630	785	700	360	615	975	2,210	1,040	1,360	600	960	890
24	475	870	680	680	780	1,080	2,520	975	1,430	695	960	600
25	560	710	715	555	715	1,050	1,920	770	1,220	990	1,100	680
26	565	690	525	510	490	1,060	1,810	800	1,080	960	1,060	875
27	770	440	530	565	390	1,170	1,730	780	990	1,010	660	860
28	765	495	770	615	740	1,410	1,640	560	1,030	1,090	730	1,000
29	660	585	660	935	-------	1,370	1,570	500	975	980	880	800
30	465	620	565	360	-------	1,290	1,240	765	810	600	620	970
31	480	-------	660	580	-------	1,280	-------	945	-------	800	670	-------

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Mar. 13. Discharge based on gage reading at Hat Rapids power plant, three discharge measurements, and weather records. Gage not in operation Oct. 16, 20–24, May 8–17, May 30 to June 3, July 3–13, and Sept. 8; discharge computed from a study of gage height at Hat Rapids in comparison with flow at the station.

Monthly discharge of Wisconsin River at Whirlpool Rapids, near Rhinelander, Wis., for the year ending Sept. 30, 1922

[Drainage area, 1,160 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,000	440	673	0.580	0.67
November	1,060	440	652	.562	.63
December	875	525	672	.579	.67
January	935	360	557	.480	.55
February	780	390	551	.475	.49
March	1,410	535	962	.829	.96
April	4,120	1,240	2,510	2.16	2.41
May	2,440	500	1,260	1.09	1.26
June	1,430	510	908	.783	.87
July	1,410	600	1,000	.862	.99
August	1,100	500	873	.753	.87
September	1,470	600	1,000	.862	.96
The year	4,120	360	969	.835	11.33

WISCONSIN RIVER AT MERRILL, WIS.

LOCATION.—At highway bridge at east end of Merrill, Lincoln County, 1,000 feet below power house of Merrill plant of Wisconsin Valley Lighting Co. and half a mile below mouth of Prairie River, coming in from left.

DRAINAGE AREA.—2,630 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—November 16, 1902, to September 30, 1922.

GAGE.—Stevens water-stage recorder installed September 11, 1914; November 16, 1902, to June 17, 1903, staff gage; June 17, 1903, to September 10, 1914, chain gage attached to downstream side of highway bridge; datum same since June 17, 1903; records prior to this date questionable. Recorder inspected by O. F. Lueck.

DISCHARGE MEASUREMENTS.—Made from bridge just above gage.

CHANNEL AND CONTROL.—Bed of river composed of heavy gravel and rock; permanent; small island below gage and small rapids on either side probably constitute control. Banks fairly high and are seldom overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.2 feet at 8 a. m. April 11 (discharge, 18,400 second-feet); minimum stage, 2.9 feet at 2 p. m. December 26 (discharge by extension of rating curve 400 second-feet); minimum discharge caused by regulation.

1902–1922: Maximum stage recorded, about 17.5 feet July 24, 1912 (discharge, 45,000 second-feet); minimum stage, 2.45 feet September 26, 1908 (discharge, about 90 second-feet). During the 24 hours preceding the maximum discharge 11.25 inches of rain fell in the vicinity of Merrill According to C. B. Stewart, consulting engineer, Madison, the run-off of the 700 square miles between Merrill and Tomahawk was at the rate of 65 second-feet per square mile. If the estimate is extended to the entire area above Merrill the flow was 17 second-feet per square mile.

REGULATION.—Above the gaging station are 17 reservoirs,[4] which are operated by the Wisconsin Valley Improvement Co. for the purpose of regulating the flow in Wisconsin River. The aggregate capacity of these reservoirs is about 6¼ billion cubic feet. In addition to the above reservoirs there are eight dams operated for power on Wisconsin and Tomahawk rivers above the station.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 1,000 and 19,400 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by discharge integrator except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Wisconsin River at Merrill, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Dec. 31	S. R. Collins	[a] 4.04	785
Feb. 3	do	[a] 4.56	1,060
Aug. 26	E. E. Foster	4.77	1,730

[a] Stage-discharge relation affected by ice.

[4] Information concerning these reservoirs, based on maps and data furnished by the manager of the Wisconsin Valley Improvement Co. and data collected by the engineeri ng department of the Wisconsin Railroad Commission, is contained in Water-Supply Paper 405, p. 127.

Daily discharge, in second-feet, of Wisconsin River at Merrill, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,680	1,060	1,460	1,330	960	1,300	4,690	2,840	2,090	1,960	2,280	1,940
2	1,580	1,290	1,480	860	1,120	1,330	5,650	3,200	2,360	1,960	2,150	1,600
3	1,070	1,340	1,550	1,240	1,110	1,230	7,020	3,250	2,230	2,250	1,920	1,620
4	2,010	1,370	1,250	1,180	1,000	1,410	7,960	3,430	2,070	1,710	1,940	1,440
5	1,920	1,340	1,020	1,260	928	1,160	9,260	3,810	1,780	1,680	1,920	1,160
6	1,930	1,490	1,680	1,280	665	1,300	10,100	4,650	1,820	1,780	2,440	1,560
7	1,350	1,070	1,470	1,140	1,040	1,560	11,300	4,910	1,640	1,920	1,340	2,050
8	1,420	1,230	1,420	1,150	1,210	1,410	12,500	5,090	1,530	2,130	1,860	2,220
9	1,660	1,300	1,460	668	943	1,510	14,400	4,200	1,770	2,780	1,900	3,600
10	1,140	1,300	1,540	1,280	952	1,820	16,700	3,980	1,880	3,170	1,800	3,230
11	1,330	1,390	1,450	1,340	987	1,740	17,700	4,260	2,400	2,180	1,870	3,670
12	1,210	1,510	750	1,160	1,040	1,900	13,800	4,040	1,600	2,340	2,000	3,020
13	1,270	1,710	1,460	1,240	848	1,810	11,900	2,630	1,630	2,180	2,050	2,370
14	1,570	1,020	1,470	1,430	1,100	2,400	10,700	3,810	1,620	1,820	1,340	2,580
15	1,400	1,380	1,540	1,270	967	2,820	10,100	3,040	1,570	1,960	1,500	2,260
16	1,620	1,200	1,460	667	928	2,900	9,540	2,770	1,800	2,160	1,800	2,350
17	1,490	1,390	1,520	1,130	889	2,770	10,100	2,590	3,320	2,280	1,340	2,580
18	1,470	1,620	1,170	1,240	850	2,900	10,100	2,880	3,600	1,560	1,660	2,320
19	1,200	1,640	855	1,160	928	2,900	8,980	3,560	3,400	1,900	1,700	2,360
20	1,440	1,530	1,610	1,340	1,050	2,850	8,980	3,660	3,170	1,930	1,840	2,230
21	1,740	1,420	1,360	1,120	1,160	2,740	7,160	3,480	2,700	2,150	1,200	2,040
22	1,670	1,310	1,360	1,200	1,100	2,880	6,600	3,180	2,380	1,800	1,590	1,830
23	1,600	1,500	1,280	773	1,220	3,030	6,060	2,850	2,370	2,360	1,670	2,080
24	1,520	1,500	1,390	770	1,460	3,250	4,870	2,870	2,070	1,800	1,950	2,370
25	1,500	1,410	1,330	950	1,370	3,930	5,080	2,660	2,080	1,870	1,750	1,560
26	1,420	1,600	1,000	1,040	1,360	4,830	4,840	2,270	2,120	2,120	1,780	1,400
27	1,310	1,600	965	880	1,050	5,020	4,650	2,240	2,000	1,990	1,700	1,360
28	1,400	942	1,480	810	1,180	5,710	4,260	2,120	2,170	1,860	1,880	1,280
29	1,450	1,340	1,380	854	-------	6,280	3,750	1,880	1,820	1,720	1,770	1,420
30	1,450	1,400	1,360	760	-------	5,860	3,240	1,950	1,700	1,960	1,710	1,280
31	1,030	-------	1,180	917	-------	5,560	--------	1,820	-------	1,506	1,680	-----

NOTE.—Stage-discharge relation affected by ice Nov. 18 to Mar. 9. Discharge determined by discharge integrator, with correction for effect of ice.

Monthly discharge of Wisconsin River at Merrill, Wis., for the year ending Sept. 30, 1922

[Drainage area, 2,630 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,010	1,030	1,480	0.563	0.65
November	1,710	942	1,370	.521	.58
December	1,680	750	1,350	.513	.59
January	1,430	667	1,080	.411	.47
February	1,460	665	1,050	.399	.42
March	6,280	1,160	2,840	1.08	1.24
April	17,700	3,240	8,730	3.32	3.70
May	5,090	1,820	3,260	1.24	1.43
June	3,600	1,530	2,160	.821	.92
July	3,170	1,560	2,030	.772	.89
August	2,440	1,200	1,780	.677	.78
September	3,670	1,160	2,090	.795	.89
The year	17,700	665	2,430	.924	12.56

WISCONSIN RIVER AT KNOWLTON, WIS.

LOCATION.—In N. ½ sec. 29, T. 26 N., R. 7 E., 50 feet below left end of a combination railroad-highway bridge of Chicago, Milwaukee & St. Paul Railway on State trunk highway No. 73 at Knowlton, Marathon County, 1½ miles below mouth of Big Eau Pleine River, which enters from right.

DRAINAGE AREA.—4,360 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch = 6 miles).

RECORDS AVAILABLE.—May 1, 1915, to September 30, 1922. Discharge records July 13, 1921, to September 30, 1922. Gage heights May 1, 1915, to December 31, 1921, published in United States Weather Bureau bulletin "Daily river stages," volumes 13 to 19.

GAGE.—Gurley graph water-stage recorder installed August 6, 1921; inspected by W. T. Gunther. Gage previously used Friez water-stage recorder installed July 13, 1921. Both gages installed in a wooden shelter 50 feet below left end of bridge. The United States Weather Bureau installed a chain gage on downstream handrail of bridge 150 feet from left end July 15, 1914.

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

CHANNEL AND CONTROL.—Bed composed of sand and light gravel. Control not well defined; there is, however, a decided contraction of the channel at an island 2,500 feet below gage. Right bank high, not subject to overflow; left bank of medium height and is overflowed at extreme flood stages.

EXTREMES OF DISCHARGE.—1921–22: Maximum stage recorded, 19.5 feet at 10 p. m. April 10 (discharge, 49,800 second-feet); minimum stage, 1.0 foot at 2 a. m. August 15, 1921 (discharge, about 900 second-feet).

REGULATION.—No storage reservoirs discharge into Wisconsin River between Knowlton and Merrill. See "Regulation" in station description of Wisconsin River at Merrill (p. 83). Between Knowlton and Merrill are four dams operated for power.

ACCURACY.—Stage-discharge relation permanent; rating curve fairly well defined between 2,000 and 32,500 second-feet. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Daily discharge ascertained by use of discharge integrator except for periods as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Wisconsin River at Knowlton, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 3	S. R. Collins	[a] 3.99	1,810	Apr. 28	A. O. Olson	5.48	5,480
Feb. 6	do	[a] 3.78	1,530	June 16	do	3.43	3,050
Mar. 9	S. B. Soulé	[a] 4.44	1,620	July 28	S. B. Soulé	3.30	2,590
Apr. 6	A. O. Olson	13.61	28,800				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Wisconsin River at Knowlton, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,290	2,000	1,850	1,520	1,600	1,360	19,800	3,780	3,050	2,920	2,890	2,450
2	1,970	1,850	1,850	1,400	1,520	1,520	12,600	3,660	2,840	2,620	2,690	2,180
3	2,060	1,810	1,940	1,760	1,640	1,560	17,600	3,780	2,750	2,840	2,960	2,700
4	2,480	1,870	1,680	1,800	1,600	1,560	19,800	4,520	3,060	2,870	2,930	2,700
5	2,180	2,140	1,440	1,800	1,600	1,560	23,300	4,920	2,920	2,780	2,580	2,540
6	2,390	1,840	1,720	1,760	1,560	1,440	29,600	4,780	3,210	2,830	2,620	2,340
7	2,430	1,790	1,600	1,720	1,560	1,440	28,200	5,300	3,010	3,000	3,310	2,540
8	2,500	1,920	1,720	1,600	1,560	1,440	33,600	5,990	2,830	3,100	2,990	3,100
9	1,940	1,830	1,850	1,320	1,220	1,600	33,600	5,990	2,690	3,290	2,890	4,020
10	2,030	1,810	1,980	1,720	1,360	1,680	45,100	5,500	3,060	5,020	2,920	3,990
11	2,350	1,850	1,640	1,560	1,480	1,600	45,500	5,500	4,120	5,000	2,970	3,570
12	2,360	1,920	1,680	1,440	1,400	1,520	33,600	5,200	4,600	4,240	2,860	4,080
13	2,410	1,690	2,080	1,560	1,290	1,480	22,900	4,520	4,080	3,570	2,660	3,780
14	2,260	1,590	2,030	1,680	1,360	1,940	19,800	4,260	3,520	3,530	2,720	3,330
15	2,160	1,940	2,030	1,640	1,480	2,080	19,500	4,520	3,250	3,340	2,900	3,200
16	1,780	1,940	2,030	1,290	1,600	2,160	19,500	3,550	3,080	2,740	2,710	2,760
17	1,660	1,760	2,160	1,720	1,760	3,000	17,900	3,550	2,900	2,920	2,600	2,970
18	2,260	1,720	2,120	1,850	1,480	3,220	16,100	3,550	4,390	3,420	2,540	3,300
19	2,370	1,640	1,400	1,600	1,440	3,600	14,000	4,520	4,130	3,000	2,440	3,060
20	2,320	1,440	1,800	1,640	1,440	3,600	11,600	5,350	4,200	2,720	2,180	2,900
21	2,040	1,640	1,600	2,120	1,400	3,720	10,100	4,520	3,700	2,710	2,590	2,850
22	2,030	1,940	1,760	1,850	1,220	3,720	9,090	4,390	3,620	3,200	2,740	2,800
23	1,760	1,940	1,760	1,360	1,150	4,460	8,390	3,900	3,550	2,910	2,540	2,750
24	1,800	1,850	1,600	1,850	1,080	5,350	7,510	3,660	3,400	3,160	2,610	2,570
25	2,330	2,080	1,150	1,850	1,400	7,300	5,820	3,780	3,120	2,890	2,800	2,850
26	2,300	2,030	1,080	1,760	1,400	8,050	5,820	3,900	2,950	2,840	2,750	2,790
27	2,330	1,720	1,440	1,760	1,360	10,700	5,660	3,140	3,240	2,970	2,240	2,290
28	2,190	1,520	1,680	1,680	1,290	15,800	5,660	2,970	3,100	2,940	2,420	2,160
29	2,120	2,030	1,760	1,520	-------	19,200	4,780	2,630	2,940	2,860	2,730	1,930
30	1,800	1,640	1,800	1,250	-------	21,900	4,520	2,730	2,960	2,530	2,600	1,740
31	1,770	-------	1,600	1,600	-------	20,200	-------	2,550	-------	2,660	2,400	-------

NOTE.—Stage-discharge relation affected by ice Nov. 15 to Mar. 25. Recording gage not operating satisfactorily May 27–31, Sept. 21, 22, 29, and 30. Discharge determined by comparison with records on Wisconsin River at Merrill.

Monthly discharge of Wisconsin River at Knowlton, Wis., for the year ending Sept. 30, 1922

[Drainage area, 4,360 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,500	1,660	2,150	0.493	0.57
November	2,140	1,440	1,820	.417	.47
December	2,160	1,080	1,740	.399	.46
January	2,120	1,250	1,640	.376	.43
February	1,760	1,080	1,440	.330	.34
March	21,900	1,360	5,150	1.18	1.36
April	45,500	4,520	18,400	4.22	4.71
May	5,990	2,550	4,220	.968	1.12
June	4,600	2,690	3,340	.766	.85
July	5,020	2,530	3,140	.720	.83
August	3,310	2,180	2,700	.619	.71
September	4,080	1,740	2,870	.658	.73
The year	45,500	1,080	4,040	.927	12.58

WISCONSIN RIVER NEAR NEKOOSA, WIS.

LOCATION.—In sec. 15, T. 21 N., R. 5 E., 1½ miles below Nekoosa, Wood County. Tenmile Creek enters from left 4 miles below, and Big Roche a Cri Creek, also from left, 38 miles below station.

DRAINAGE AREA.—5,500 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles.)

RECORDS AVAILABLE.—May 21, 1914, to September 30, 1922.

GAGE.—Stevens water-stage recorder installed July 18, 1916, in wooden shelter on right bank, prior to that date Gurley water-stage recorder at same location. Gage inspected by Henry Mans.

DISCHARGE MEASUREMENTS.—Made from cable just above gage.

CHANNEL AND CONTROL.—Bed composed of gravel; clean, permanent. Banks high and rarely overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 16.1 feet at 1 a. m. April 12 (discharge, 61,000 second-feet); minimum stage, 0.0 foot several times during August 25 and 26 (discharge about 500 second-feet). Minimum flow is due to regulation.

1914–1922: Maximum stage recorded, that of 1922; minimum stage, that of 1922.

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

REGULATION.—No storage reservoirs discharging into Wisconsin River between Nekoosa and Merrill. See "Regulation" in station description of Wisconsin River at Merrill (p. 83). Between Nekoosa and Merrill are 12 dams operated for power.

ACCURACY.—Stage-discharge relation permanent, except as affected by ice. Rating curve well defined between 1,400 and 55,000 second-feet and extended above and below these limits. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Daily discharge ascertained by use of discharge integrator, except as explained in footnote to table of daily discharge. Open-water records excellent; winter records fair.

Discharge measurements of Wisconsin River near Nekoosa, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 4	S. R. Collins	[a] 2.92	1,850	Apr. 13	A. O. Olson	13.98	44,400
Mar. 8	S. B. Soulé	[a] 2.84	1,890	July 29	S. B. Soulé	2.06	3,060

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Wisconsin River near Nekoosa, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,620	1,520	2,170	1,270	2,220	2,360	16,400	6,670	2,940	3,680	2,420	3,180
2	2,010	1,960	2,240	1,140	2,180	1,870	16,400	5,550	2,740	3,380	2,040	3,480
3	2,070	1,900	2,280	1,440	2,310	1,880	15,200	5,640	2,960	6,540	2,600	2,340
4	2,110	1,840	1,740	1,730	2,860	2,000	24,100	6,170	2,600	10,300	2,330	2,200
5	2,140	1,560	1,740	1,740	2,870	2,100	33,000	6,880	3,120	5,660	2,500	3,360
6	2,180	1,450	1,830	2,000	3,000	2,250	38,200	7,230	3,600	3,170	2,660	3,100
7	2,220	1,660	1,630	1,760	2,940	1,900	39,100	7,950	3,560	3,750	2,530	2,780
8	2,260	1,680	1,780	1,680	3,350	1,780	38,200	8,800	2,630	3,450	3,490	3,380
9	2,290	1,820	1,910	1,710	2,880	1,640	48,900	8,890	2,550	4,500	2,730	4,130
10	2,330	1,600	1,640	1,310	2,590	1,890	52,900	8,750	3,370	5,140	2,790	6,140
11	2,150	1,810	1,930	1,460	2,670	2,130	58,500	8,520	9,310	3,530	2,900	6,170
12	2,270	1,740	2,140	1,680	3,220	1,800	58,500	8,160	11,200	3,790	3,120	5,920
13	2,380	1,520	1,750	1,430	3,410	1,830	43,500	7,740	10,200	3,530	2,240	6,080
14	2,580	1,720	2,200	1,480	3,200	1,610	33,000	6,510	7,560	2,950	1,780	4,550
15	2,460	1,710	2,180	1,690	3,150	2,500	28,000	6,410	5,870	3,870	2,440	3,740
16	1,780	2,280	2,270	1,940	3,090	3,120	26,900	6,100	4,930	3,730	2,760	3,900
17	1,840	2,210	1,940	1,200	3,380	2,750	26,500	4,910	4,700	2,590	1,720	3,780
18	1,640	2,020	1,600	1,540	2,830	3,840	24,400	5,340	4,460	3,150	2,600	3,060
19	1,930	2,150	1,430	1,970	2,820	4,960	22,800	5,090	4,710	3,500	1,330	4,280
20	2,400	1,780	1,660	1,690	2,390	6,330	20,100	7,440	4,950	3,290	1,560	3,660
21	2,600	1,480	2,370	1,610	2,280	5,250	17,400	7,910	5,200	2,600	1,840	3,220
22	1,990	1,510	2,580	2,000	3,310	5,280	15,200	7,340	4,680	3,220	2,110	3,340
23	1,650	1,740	2,130	2,420	2,920	6,220	13,800	5,700	3,590	4,580	2,300	3,390
24	2,000	1,930	2,540	2,270	2,950	6,060	12,400	5,450	3,420	4,800	1,200	2,340
25	1,680	1,820	1,320	2,410	2,980	6,020	11,500	4,940	4,260	3,600	1,170	2,860
26	2,510	1,850	1,660	2,520	2,330	9,080	11,300	4,880	3,580	2,820	1,750	3,180
27	2,180	2,010	2,430	2,370	2,760	9,740	8,320	4,830	3,010	2,610	1,900	2,960
28	2,380	2,020	1,180	2,140	2,470	11,400	8,530	4,120	3,980	2,680	1,780	2,340
29	2,390	1,680	1,340	1,900	-------	13,400	8,060	3,280	2,550	2,580	5,550	2,370
30	1,720	2,450	1,560	2,080	-------	15,600	7,220	3,650	3,470	2,720	5,860	3,700
31	2,010	-------	1,340	1,870	-------	16,500	---------	3,960	---------	2,330	2,970	-------

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Mar. 23. Discharge determined by study of records for Wisconsin River at Merrill. Water gage recorder not operating satisfactorily Oct. 4–9, June 17, 19, 20, July 8–14, and Aug. 5. Discharge interpolated, except for the period in July, when discharge was computed from study of records of Wisconsin River at Merrill.

Monthly discharge of Wisconsin River near Nekoosa, Wis., for the year ending Sept. 30, 1922

[Drainage area, 5,500 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,620	1,640	2,150	0.391	0.45
November	2,450	1,450	1,810	.329	.37
December	2,580	1,180	1,890	.344	.40
January	2,520	1,140	1,790	.325	.37
February	3,410	2,180	2,830	.515	.54
March	16,500	1,610	5,000	.909	1.05
April	58,500	7,220	25,900	4.71	5.26
May	8,890	3,280	6,280	1.14	1.31
June	11,200	2,550	4,520	.822	.92
July	10,300	2,330	3,810	.693	.80
August	5,860	1,170	2,480	.451	.52
September	6,170	2,200	3,630	.660	.74
The year	58,500	1,140	5,160	.938	12.73

WISCONSIN RIVER AT MUSCODA, WIS.

LOCATION.—In sec. 1, T. 8 N., R. 1 W., at highway bridge 1 mile north of Muscoda, Grant County. Eagle Mill Creek enters from right half a mile below, and Underwood Creek from left 4½ miles above station.

DRAINAGE AREA.—10,300 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—December 21, 1902, to December 31, 1903; December 1, 1913, to September 30, 1922. Gage heights November 1, 1908, to December 31, 1912, published in United States Weather Bureau bulletin, "Daily river stages," parts 9, 10, and 11.

GAGE.—Chain gage attached to handrail on upstream side of bridge; read by William Hessler. Elevation of zero of present gage 12.62 feet above that of gage maintained December 20, 1902, to December 3, 1913; elevation of gage during period November, 1908, to December 3, 1913, as read and published by United States Weather Bureau, was about the same as that of present gage, sea-level elevation of which is approximately 666.2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.60 feet at 7 a. m. April 16 (discharge, 72,100 second-feet); minimum open-water stage, 0.82 foot at 5 p. m. November 25 (discharge, 3,600 second-feet). Absolute minimum discharge, 2,900 second-feet on January 16 (stage-discharge relation affected by ice).

1903, 1914–1922: Maximum stage recorded, that of 1922; minimum open-water discharge occurred with a stage of 0.54 foot August 29, 1921 (discharge, 2,770 second-feet). Estimated discharge, about 1,600 second-feet, under frozen conditions, December 20, 1921.

According to the records of the United States Weather Bureau [5] (see note under "Gage"), on June 11, 1881, the river reached a stage of 11.1 feet and during August, 1868, zero on gage; discharge not computed owing to changes in channel and datum of gage.

REGULATION.—Nearest power plant above station is at Prairie du Sac, 40 miles distant; since the latter part of 1915 considerable diurnal fluctuation has been observed at the gage. Owing to regulation by storage in the headwaters the flow at this station is not natural.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by a gradual shift during the summer. Rating curve well defined between 4,000 and 45,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Open-water records poor; winter records roughly approximate.

Discharge measurements of Wisconsin River at Muscoda, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 19	Olson and Collins	[a] 2.26	3,470	June 8	Olson and Soulé	2.28	8,020
Apr. 1	do	4.83	19,800	Aug. 7	Foster and Soulé	1.28	5,760

[a] Stage-discharge relation affected by ice.

[5] Daily river stages, pt. 10, p. 98, U. S. Dept. Agr.

Daily discharge, in second-feet, of Wisconsin River at Muscoda, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,480	5,200	4,450	3,780	4,450	5,480	19,700	14,400	9,700	7,400	6,700	4,940
2	4,940	4,940	6,380	3,120	4,690	5,480	20,300	16,200	9,300	6,700	7,040	4,690
3	4,220	4,690	6,700	3,340	4,000	4,940	20,800	14,400	8,900	5,760	6,700	4,690
4	4,450	4,690	6,060	4,220	4,450	6,060	24,400	12,600	8,140	6,060	6,380	4,000
5	4,940	4,450	6,060	4,000	4,450	6,700	23,100	12,600	6,700	5,760	6,380	4,000
6	4,690	4,220	6,060	3,120	4,000	8,520	25,700	11,800	7,400	6,380	6,060	4,690
7	5,200	3,780	5,760	3,120	4,220	11,800	25,700	11,800	6,700	7,400	5,200	4,940
8	4,940	4,940	5,760	3,340	4,220	13,500	24,400	12,000	6,700	7,400	5,760	4,690
9	4,690	4,940	5,200	3,120	4,450	12,600	28,500	15,300	6,380	6,380	5,480	4,220
10	4,220	4,940	4,690	3,560	4,450	13,000	36,800	12,600	7,760	5,200	5,480	4,690
11	4,450	4,940	4,690	3,560	4,690	20,300	49,500	11,300	8,900	6,700	5,480	4,000
12	4,450	4,450	4,450	3,340	3,780	20,800	55,600	17,200	7,400	8,140	5,480	4,450
13	4,450	4,450	5,200	3,120	3,120	14,800	55,600	13,500	7,760	7,760	5,200	4,450
14	4,450	4,000	5,480	3,340	3,560	13,500	58,900	10,900	10,500	8,140	4,450	4,690
15	4,450	4,940	5,200	3,120	3,340	13,000	68,800	14,400	14,800	11,800	5,480	5,200
16	4,450	4,940	5,480	2,900	3,120	12,200	72,100	14,800	15,800	12,600	5,480	5,480
17	3,780	4,940	6,380	3,340	3,340	12,200	67,700	10,900	17,200	11,800	5,480	5,760
18	4,940	5,480	5,480	3,560	3,780	12,200	61,100	10,900	13,000	9,700	5,480	5,200
19	5,760	5,480	5,760	3,340	3,780	13,900	53,500	14,800	14,400	7,040	5,480	6,700
20	6,060	4,940	6,060	3,120	4,220	16,200	46,500	11,300	12,200	7,760	5,480	6,700
21	5,760	4,000	5,760	3,120	4,220	18,700	46,500	10,100	11,300	7,400	4,690	6,060
22	5,200	4,690	5,480	3,340	8,520	14,400	40,500	8,900	11,300	7,400	5,200	5,760
23	4,940	4,940	5,480	3,120	22,500	13,000	35,900	10,500	13,900	7,400	5,480	5,760
24	4,220	4,940	4,940	3,340	19,700	12,600	34,100	13,000	12,200	6,700	5,200	5,480
25	4,940	3,780	4,450	3,560	8,520	14,400	31,600	13,000	11,300	6,700	4,940	4,690
26	4,940	4,220	4,000	3,560	6,060	14,800	23,100	12,200	8,520	6,700	4,450	5,480
27	4,940	4,450	4,000	3,780	5,480	13,900	25,100	11,800	8,900	7,040	4,690	5,480
28	4,940	3,780	4,450	3,560	6,060	13,900	19,200	8,900	8,900	6,700	4,000	5,200
29	4,940	4,450	4,000	3,780	-------	14,800	18,700	9,300	7,760	6,700	4,690	4,940
30	5,480	4,450	4,450	3,340	-------	17,200	16,200	10,500	7,400	6,700	4,690	4,940
31	4,690	-------	4,450	3,780	-------	20,800	-------	8,900	-------	5,480	4,690	-------

NOTE.—Stage-discharge relation affected by ice Dec. 22 to Mar. 10; discharge computed from study of gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records. Discharge Mar. 11 to Sept. 30 computed by indirect method for shifting control.

Monthly discharge of Wisconsin River at Muscoda, Wis., for the year ending Sept. 30, 1922

[Drainage area, 10,300 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	6,060	3,780	4,840	0.470	0.54
November	5,480	3,780	4,640	.450	.50
December	6,700	4,000	5,250	.510	.59
January	4,220	2,900	3,410	.331	.38
February	22,500	3,120	5,760	.559	.58
March	20,800	4,940	13,100	1.27	1.46
April	72,100	16,200	37,600	3.65	4.07
May	17,200	8,900	12,300	1.19	1.37
June	17,200	6,380	10,000	.971	1.08
July	12,600	5,200	7,440	.722	.83
August	7,040	4,000	5,400	.524	.60
September	6,700	4,000	5,070	.492	.55
The year	72,100	2,900	9,550	.927	12.55

TOMAHAWK RIVER NEAR BRADLEY, WIS.

LOCATION.—In sec. 16, T. 36 N., R. 6 E., 2 miles west of Cassion, 4 miles north of Bradley, Oneida County, 4 miles downstream from mouth of Bearskin Creek. which enters from right, and 8 miles above mouth of river.

DRAINAGE AREA.—422 square miles.

RECORDS AVAILABLE.—September 18, 1914, to September 30, 1922.

GAGE.—Slope gage fastened to concrete posts on right bank, installed September 24, 1919, prior to that date; chain gage fastened to cantilever arm on right bank; both gages at same datum; read by Frank Sutherland.

DISCHARGE MEASUREMENTS.—Made from cable half a mile below gage.

CHANNEL AND CONTROL.—Bed at gage and a short distance below, sandy and likely to shift. Control is formed by rapids 2,000 feet below gage. Bed at cable section heavy gravel. When a head of 15 feet is maintained in Rice Lake storage dam, in secs. 4 and 9. T. 35 N., R. 6 E., backwater will extend halfway up the rapids which may affect the stage-discharge relation. The maximum head maintained during the year was considerably less than 15 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 6.3 feet at 8 a. m. April 14 (discharge, 1,870 second-feet); minimum discharge estimated 165 second-feet February 1–3 when stage-discharge relation was affected by ice.

1914–1922: Maximum stage recorded, 6.90 feet April 24, 1916 (discharge, 2,200 second-feet); minimum stage, 1.29 feet July 1 and August 9, 1921 (discharge, 132 second-feet).

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

REGULATION.—The following reservoirs are maintained above station, for the purpose of regulating flow of Wisconsin River.

Reservoirs used to regulate flow of Wisconsin River

Name	Location of reservoir	Location of dam	Area of reservoir	Drainage area	Capacity (millions of cubic feet)	
					Summer	Winter
			Sq. mi.	*Sq. mi.*		
Squirrel	T. 39 N., R. 5 E.	Sec. 30, T. 39 N., R. 5 E.	3.00	17.07	152	152
Minocqua	Tps. 38–40 N. Rs. 6–7 E.	Sec. 10, T. 39 N., R. 6 E.	11.31	81.60	291	651
			14.31	98.67	443	803

ACCURACY.—Stage-discharge relation permanent, except as affected by ice. Rating curve well defined between 210 and 2,000 second-feet. Gage read to hundredths twice daily except during winter period and to April 27, when it was read once a week. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Medium and high stage open-water records, with the exception of the month of April, good; low-water records fair; winter records subject to considerable error.

Discharge measurements of Tomahawk River near Bradley, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 30	S. R. Collins	[a] 2.38	277	Apr. 27	A. O. Olson	3.46	639
Feb. 2	do	[a] 2.73	168	Aug. 25	E. E. Foster	1.71	211

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Tomahawk River near Bradley, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	358	278	325	275	165	190	1,040	502	395	502	218	218
2	346	289	325	275	165	210	1,090	474	395	559	237	218
3	334	300	325	275	165	230	1,130	502	395	559	218	228
4	312	312	325	280	175	245	1,180	530	346	502	209	237
5	300	323	335	280	175	255	1,220	589	323	447	200	247
6	300	323	330	280	185	290	1,270	619	278	395	218	257
7	289	323	330	280	185	310	1,320	619	247	370	218	278
8	278	323	330	275	185	335	1,420	619	237	395	218	323
9	278	323	325	275	190	370	1,520	619	218	421	237	421
10	278	312	325	275	190	395	1,620	589	237	447	228	447
11	278	312	325	270	190	420	1,720	559	257	447	237	447
12	289	312	320	270	190	445	1,770	502	268	421	257	447
13	289	312	320	270	190	445	1,820	474	268	370	257	447
14	278	323	315	265	185	475	1,870	447	257	323	237	447
15	278	334	315	260	185	500	1,750	421	237	289	218	421
16	278	334	310	255	185	530	1,630	395	474	278	209	421
17	289	323	300	250	185	560	1,510	421	815	289	200	395
18	300	323	300	245	175	560	1,390	395	923	289	200	395
19	323	312	300	240	175	590	1,270	447	961	268	192	395
20	334	325	300	235	175	620	1,150	447	1,040	257	192	395
21	312	325	300	230	175	650	1,040	447	1,040	247	192	370
22	300	325	300	220	175	650	980	421	1,000	247	192	323
23	289	325	290	215	165	680	920	370	886	237	183	323
24	289	325	290	210	165	715	860	358	713	228	200	312
25	278	325	290	205	165	745	800	358	589	218	200	300
26	268	325	290	200	175	780	740	346	474	200	209	278
27	268	325	290	190	175	815	680	323	421	192	209	278
28	268	325	280	185	185	815	619	300	395	183	200	278
29	268	325	280	180	-------	885	619	278	334	183	200	268
30	268	325	275	175	-------	960	559	289	346	183	192	268
31	268	-------	275	170	-------	1,000	-------	323	-------	200	200	-------

NOTE.—Stage-discharge relation affected by ice Nov. 20 to Mar. 31; discharge estimated by means of a few gage-height readings, two discharge measurements, observer's notes, weather records, and records of amount of storage released from reservoirs. Gage not read Apr. 1–6, 8–13, 15–20, and 22–27; discharge interpolated.

Monthly discharge of Tomahawk River near Bradley for the year ending Sept. 30, 1922

[Drainage area, 422 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	358	268	293	0.694	0.80
November	334	278	319	.756	.84
December	335	275	308	.730	.84
January	280	170	242	.573	.66
February	190	165	178	.422	.44
March	1,000	190	538	1.27	1.46
April	1,870	559	1,220	2.89	3.22
May	619	278	451	1.07	1.23
June	1,040	218	492	1.17	1.30
July	559	183	327	.775	.89
August	257	183	212	.502	.58
September	447	218	336	.796	.89
The year	1,870	165	409	.969	13.15

PRAIRIE RIVER NEAR MERRILL, WIS.

LOCATION.—On line between secs. 20 and 29, T. 32 N., R. 7 E., at highway bridge 4½ miles northeast of Merrill, Lincoln County, and 5½ miles above mouth of river. Haymeadow Creek enters from left 5 miles above station.

DRAINAGE AREA.—164 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 17, 1914, to September 30, 1922.

GAGE.—Chain gage attached to upstream side of bridge; read by Mrs. Meta Krause.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—Bed composed of gravel; clean and free from vegetation. Right bank is high, not subject to overflow; left bank may be overflowed at extreme flood stages; both banks wooded. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.90 feet at 9 a. m. April 11 (discharge, 2,110 second-feet); minimum discharge, 65 second-feet February 26 to March 1 (stage-discharge relation affected by ice).

1914–1922: Maximum stage recorded, 6.1 feet April 22, 1916 (discharge, 2,290 second-feet); minimum discharge that of 1922.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 70 and 2,200 second-feet. Gage read to hundredths once a day. Daily discharge ascertained by applying daily gage height to rating table, except as explained in footnote to table of daily discharge. Open-water records excellent; winter records fair.

Discharge measurements of Prairie River near Merrill, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Dec. 31	S. R. Collins	[a] 1.96	79.0
Aug. 26	E. E. Foster	1.63	77.0

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Prairie River near Merrill, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	99	96	99	75		65	384	212	115	112	88	88
2	96	96	98			70	458	212	112	105	95	102
3	94	94	99		70	70	614	244	112	99	94	94
4	96	92	102			70	870	278	108	96	91	88
5	99	94	102			70	1,010	296	105	94	88	88
6	96	94	102		75	75	1,060	330	102	91	88	91
7	101	91	105	80		75	1,160	348	96	105	88	91
8	91	94	102			80	1,220	330	366	118	112	137
9	94	96	96			85	1,780	348	348	137	112	184
10	94	96	102			90	1,940	348	402	184	105	198
11	102	94	105			100	2,110	296	118	184	115	159
12	108	94	99			110	1,700	244	115	159	112	137
13	105	94	91			126	1,560	212	115	137	105	122
14	105	94	94			159	963	184	112	115	99	126
15	108	94	99	75	70	198	963	159	102	105	96	118
16	112	94	96	75		244	870	159	118	99	91	105
17	108	96	94	80		244	870	137	228	96	88	102
18	105	96	90	80		244	781	148	348	94	86	99
19	105	96	90			278	696	184	313	91	86	102
20	102	88	85			278	614	184	244	88	86	99
21	102	86	85			313	535	159	184	99	86	96
22	105	96	85			384	458	148	148	126	86	96
23	102	102				313	421	133	129	133	86	94
24	99	99				244	384	129	115	118	84	91
25	99	96		75		278	366	129	105	108	84	88
26	96	96			65	366	348	126	96	96	86	86
27	96	105	80		65	384	313	118	96	91	86	86
28	99	102			65	402	278	115	94	88	84	86
29	99	99			-------	421	261	108	94	88	84	86
30	99	99			-------	458	244	108	91	86	81	86
31	99	-------			-------	421	-------	118	-------	91	81	-------

NOTE.—Stage-discharge relation affected by ice Dec. 18 to Mar. 12; discharge based on gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records. Figures in brackets show mean discharge for periods indicated.

Monthly discharge of Prairie River near Merrill, Wis., for the year ending Sept. 30, 1922

[Drainage area, 164 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	112	91	100	0.610	0.70
November	105	86	95.4	.582	.65
December	105	80	91.6	.559	.64
January	80	75	77.4	.472	.54
February	75	65	69.6	.424	.44
March	458	65	217	1.32	1.52
April	2,110	244	841	5.13	5.72
May	348	108	201	1.23	1.42
June	402	91	161	.982	1.10
July	184	86	111	.677	.78
August	115	81	92.0	.561	.65
September	198	86	108	.659	.74
The year	2,110	65	180	1.10	14.90

EAU CLAIRE RIVER AT KELLY, WIS.

LOCATION.—In sec. 13, T. 28 N., R. 8 E., at highway bridge three-fourths mile northeast of Kelly, Marathon County, 1 mile above mouth of Big Sandy Creek, which enters from right, and 4½ miles above mouth of river.

DRAINAGE AREA.—326 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, 1914, to September 30, 1922.

GAGE.—Chain gage attached to downstream side of highway bridge; read by August Krueger.

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

CHANNEL AND CONTROL.—Bed composed of heavy gravel and rock; gage is in the rapids which form control. Banks medium high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.40 feet at 3 p. m. April 9 (discharge, 6,320 second-feet); minimum discharge, 50 second-feet January 23, 25, 27, 28 (stage-discharge relation affected by ice).

1914–1922: Maximum stage recorded, that of 1922; minimum open-water stage, 0.45 foot, August 13, 14, 15, October 2, 3, 1914 (discharge, 40 second-feet). A discharge of 30 second-feet December 6, 1917, was estimated when stage-discharge relation was affected by ice.

ACCURACY.—Stage-discharge relation not permanent, affected by ice, and changed gradually during the summer. Rating curve used well defined between 80 and 3,200 second-feet. Gage read to hundredths once daily. Daily discharge October 1 to November 9 and November 14–19 ascertained by applying mean daily gage height to rating table; discharge April 1 to September 30 ascertained by indirect method for shifting control and for ice period as explained in footnote to table of daily discharge. Open-water records good; winter records fair.

Discharge measurements of Eau Claire River at Kelly, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 2	S. R. Collins	[a] 1.54	63
Feb. 4	do	[a] 1.97	63
July 26	S. B. Soulé	1.11	153

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Eau Claire River at Kelly, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	112	101		65	65	65	990	269	148	136	134	141
2	108	101		65	65	65	1,130	261	148	148	144	263
3	108	101			60	70	1,640	340	136	144	138	203
4	101	101				80	1,550	587	129	124	124	161
5	101	94				90	2,450	499	129	124	119	131
6	101	94				110	2,670	416	124	119	129	122
7	101	94		55		110	3,390	471	124	174	228	117
8	101	94				115	4,690	416	112	255	267	225
9	101	86				115	6,040	416	112	320	238	1,060
10	101	90	100			115	5,210	416	241	862	222	738
11	112	90				115	3,390	340	416	677	200	390
12	112	90		60		120	2,240	300	255	499	164	300
13	112	90		65		120	1,460	255	187	340	144	252
14	112	94		65		120	1,460	233	174	269	129	236
15	112	112		70		120	1,370	214	168	214	114	214
16	112	101		65	65	130	1,370	206	168	174	106	187
17	112	108		55		135	1,370	214	255	168	106	166
18	124	101	95	55		150	1,290	241	557	161	101	156
19	124	101	95	55		170	990	241	471	136	97	151
20	117	90	90	60		185	862	241	365	129	97	151
21	112	75	90	55		200	738	214	365	195	97	146
22	112	75	80	55		220	647	195	340	241	97	136
23	108	80	70	50		245	557	174	284	241	97	121
24	108	85		50		245	499	174	241	214	97	117
25	101	90		50		255	443	187	200	187	101	112
26	101	95		55		285	416	187	174	161	97	103
27	101	100	65	50		320	365	174	161	136	92	103
28	101	100		50		390	340	148	154	129	92	99
29	101	100		55	-------	500	320	144	148	114	88	94
30	101	100		55	-------	645	284	136	136	109	88	94
31	101	-------		55	-------	860	-------	136	-------	144	88	-------

NOTE.—Stage-discharge relation affected by ice Nov. 10–13 and Nov. 20 to Mar. 31; discharge based on gage heights corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records. Figures in brackets show mean discharge for periods indicated.

Monthly discharge of Eau Claire River at Kelly, Wis., for the year ending Sept. 30, 1922

[Drainage area, 326 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	124	101	107	0.328	0.38
November	112	75	94.4	.290	.32
December	100	65	88.4	.271	.31
January	70	50	56.6	.174	.20
February	65	60	64.8	.199	.21
March	860	65	208	.638	.74
April	6,040	284	1,670	5.12	5.71
May	587	136	272	.834	.96
June	557	112	221	.678	.76
July	862	109	227	.696	.80
August	267	88	130	.399	.46
September	1,060	94	216	.663	.74
The year	6,040	50	279	.856	11.59

BIG EAU PLEINE RIVER NEAR STRATFORD, WIS.

LOCATION.—In sec. 13, T. 27 N., R. 3 E., at highway bridge at a place locally known as Weber farm, 2 miles north of Stratford, Marathon County, and 1 mile above Chicago & Northwestern Railway bridge. Dill Creek enters from right 5 miles above station.

DRAINAGE AREA.—223 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—July 24, 1914, to September 30, 1922.

GAGE.—Sloping gage, reading from 1.0 to 15.6 feet, on right bank of river and vertical staff gage, reading from 15 to 18 feet, at upper end of sloping gage; read by Christian Weber.

DISCHARGE MEASUREMENTS.—Made by wading 1,000 feet below gage; or from highway bridge half a mile below gage.

CHANNEL AND CONTROL.—Bed composed of heavy gravel and rock; control at head of rapids 400 feet below gage. Banks at gage are high and will be overflowed at stage of 15 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.4 feet at 6 p. m. April 9 (discharge, 7,830 second-feet); minimum stage, 1.30 feet August 31 to September 7 (discharge, 3.0 second-feet).

1914–1922: Maximum stage recorded, 10.9 feet November 10, 1919 (discharge, 8,630 second-feet); minimum stage, 1.25 feet August 28 and 29, 1920 (discharge, 2.5 second-feet). The flood of June, 1914, reached a maximum height of 20.7 feet as determined by levels run to high-water marks.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation permanent, except as affected by ice. Rating curve well defined between 5 and 4,000 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records good during medium and high stages and fair during low stages; records for extreme low-water stage may be poor.

Discharge measurements of Big Eau Pleine River near Stratford, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Apr. 11	A. O. Olson	4.36	858
July 28	S. B. Soulé	1.52	7.9

Daily discharge, in second-feet, of Big Eau Pleine River near Stratford, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Apr.	May	June	July	Aug.	Sept.
1	6	10	18	930	46	25	15	11	3
2	5	10	18	2,610	43	22	15	18	3
3	5	10	17	4,250	102	22	12	19	3
4	5	8	15	3,370	182	24	12	15	3
5	5	7	15	2,130	148	19	10	11	3
6	5	10	15	2,310	139	17	10	15	3
7	5	10	15	2,220	170	15	25	15	3
8	5	10	15	1,550	159	13	40	12	10
9	5	10	15	7,830	460	18	206	10	17
10	7	10	15	2,710	302	272	336	8	11
11	10	10	12	1,050	206	870	126	7	8
12	12	10	12	870	159	231	79	7	7
13	10	10	12	1,550	126	133	60	7	7
14	10	10	12	1,470	91	113	50	6	10
15	11	10	12	930	113	81	36	6	10
16	12	12	15	580	126	77	33	6	8
17	12	12	18	395	113	65	182	5	7
18	15	15	18	272	206	49	47	5	8
19	15	15	15	218	483	33	31	5	11
20	13	15	15	194	272	33	24	5	12
21	12	15	12	182	159	29	22	5	11
22	12	15	12	231	102	25	24	5	10
23	12	15	12	206	65	22	22	5	10
24	12	13	12	159	61	19	18	5	7
25	12	12	------	126	53	17	15	5	7
26	12	12	------	113	46	15	13	5	6
27	11	13	------	98	39	15	12	4	6
28	10	15	------	77	33	15	12	4	5
29	10	17	------	65	29	13	10	4	5
30	10	18	------	53	25	12	8	3	5
31	10	------	------	------	25	------	7	3	------

NOTE.—Stage-discharge relation affected by ice Dec. 25 to Mar. 31. No records obtained.

Monthly discharge of Big Eau Pleine River near Stratford, Wis., for the year ending Sept. 30, 1922

[Drainage area, 223 square miles.]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	15	5	9.55	0.043	0.05
November	18	7	12.0	.054	.06
December 1–24	18	12	14.5	.065	.06
April	7,830	53	1,290	5.78	6.45
May	483	25	138	.619	.71
June	870	12	77.1	.346	.39
July	336	7	48.8	.219	.25
August	19	3	7.77	.035	.04
September	17	3	7.30	.033	.04

BARABOO RIVER NEAR BARABOO, WIS.

LOCATION.—In sec. 33, T. 12 N., R. 7 E., at highway bridge 4 miles downstream from Baraboo, Sauk County, 3 miles below creek that rises near Devils Lake and enters from right, and 15 miles above mouth of river.

DRAINAGE AREA.—572 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—December 18, 1913, to March 31, 1922, when station was discontinued.

GAGE.—Chain gage, attached to upstream side of bridge; read by Theodore Schneider.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge to which gage is attached.

CHANNEL AND CONTROL.—Channel composed of sand and mud; no well-defined control, water is confined to one channel at all stages except at flood stages when right bank is overflowed for a distance of 1,000 feet.

EXTREMES OF DISCHARGE.—Maximum discharge during period October, 1, 1921, to March 31, 1922, 3,610 second-feet February 27 (stage-discharge relation affected by ice); minimum discharge, 115 second-feet February 17 (stage-discharge relation affected by ice).

1914–1922: Maximum stage recorded about 17.5 feet March 26, 1917 (discharge, 7,900 second-feet); minimum stage, 0.71 foot July 26, 1916 (discharge, 76 second-feet).

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

REGULATION.—There are four dams near Baraboo, 4 miles above station, and one at Reedsburg, 18 miles above station. Smaller plants are also operated on the tributaries. The operation of these various plants causes diurnal fluctuation at the gage of about 0.3 foot at low-water stages. Estimates of mean monthly discharge probably represent nearly the natural flow.

ACCURACY.—Stage-discharge relation not permanent; affected by a gradual shift and by ice. Rating curve poorly defined. Gage read to quarter-tenths twice daily. Daily discharge ascertained by indirect method for shifting control October 1 to December 17 and March 12–31 and for winter period as explained in footnote to table of daily discharge. Open-water records poor; winter records roughly approximate.

Discharge measurements of Baraboo River near Baraboo, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Oct. 4	A. O. Olson	2.43	260
Jan. 13	S. B. Soulé	[a] 2.58	216
Feb. 11	do	[a] 3.28	233

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Baraboo River near Baraboo, Wis., for the period Oct. 1, 1921, to Mar. 31, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	205	411	411	185	185	2,270	16	244	299	327	250	180	1,290
2	192	313	990	170	225	1,240	17	299	313	369	225	115	1,190
3	224	285	1,110	245	230	615	18	369	500	335	240	155	1,030
4	205	299	783	220	210	480	19	397	500	320	230	145	1,630
5	218	341	575	280	265	450	20	341	560	300	210	255	2,050
6	218	327	425	290	250	2,300	21	327	425	285	150	245	1,240
7	250	299	355	155	200	3,150	22	285	369	270	205	1,130	1,110
8	224	238	327	190	230	3,010	23	278	271	255	210	2,300	870
9	218	212	299	255	185	2,550	24	285	244	240	210	2,630	671
10	285	244	271	265	250	2,480	25	244	257	220	250	3,010	607
11	257	257	271	190	235	2,200	26	250	244	205	225	3,520	850
12	238	271	285	190	280	2,170	27	257	205	190	190	3,610	950
13	231	271	313	215	320	2,240	28	238	299	180	190	2,800	950
14	231	271	299	175	255	2,240	29	224	313	175	220	------	950
15	231	285	299	220	230	1,720	30	327	285	170	210	------	1,010
							31	383	------	155	170	------	767

NOTE.—Stage-discharge relation affected by ice Dec. 18 to Mar. 11; discharge based on gage heights corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records.

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Monthly discharge of Baraboo River near Baraboo, Wis., for the period Oct. 1, 1921, to Mar. 31, 1922

[Drainage area, 572 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	397	192	264	0.462	0.53
November	560	205	314	.549	.61
December	1,110	155	355	.621	.72
January	290	150	214	.374	.43
February	3,610	115	844	1.48	1.54
March	3,150	450	1,490	2.60	3.00

KICKAPOO RIVER AT GAY MILLS, WIS.

LOCATION.—In sec. 28, T. 10 N., R. 4 W., at highway bridge immediately below Norwood Mill, in Gays Mills, Crawford County, 25 miles above mouth of river and 2 miles below mouth of Tainter Creek, which enters from right.

DRAINAGE AREA.—629 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—December 25, 1913, to September 30, 1922.

GAGE.—Chain gage fastened to downstream side of bridge; read by George Atwood.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge and by wading a short distance below gage.

CHANNEL AND CONTROL.—Channel composed of rock covered by a deposit of sand and silt; banks at gage section fairly high and not subject to overflow. No definite control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.1 feet at 6 p. m. March 6 (discharge, about 2,620 second-feet); minimum stage, 1.30 feet at 7.20 a. m. and 6 p. m. September 4 and 7.40 a. m. September 5 (discharge, 227 second-feet).

1914–1922: Maximum stage recorded, 15.05 feet March 24, 1917 (discharge about 6,300 second-feet); minimum discharge about 100 second-feet, during the latter part of January, 1915 (stage discharge relation affected by ice).

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Mills at Gays Mills immediately above the station, Soldiers Grove, 7 miles upstream and at several points above Soldiers Grove use comparatively little storage, so that the recorded flow past the station represents nearly natural conditions. During low stages a small diurnal fluctuation is observed at the gage.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter and by shifting channel for remainder of year. Rating curve poorly defined. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table July 11–31 and by indirect method for shifting control October 1 to December 22, March 3 to July 10, and August 1 to September 30, except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Kickapoo River at Gays Mills, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Feb. 7	S. B. Soulé	[a] 2.74	312
June 8	A. O. Olson	1.68	320
Aug. 8	S. B. Soulé	1.99	351

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Kickapoo River at Gays Mills, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	365	365	325	445	315	640	558	449	386	325	325	236
2	345	325	407	455	315	680	558	449	365	285	285	256
3	325	325	386	445	315	695	603	492	365	305	285	236
4	345	325	325	435	315	915	626	470	345	305	285	218
5	325	325	325	435	315	1,510	603	449	365	285	285	227
6	325	305	325	420	315	2,300	580	428	325	325	536	246
7	386	305	325	420	315	2,300	626	428	325	407	580	236
8	407	365	305	420	315	1,980	672	428	325	407	365	536
9	345	365	305	405	315	1,630	1,330	449	325	365	325	815
10	407	365	325	405	315	1,030	1,860	449	791	407	285	449
11	365	345	305	405	315	1,060	1,940	407	1,420	386	285	325
12	345	325	305	405	315	1,120	1,700	407	1,390	325	285	285
13	325	325	325	405	315	1,120	1,570	407	767	305	285	285
14	325	345	325	405	315	1,180	1,000	365	791	305	285	325
15	325	345	325	405	315	970	791	365	492	305	285	325
16	305	365	325	405	315	695	695	386	449	672	256	285
17	325	386	407	405	315	649	649	386	428	536	265	265
18	365	449	325	390	315	603	743	428	386	626	265	305
19	470	428	345	375	315	791	767	492	365	365	265	325
20	407	365	365	360	315	1,090	672	449	365	365	236	325
21	345	345	345	345	315	719	603	407	365	325	256	325
22	325	285	325	345	330	626	580	386	345	449	246	285
23	305	325	445	345	345	626	558	386	365	558	256	265
24	305	345	435	330	375	865	536	407	365	492	265	265
25	325	305	435	330	420	915	536	492	325	365	256	246
26	285	305	435	330	455	1,450	536	428	305	325	246	256
27	305	325	435	330	495	1,330	514	407	325	345	256	256
28	305	325	435	330	550	865	470	407	305	305	236	246
29	365	345	435	315	-------	672	470	345	325	325	236	246
30	407	345	445	315	-------	626	449	365	285	285	256	265
31	407	-------	445	315	-------	580	-------	386	-------	305	246	-------

NOTE.—Stage-discharge relation affected by ice Dec. 23 to Mar. 2: discharge based on gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records.

Monthly discharge of Kickapoo River at Gays Mills, Wis., for the year ending Sept. 30, 1922

[Drainage area, 629 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	470	285	349	0.555	0.64
November	449	285	343	.545	.61
December	445	305	365	.580	.67
January	455	315	383	.609	.70
February	550	315	342	.544	.57
March	2,300	580	1,040	1.65	1.90
April	1,940	449	793	1.26	1.41
May	492	345	419	.666	.77
June	1,420	285	469	.746	.83
July	672	285	377	.599	.69
August	580	236	291	.463	.53
September	815	218	305	.485	.54
The year	2,300	218	457	.727	9.86

TURKEY RIVER AT GARBER, IOWA.

LOCATION.—In sec. 36, T. 92 N., R. 4 W., at single-span highway bridge at Garber, Clayton County, 800 feet above mouth of Wayman Creek, which enters from right.

DRAINAGE AREA.—1,530 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—August 29, 1913, to November 30, 1916; May 14, 1919, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of bridge; read by E. J. Prolow.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and mud; channel shifting. Right bank high and not subject to overflow; left bank is overflowed at stages above 13 feet, the road to left approach to bridge being overflowed at gage height of 22 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 28.06 feet at 4.25 a. m. February 23 (discharge, about 26,600 second-feet); minimum stage, 3.55 feet September 5, 6, and 7 (discharge, 88 second-feet).

1913–1916; 1919–1922: Maximum stage recorded, that of 1922; minimum discharge, that of 1922.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—An electric light plant and grist mill at Elkader probably cause a slight diurnal fluctuation.

ACCURACY.—Stage-discharge relation changed in April and July; also affected by ice. Rating curve used October 1 to April 25 and July 22 to September 30 well defined between 300 and 11,000 second-feet. Curve used April 26 to July 21 well defined between 200 and 1,600 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Turkey River at Garber, Iowa, during the year ending Sept. 30, 1922

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Apr. 26	5.45	1,310
Sept. 10	4.22	326

Daily discharge, in second-feet, of Turkey River at Garber, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Feb.	Apr.	May	June	July	Aug.	Sept.
1	1,290	700	430	4,720		820	585	355	1,290	225
2	915	560	430	3,520		890	615	355	1,140	190
3	770	462	630	2,000		960	475	355	840	175
4	630	495	430	1,840		960	555	310	770	130
5	700	265	370	1,760		1,180	555	290	700	88
6	430	840	342			1,580	615	332	560	88
7	1,220	770	315			1,420	680	2,560	560	88
8	770	560	315	1,600		960	528	1,500	560	100
9	700	430	370			890	425	820	630	315
10	630	400	400		7,170	890	615	680	560	430
11	560	430	370			820	555	582	560	430
12	560	430	400			820	528	550	630	265
13	495	430	430	1,360		820	425	550	560	315
14	495	462	400			890	425	485	560	225
15	430	370	370			820	680	518	630	245
16	462	370	370			750	475	550	560	430
17	560	370	370			680	400	2,060	495	343
18	560	770	370	1,250		680	475	820	560	315
19	430	770	430			750	528	820	495	265
20	400	630	560			680	615	750	495	315
21	370	560	245	3,620		615	450	680	560	370
22	342	495		13,300		820	400	6,730	495	245
23	342	495		25,300		1,180	528	3,120	430	225
24	495	400		18,500		615	358	2,410	430	225
25	400	400		8,820		820	528	990	430	225
26	370	400	350		1,260	890	425	990	315	225
27	370	462		5,000	1,100	518	332	915	290	225
28	400	430			1,100	680	310	915	315	225
29	495	430			960	680	332	915	265	245
30	1,060	462			820	680	290	990	265	225
31	990					680		1,140	225	

NOTE.—Stage-discharge relation affected by ice Dec. 22–31 and Feb. 6–20; discharge computed by means of weather records, observer's notes, and comparison with records in nearby drainage basins. Discharge Feb. 22–25 based on gage-height graph obtained from field survey and observer's history of events. Discharge Feb. 26–28 estimated. No records Jan. 1–31, Mar. 1 to Apr. 9, and Apr. 11–25. Braced figures show mean discharge for periods indicated.

Monthly discharge of Turkey River at Garber, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 1,530 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,290	342	601	0.393	0.45
November	840	265	502	.328	.37
December	630	245	382	.250	.29
February	25,300		4,270	2.79	2.90
May	1,580	518	853	.558	.64
June	680	290	490	.320	.36
July	6,730	290	1,130	.739	.85
August	1,290	225	557	.364	.42
September	430	88	247	.161	.18

MAQUOKETA RIVER BELOW NORTH FORK OF MAQUOKETA RIVER, NEAR MAQUOKETA, IOWA

LOCATION.—In southwest corner NE. ¼ sec. 17, T. 84 N., R. 3 E., at Bridgeport Bridge, 3 miles northeast of Maquoketa, Jackson County, 1,200 feet above mouth of Mill Creek, and 2 miles below mouth of North Fork of Maquoketa River.

DRAINAGE AREA.—1,600 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000). Drainage area at mouth, 1,960 square miles.

RECORDS AVAILABLE.—September 1, 1913, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of bridge, 100 feet from right abutment; read by John Strodthoff.

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

CHANNEL AND CONTROL.—There is no definite control; bed composed of sand and mud; shifts during high water. Above 13-foot stage; overflow occurs under a pile-trestle approach on the left side.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.85 feet at 10 a. m. February 24 (discharge, 15,200 second-feet); minimum stage, 2.1 feet September 26–28 (discharge, 460 second-feet).

1913–1920: Maximum stage recorded, about 23.5 feet, probably in 1905 (discharge, about 24,300 second-feet); minimum stage, 1.59 feet December 25, 1918 (discharge, about 245 second-feet).

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation changed during high water in February; also affected by ice. Rating curve used October 1 to February 22, and curve used February 23 to September 30 well defined between 300 and 16,000 second-feet. Gage read to hundredths once daily and frequently during periods of high water. Daily discharge ascertained by applying mean daily gage height to rating table, by use of indirect method for shifting control July 23 to September 30 and as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Maquoketa River below North Fork of Maquoketa River, near Maquoketa, Iowa, during the year ending Sept. 30, 1922.

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Apr. 28	3.70	1,160
Sept. 9	2.32	556

Daily discharge in second-feet of Maquoketa River, below North Fork of Maquoke River, near Maquoketa, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,270	1,360	730			955	1,220	955	1,320	585	1,270	520
2	1,160	1,140	2,100	640		955	1,320	905	1,270	585	1,270	520
3	1,080	980	3,400			905	1,380	905	1,160	585	1,560	520
4	1,000	880	2,360	3,000		1,000	1,500	905	1,100	585	1,160	500
5	955	830	1,720	3,660		1,100	1,740	905	1,000	520	1,000	500
6	905	780	1,240	1,080		1,270	1,680	905	955	540	905	520
7	930	730	1,140	930		1,680	1,680	855	855	540	855	500
8	1,220	830	1,030	830		1,220	1,620	855	855	810	855	500
9	1,030	930	980	830		955	3,240	855	810	765	765	540
10	880	880	930	730		855	4,850	955	765	1,380	720	1,380
11	830	880	930	685		905	5,140	1,000	765	1,220	720	810
12	780	880	930	640	550	810	4,000	855	720	955	675	585
13	730	880	930			810	3,360	810	765	810	675	540
14	685	830	930			810	2,640	810	765	810	675	520
15	685	830	880			810	2,180	675	765	675	675	500
16	685	830	930			810	1,860	720	955	905	630	480
17	685	880	2,620			810	2,380	810	810	1,060	630	480
18	980	980	2,360			810	2,380	905	720	1,560	630	500
19	880	980	1,900			1,100	2,180	905	675	955	585	520
20	830	955	1,480			4,460	1,800	810	675	765	585	585
21	685	930	1,240	580		3,620	1,560	810	675	720	630	585
22	640	830	685			1,680	1,380	765	675	2,700	630	562
23	640	730	640		10,200	1,380	1,270	720	675	8,500	585	562
24	640	730	595		14,200	1,220	1,800	3,320	720	6,530	630	540
25	640	780	595		5,660	1,380	1,160	5,920	630	3,290	585	480
26	595	685	620		2,380	2,440	1,220	6,180	630	2,060	585	460
27	640	685			1,680	1,740	1,270	4,920	630	1,620	562	460
28	595	685			1,270	1,800	1,160	2,640	585	1,380	540	460
29	880	685	640		-------	1,500	1,060	1,990	630	1,620	562	480
30	1,720	730			-------	1,500	1,000	1,620	630	1,320	520	480
31	1,540	-------			-------	1,320	-------	1,440	-------	1,380	562	-------

NOTE.—Stage-discharge relation affected by ice Dec. 23 to Jan. 4 and Jan. 13 to Feb. 22; discharge based on observer's notes and weather records. Discharge interpolated Nov. 20, Apr. 9, and May 24.

Monthly discharge of Maquoketa River below North Fork of Maquoketa River, near Maquoketa, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 1,600 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,720	595	884	0.552	0.64
November	1,360	685	858	.536	.60
December	3,400	620	1,220	.763	.88
January	3,660	----------	817	.511	.59
February	14,200	----------	1,700	1.06	1.10
March	4,460	810	1,370	.856	.99
April	5,140	1,000	2,030	1.27	1.42
May	6,180	675	1,540	.962	1.11
June	1,320	585	806	.504	.56
July	8,500	520	1,540	.962	1.11
August	1,560	520	749	.468	.54
September	1,380	460	553	.346	.39
The year	14,200	460	1,170	.731	9.93

ROCK RIVER AT AFTON, WIS.

LOCATION.—On line between secs. 22 and 27, T. 2 N., R. 12 E., at highway bridge in Afton, Rock County, 9 miles above Illinois State line. Bass Creek enters from right three-fourths mile below station.

DRAINAGE AREA.—3,190 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch = 6 miles).

RECORDS AVAILABLE.—February 5, 1914, to September 30, 1922.

GAGE.—Chain gage fastened to downstream side of bridge; read by George Robb.

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

CHANNEL AND CONTROL.—Banks medium high and will not be overflowed to any extent at flood stages; channel gravel and clean silt, practically permanent. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.65 feet at 5.05 p. m. April 11 (discharge, 8,640 second-feet); minimum stage, 0.62 foot at 6.05 a. m. August 31 (discharge, 480 second-feet).

1914–1922: Maximum stage recorded, 10.51 feet March 26, 1918 (discharge, 12,700 second-feet); minimum stage, 0.38 foot August 31, 1919 (discharge about 428 second-feet).

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

REGULATION.—Operation of power plants at Janesville and above causes slight fluctuations at gage during low stages.

ACCURACY.—Stage-discharge relation practically permanent, except as affected by ice. Rating curve used well defined between 595 and 6,100 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Open-water records good, winter records fair.

Discharge measurements of Rock River at Afton, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 26	S. B. Soulé	[a] 2.64	895	May 17	Soulé and Olson	2.59	1,360
May 12	Soulé and Olson	3.80	2,390	July 13	S. B. Soulé	2.94	1,690

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Rock River at Afton, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,960	2,310	2,130	1,430	1,010	6,240	6,800	4,900	2,220	950	850	755
2	2,860	2,220	2,400	1,500	1,060	6,240	6,660	4,510	2,130	1,180	900	710
3	2,760	2,130	2,960	1,500	1,110	7,100	6,660	4,390	1,960	1,120	950	850
4	2,760	2,130	3,060	1,500	1,170	6,100	6,660	4,150	1,800	1,120	1,000	755
5	2,310	2,130	3,260	1,500	1,230	6,520	6,660	3,910	1,800	1,120	950	850
6	2,220	2,040	3,360	1,500	1,230	6,660	6,520	3,800	1,800	1,000	850	800
7	2,490	2,130	3,470	1,500	1,230	6,520	6,240	3,260	1,880	1,120	1,240	710
8	2,220	2,220	3,470	1,430	1,230	6,380	6,380	3,360	1,580	1,060	1,240	755
9	2,040	2,310	3,360	1,430	1,290	6,380	6,240	3,060	1,510	1,000	1,180	1,240
10	2,220	2,130	3,160	1,360	1,290	6,660	6,380	2,860	1,580	1,300	1,060	1,510
11	2,130	1,960	3,060	1,360	1,290	6,800	8,200	2,580	1,650	1,440	950	1,300
12	2,220	1,960	2,960	1,290	1,290	6,950	7,710	2,490	1,800	1,650	950	1,120
13	2,130	2,130	2,860	1,230	1,230	7,100	7,870	2,220	2,040	2,220	850	1,120
14	1,960	1,880	2,860	1,230	1,230	7,250	8,030	2,040	2,310	1,800	950	1,240
15	2,040	1,800	2,860	1,170	1,230	7,710	8,030	1,580	2,860	1,880	1,000	1,180
16	2,220	1,580	2,860	1,110	1,230	7,870	8,030	1,440	2,760	1,960	900	1,240
17	2,220	1,510	3,260	1,060	1,290	7,550	8,200	1,440	2,760	2,670	850	1,300
18	2,310	1,650	2,310	1,060	1,290	7,400	7,870	1,440	2,670	2,400	850	1,180
19	2,310	2,040	2,310	1,010	1,360	7,400	7,550	1,370	2,760	2,310	900	1,180
20	2,490	1,720	2,140	1,010	1,360	7,550	7,550	1,440	2,760	2,130	800	1,300
21	2,400	1,960	1,900	960	1,300	6,800	7,710	1,440	2,670	1,960	900	1,240
22	2,490	1,880	1,740	960	4,150	7,100	7,400	1,440	2,490	1,880	900	1,240
23	2,580	755	1,580	910	7,550	6,950	7,100	1,440	2,220	1,580	900	1,240
24	2,860	1,880	1,500	910	6,100	7,100	6,950	1,510	2,040	1,800	900	1,120
25	2,760	2,220	1,430	910	5,550	6,950	6,660	3,470	1,880	1,720	850	1,180
26	2,580	2,310	1,430	895	5,420	6,950	6,520	3,580	1,720	1,440	850	1,240
27	2,400	2,220	1,430	910	5,960	7,100	6,240	3,060	1,370	1,180	800	1,180
28	2,220	2,220	1,360	910	5,960	7,100	6,240	2,490	1,370	1,120	900	1,120
29	2,220	2,040	1,360	910	-------	7,250	5,550	2,400	1,300	850	900	1,120
30	2,130	2,130	1,430	960	-------	7,400	5,160	2,400	1,180	800	670	1,060
31	2,310	-------	1,430	1,010	-------	7,100	-------	2,310	-------	900	560	-------

NOTE.—Stage-discharge relation affected by ice Dec. 19 to Feb. 20; discharge based on gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records.

Monthly discharge of Rock River at Afton, Wis., for the year ending Sept. 30, 1922

[Drainage area, 3,190 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,960	1,960	2,380	0.746	0.86
November	2,310	755	1,990	.624	.70
December	3,470	1,360	2,410	.755	.87
January	1,500	895	1,180	.370	.43
February	7,550	1,010	2,380	.746	.78
March	7,870	6,100	6,970	2.18	2.51
April	8,200	5,160	6,990	2.19	2.44
May	4,900	1,370	2,640	.828	.95
June	2,860	1,180	2,030	.636	.71
July	2,670	800	1,500	.470	.54
August	1,240	560	915	.287	.33
September	1,510	710	1,090	.342	.38
The year	8,200	560	2,710	.849	11.50

ROCK RIVER AT LYNDON, ILL.

LOCATION.—In sec. 21, T. 20 N., R. 5 E., at highway bridge known as Lyndon Bridge, in Lyndon, Whiteside County, 10 miles above Rock Creek and 20 miles below dam at Sterling.

DRAINAGE AREA.—9,010 square miles.

RECORDS AVAILABLE.—November 24, 1914, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by George Cady.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of gravel; may shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.8 feet at 7 a. m. April 12 (discharge, 26,200 second-feet); minimum stage, 5.06 feet at 7 a. m. September 20 (discharge, 1,820 second-feet).

1915–1922: Maximum stage recorded, 19.6 feet February 16, 1918 (discharge not determined because of backwater from ice); maximum open-water stage recorded, 17.0 feet, March 28, 1916 (discharge, 39,500 second-feet); minimum stage, 3.72 feet September 27, 1918 (discharge, 536 second-feet).

DIVERSIONS.—Water is diverted at Sterling dam to feed Illinois and Mississippi Canal, probably averages about 100 second-feet.

REGULATION.—Flow past gage is regulated by power plants in city of Sterling and above, mean of two daily readings of gage during low stages is probably somewhat less than true mean daily gage height due to such regulation.

ACCURACY.—Stage discharge relation practically permanent; seriously affected by ice during winter. Rating curve well defined between 1,000 and 25,000 second-feet, fairly well defined beyond these limits. Gage read to hundredths twice daily. Diurnal fluctuation at gage rather large during low stages. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium and high stages, fair for ordinary low stages during open-water periods, poor for extremely low stages and for periods of ice effect.

Discharge measurements of Rock River at Lyndon, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Oct. 19	7.78	7,160
Mar. 30	11.31	17,000
Aug. 16	5.68	2,830

Daily discharge, in second-feet, of Rock River at Lyndon, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	-------	5,000	5,440	6,820		23,000	21,600	10,000	6,350	3,030	2,850	1,880
2	6,580	5,220	6,350	7,550		23,000	20,200	9,550	6,120	3,210	2,850	2,030
3	-------	5,220	7,300	7,550		22,600	17,400	8,800	5,970	2,850	2,670	2,180
4	-------	5,220	9,300			21,600	14,800	8,550	5,820	2,520	3,030	2,340
5	-------	5,220	9,800			21,200	14,200	8,300	5,660	2,180	3,030	2,340
6	-------	5,440	8,550			18,000	13,600	7,800	5,440	2,500	3,030	2,180
7	-------	5,440	7,550			18,400	13,000	7,300	4,580	2,340	3,030	2,340
8	-------	5,440	7,550			15,400	12,500	7,060	4,370	2,180	3,210	2,180
9	4,790	5,440	7,300			13,000	13,600	6,820	4,170	2,500	2,850	2,340
10	-------	5,440	7,300			13,300	17,400	6,580	4,170	7,800	2,670	2,340
11	-------	5,440	7,300	10,000	7,800	13,600	22,600	6,350	4,170	8,300	2,610	2,340
12	-------	5,440	7,300			13,900	25,000	6,350	4,260	7,300	2,560	2,340
13	-------	5,440	7,550			13,000	23,000	6,120	4,350	6,820	2,500	2,340
14	-------	5,440	7,300			13,600	23,800	5,660	4,440	6,580	2,500	2,340
15	5,000	5,220	7,300			13,000	21,600	5,890	4,530	6,350	2,500	2,340
16	5,440	5,220	8,300			12,700	22,300	5,000	4,620	6,120	2,670	2,500
17	6,140	5,220	9,550			12,200	26,200	4,790	4,710	6,350	2,340	2,670
18	6,850	5,220	9,550			12,500	24,200	4,580	4,790	6,120	2,180	2,670
19	7,550	5,440	10,600			14,500	20,900	4,370	4,790	5,890	2,500	2,850
20	7,800	5,440	13,600			20,200	19,500	4,370	4,370	4,790	2,340	2,180
21	7,800	5,440	14,800			20,600	18,100	4,170	4,170	5,000	2,300	2,500
22	5,440	5,440	10,600		8,550	16,000	17,000	4,170	4,170	5,660	2,250	2,670
23	5,220	5,890	10,000		18,400	14,800	15,400	4,170	4,170	7,300	2,210	3,030
24	5,180	5,890	10,300		22,300	14,800	13,600	4,370	4,170	5,890	2,160	2,030
25	5,130	3,970	8,300		22,000	14,800	13,000	7,300	3,770	5,440	2,120	2,030
26	5,090	3,770	8,550	9,000	20,900	14,800	11,900	11,400	3,770	5,000	2,070	2,180
27	5,040	3,770	8,300		22,600	15,100	11,100	11,100	3,580	4,170	2,030	2,030
28	5,000	3,770	7,800		23,400	15,400	10,800	10,300	3,390	3,390	2,500	2,180
29	5,110	4,580	7,800		-------	16,700	10,300	8,300	3,210	3,030	2,340	2,180
30	5,220	5,220	7,800		-------	17,400	10,300	8,800	3,030	3,030	2,340	2,500
31	5,220	-------	7,300		-------	21,600	-------	7,580	-------	3,030	2,340	-------

NOTE.—Stage-discharge relation affected by ice Jan. 4 to Feb. 21; discharge estimated by use of gage heights, observer's notes, and weather records. Gage not read Oct. 17, 18, 24–27, 29, Mar. 10, 11, May 31, June 3, 4, 12–17, July 4, Aug. 11, 12, and 21–26; discharge interpolated. Braced figures show mean discharge for periods indicated.

Monthly discharge of Rock River at Lyndon, Ill., for the year ending Sept. 30, 1922

[Drainage area, 9,010 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October 15–31	7,800	5,000	5,780	0.642	0.41
November	5,890	3,770	5,140	.570	.64
December	14,800	5,440	8,590	.953	1.10
January	-------	6,820	9,380	1.04	1.20
February	23,400	-------	10,800	1.20	1.25
March	23,000	12,200	16,500	1.83	2.11
April	26,200	10,300	17,300	1.92	2.14
May	11,400	4,170	6,970	.772	.89
June	6,350	3,030	4,500	.499	.56
July	8,300	2,180	4,730	.525	.61
August	3,210	2,030	2,530	.281	.32
September	3,030	1,880	2,340	.260	.29

PECATONICA RIVER AT FREEPORT, ILL.

LOCATION.—In sec. 32, T. 27 N., R. 8 E., at highway bridge at Hancock Avenue, half a mile east of Illinois Central Railroad station at Freeport, Stephenson County, and 2 miles above mouth of Yellow Creek.

DRAINAGE AREA.—1,330 square miles.

RECORDS AVAILABLE.—September 11, 1914, to September 30, 1922.

GAGE.—Chain gage attached to upstream side of bridge; read by W. C. Krueger.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and silt; likely to shift; left bank of only medium height and is overflowed during high water; at stages above 16 feet part of the flow passes over the left bank and through East Freeport.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.8 feet at 5 p. m. February 25 (discharge, 14,500 second-feet); minimum stage, 4.12 feet September 7 and 8 (discharge, 412 second-feet).

1914–1922: Maximum stage recorded, 19.4 feet March 28, 1916 (discharge, 17,000 second-feet); minimum discharge, 200 second-feet December 14, 1917.

ICE.—Stage discharge relation affected by ice.

REGULATION.—A dam and power plant three-fourths mile upstream regulates flow past gage. Only slight diurnal fluctuation is noticeable.

ACCURACY.—Stage-discharge relation permanent, except as affected by ice. Rating curve well defined between 328 and 7,000 second-feet and fairly well defined beyond these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records good; winter records poor.

Discharge measurements of Pecatonica River at Freeport, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-feet*
Oct. 18	8.07	1,270
Mar. 29	8.67	1,420
Aug. 17	4.66	516

Daily discharge, in second-feet, of Pecatonica River at Freeport, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,760	1,400	835			5,250	1,050	950	900	575	595	447
2	875	1,180	1,400			3,830	1,020	925	925	575	635	447
3	950	1,020	1,730			2,030	1,080	900	925	555	615	447
4	815	950	2,030			1,460	1,150	925	815	537	595	447
5	775	875	1,820			1,490	1,220	950	795	537	575	429
				{1,400								
6	775	835	1,430			2,110	1,200	900	775	537	519	429
7	795	815	1,350			2,900	1,200	875	735	555	595	412
8	900	815	1,180			3,750	1,300	855	715	595	555	412
9	1,080	1,080	1,100			4,270	1,640	835	695	855	575	815
10	900	1,000	1,050			3,450	1,880	835	695	1,640	537	1,220
11	815	975	1,050		{1,000	1,940	3,910	815	695	1,220	519	1,050
12	795	925	1,080			1,220	3,750	795	835	1,150	501	855
13	775	900	1,120			1,120	3,060	775	900	1,380	519	695
14	735	855	1,100			1,120	2,500	735	775	1,150	501	483
15	735	855	1,020			1,080	1,850	715	735	900	501	483
16	715	835	1,080			1,050	1,640	735	695	695	501	483
17	735	855	2,310			925	1,880	775	655	900	501	483
18	1,180	900	2,270			855	1,820	875	635	1,380	483	465
19	1,250	950	1,640			1,400	1,760	900	635	1,050	465	483
20	1,080	950				2,850	1,610	950	635	835	465	501
21	975	900		{800		2,900	1,430	875	635	615	465	519
22	835	875			2,000	3,000	1,300	855	635	1,250	448	501
23	775	835			3,830	2,350	1,250	795	615	1,760	483	501
24	755	775			6,490	1,300	1,200	775	595	1,430	483	465
25	715	835			14,200	1,080	1,180	2,230	595	1,000	501	465
			{1,200									
26	735	815			14,200	1,300	1,100	2,070	575	675	501	465
27	755	815			9,680	1,280	1,050	1,670	575	615	465	483
28	735	835			8,010	1,430	1,050	1,200	575	595	465	465
29	925	835			-------	1,400	1,050	1,020	575	575	447	465
30	1,520	835			-------	1,280	975	900	555	575	465	465
31	1,700	-------			-------	1,180	-------	855	-------	615	447	-------

NOTE.—Stage-discharge relation affected by ice Dec. 20 to Feb. 21; discharge estimated from gage-height record, observer's notes, and climatic record. Braced figures indicate mean discharge for period indicated.

Monthly discharge of Pecatonica River at Freeport, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,330 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,760	715	931	0.700	0.81
November	1,400	775	911	.685	.76
December	2,310	835	1,320	.992	1.14
January	----------	----------	994	.747	.86
February	14,200	----------	2,840	2.14	2.23
March	5,250	855	2,020	1.52	1.75
April	3,910	975	1,600	1.20	1.34
May	2,230	715	976	.734	.85
June	925	555	703	.529	.59
July	1,760	537	881	.662	.76
August	635	447	514	.386	.44
September	1,220	412	543	.408	.46
The year	14,200	412	1,180	.887	11.99

SUGAR RIVER NEAR BRODHEAD, WIS.

LOCATION.—In sec. 26, T. 2 N., R. 9 E., at highway bridge 2 miles southwest of Brodhead, Green County, and 12 miles above Illinois State line. Jordan Creek enters from right 2 miles below station and Little Jordan Creek, from right 4 miles above.

DRAINAGE AREA.—529 square miles (measured on map issued by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch = 6 miles).

RECORDS AVAILABLE.—February 7, 1914, to September 30, 1922.

GAGE.—Chain gage attached to upstream side of bridge; read by Arthur Christensen.

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

CHANNEL AND CONTROL.—Bed composed of sand and gravel; control not well defined. Right bank of medium height; seldom overflowed; left bank at gage overflowed at stage of 6.8 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.78 feet at 4.15 p. m. February 23 (discharge, about 5,410 second-feet); minimum stage 0.78 foot at 6.30 p. m. September 5 (discharge, about 53 second-feet).

1914–1922: Maximum stage recorded, 11.4 feet September 13, 1915 (discharge, about 13,000 second-feet); minimum discharge, that of 1922.

REGULATION.—A power plant at Brodhead 2 miles above station causes slight fluctuation of stage during low water, but the pondage is small and it is believed that the monthly discharge represents the natural flow quite accurately. The difference between morning and evening gage readings is seldom more than 0.2 foot. There are two power plants farther upstream but they probably have no effect on the discharge at the gage.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by shifts during year. Rating curve fairly well defined between 122 and 3,230 second-feet; poorly defined above and below these limits. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used February 19 to April 30 and August 1 to September 30, and as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Sugar River near Brodhead, Wis., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Jan. 25	S. B. Soulé	*2.35	213	July 13	S. B. Soulé	3.01	751
Apr. 12	do	4.67	1,630	Sept. 29	E. E. Foster	1.47	206
May 17	Soulé and Olson	1.63	229				

*Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Sugar River near Brodhead, Wis., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	321	635	306	220	220	612	368	306	306	196	235	170
2	248	438	635	235	220	438	321	276	321	165	262	139
3	306	368	750	262	220	385	402	291	306	222	235	86
4	291	321	900	276	220	420	498	306	276	151	235	156
5	276	306	635	520	220	589	543	306	276	160	209	92
6	276	248	420	520	235	1,740	477	306	291	180	180	153
7	402	321	368	420	235	2,870	477	276	262	173	193	139
8	420	306	336	276	250	2,170	520	291	262	193	306	146
9	368	321	306	262	250	1,320	800	291	248	173	291	420
10	352	352	306	248	262	589	850	262	248	222	235	543
11	336	336	336	306	306	520	2,240	276	248	336	209	385
12	236	306	336	276	352	402	1,800	248	276	520	209	262
13	291	262	336	222	370	458	1,260	276	336	727	170	209
14	291	291	336	220	350	520	850	262	306	658	209	183
15	262	262	336	220	350	458	612	262	276	402	222	209
16	222	291	368	220	335	420	498	248	262	276	209	209
17	306	336	658	220	320	321	589	248	222	291	196	153
18	368	352	543	220	305	336	612	248	196	262	209	180
19	438	368	498	220	262	543	612	248	196	276	186	262
20	477	321	498	220	248	1,260	498	248	196	262	153	209
21	402	352	420	210	262	1,100	402	248	222	235	209	209
22	306	306	368	210	2,170	1,320	368	276	222	248	178	193
23	248	321	262	210	5,390	1,000	352	291	222	175	209	188
24	276	291	250	210	4,190	612	352	262	222	248	196	160
25	262	262	235	215	2,730	477	352	420	148	222	209	193
26	262	276	220	210	2,100	458	336	800	175	235	196	186
27	291	291	220	210	850	566	321	850	209	235	158	193
28	291	306	220	210	750	477	291	681	209	222	196	168
29	385	321	220	210	-------	520	291	438	235	191	186	178
30	438	306	220	220	-------	520	306	336	209	160	163	196
31	612	-------	220	220	-------	420	-------	276	-------	180	163	-------

NOTE.—Stage-discharge relation affected by ice Dec. 24 to Jan. 2, Jan. 14 to Feb. 9, and Feb. 3–18; discharge based on gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records.

Monthly discharge of Sugar River near Brodhead, Wis., for the year ending Sept. 30, 1922

[Drainage area, 529 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	612	222	331	0.626	0.72
November	635	248	326	.616	.69
December	900	220	389	.735	.85
January	520	210	255	.482	.56
February	5,390	220	856	1.62	1.69
March	2,870	321	769	1.45	1.67
April	2,240	291	607	1.15	1.28
May	850	248	334	.631	.73
June	336	148	246	.465	.52
July	727	151	264	.499	.58
August	306	153	207	.391	.45
September	543	86	206	.389	.43
The year	5,390	86	396	.749	10.17

IOWA RIVER AT MARSHALLTOWN, IOWA

LOCATION.—In sec 23, T. 84 N., R. 18 W., at Third Avenue Bridge, 1 mile north of Marshalltown, Marshall County. Asher Creek, 1 mile above, and Burnett Creek, 1 mile below; both enter from left; Linn Creek enters from right 2 miles below station.

DRAINAGE AREA.—1,380 square miles (measured on map issued by United States Geological Survey; scale, 1, 500,000).

RECORD AVAILABLE.—May 21, 1915, to September 30, 1922. February 23, 1903, to August 8, 1903, from old site 1 mile above present station.

GAGE.—Chain gage attached to downstream handrail of bridge, 60 feet from right pier; read by B. S. Beehrle.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—Gravel bar forms control at extreme low water. Bed composed of mud and sand, subject to change. Both banks subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.55 feet, at 6.30 p. m. February 24 (discharge, 5,500 second-feet); minimum stage, 1.59 feet at 6.25 p. m. September 23 (discharge, 49 second-feet).

1915–1922: Maximum stage recorded, 17.74 feet, June 4, 1918 (discharge, 42,000 second-feet); minimum discharge about 2 second-feet November 24, 1917.

ICE.—Stage-discharge relation affected by ice for short periods during extremely cold weather.

REGULATION.—Operation of a power plant at Eldora causes slight diurnal fluctuation during periods of low-water flow.

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

Discharge measurements of Iowa River at Marshalltown, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Jan. 18	E. D. Burchard	[a] 2.20	100
June 16	J. B. Spiegel	2.26	182
Sept. 13	do	1.79	77.5

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Iowa River at Marshalltown, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	625	300	255		785	1,880	585	585	585	120	348	80
2	585	285	255		435	1,740	625	545	505	120	315	90
3	545	270	240	200	330	1,840	665	545	505	120	255	90
4	488	270	240		300	1,640	705	545	400	110	215	100
5	470	270	255		270	1,220	705	545	400	80	202	80
6	452	285	255			1,090	705	545	365	400	152	72
7	452	270	240			1,090	955	525	315	585	140	65
8	435	255	240	150	230	1,000	955	505	300	665	140	65
9	418	315	228			1,050	1,400	505	285	525	140	65
10	400	270	228			1,220	1,840	470	255	585	130	72
11	382	300	228			1,180	2,180	435	240	330	130	80
12	330	285	240			1,140	3,000	400	228	315	140	90
13	330	285	228	125	250	1,140	2,700	382	228	300	130	80
14	330	270	228			1,220	2,480	330	228	285	120	72
15	300	270	228			1,180	2,340	300	228	270	120	65
16	300	285	240			1,180	2,080	330	178	865	110	72
17	300	300	365			1,140	1,880	315	178	1,400	100	72
18	300	315	285	100	190	910	1,640	330	178	1,140	100	72
19	285	285	255			955	1,450	315	165	705	90	80
20	285	255	240			1,040	1,140	300	190	435	90	72
21	285	255	228		200	955	1,040	300	190	330	100	72
22	285	255	228		240	955	865	285	178	315	100	58
23	270	240	228	88	2,880	825	865	348	165	300	110	50
24	270	240	235		4,790	785	785	705	365	240	100	58
25	270	215	230		3,480	745	785	745	152	165	90	65
26	270	270			3,540	705	705	910	120	165	80	72
27	270	270			2,940	705	665	865	120	140	80	65
28	255	255	220	95	2,750	705	665	825	120	165	72	65
29	270	255			-------	665	625	745	120	270	65	72
30	300	240			-------	625	585	545	120	435	65	65
31	315	-------		400	-------	625	-------	665	-------	365	80	-------

NOTE.—Stage-discharge relation affected by ice Dec. 23 to Feb. 22; discharge based on a study of observer's notes, weather records, and hydrograph for Squaw Creek at Ames.

Monthly discharge of Iowa River at Marshalltown, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 1,380 square miles.]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	625	255	357	0.259	0.30
November	315	215	271	.196	.22
December	365	----------	240	.174	.20
January	400	----------	135	.098	.11
February	4,790	----------	939	.680	.71
March	1,880	625	1,070	.775	.89
April	3,000	585	1,250	.906	1.01
May	910	285	506	.367	.42
June	585	120	254	.184	.21
July	1,400	80	395	.286	.33
August	348	65	133	.096	.11
September	100	50	72.5	.053	.06
The year	4,790	50	465	.337	4.57

IOWA RIVER AT IOWA CITY, IOWA

LOCATION.—In sec. 15, T. 79 N., R. 6 W., 200 feet below highway bridge in Iowa City, Johnson County, 100 feet below Iowa State University hydraulic laboratory.

DRAINAGE AREA.—3,140 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—November 19, 1921, to September 30, 1922, at present site; from October 30, 1913, to November 18, 1921, at highway bridge 500 feet below Chicago, Rock Island & Pacific Railroad; June 1, 1903, to July 21, 1906, at station, 200 feet above present location.

GAGE.—Gurley water-stage recorder installed November 19, 1921. Prior to that date a chain gage was used. Recorder inspected by Floyd A. Nagler.

DISCHARGE MEASUREMENTS.—Made from table 75 feet below gage.

CHANNEL AND CONTROL.—Bed composed of sand with fairly definite control. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.98 feet at 10 a. m. April 11, (discharge, 5,880 second-feet); minimum stage, −0.97 foot at 2 p. m. September 25 (discharge, 36 second-feet)

1903–1906; 1913–1922: Maximum stage recorded, 19.45 feet June 7, 1918 (discharge, 36,200 second-feet); minimum discharge about 10 second-feet December 26, 1916.

REGULATION.—Considerable diurnal fluctuation occurs at low stages, owing to operation of power plant above station.

ICE.—Stage-discharge relation affected by ice during periods of extremely cold weather.

ACCURACY.—Stage-discharge relation permanent at old station; not permanent at present location. Rating curve used October 1 to November 18, curve used November 19 to March 22 and May 13 to September 30, and curve used March 23 to May 12 are well defined. Gage read to hundredths once daily October 1 to November 18. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of water-stage recorder graph and from August 13 to September 30 by discharge integrator and as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Iowa River at Iowa City, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 19	E. D. Burchard	1.47	1,010	June 26	Wilsey and Phillips	0.18	395
Jan. 25	Mercer and Erickson	*0.56	321	July 3	do	.04	382
Apr. 5	do	2.81	1,730	11	J. B. Spiegel	2.18	1,330
May 13	Spiegel and Erickson	2.10	1,150	14	do	1.33	938

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Iowa River at Iowa City, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,680	1,460	930	980	705	2,040	1,950	1,870	1,540	445	1,220	288
2	2,470	1,280	1,880	880	1,060	2,640	1,870	1,800	1,480	458	1,030	320
3	2,260	1,280	1,510	855	1,110	3,270	1,830	1,720	1,510	361	905	258
4	2,100	1,180	1,310	2,370	1,580	3,650	1,720	1,620	1,400	417	880	300
5	1,940	1,080	1,200	2,820	1,880	3,750	1,720	1,580	1,280	401	805	264
6	1,710	1,010	1,110	2,200	1,480	4,600	1,760	1,580	1,200	397	780	274
7	1,640	1,040	1,060	1,760	1,280	3,090	1,950	1,510	1,200	476	705	248
8	1,640	1,040	1,000	1,310	1,080	2,280	1,870	1,510	1,080	610	655	255
9	1,560	1,040	980	1,030	880	2,000	3,090	1,950	1,000	1,140	605	308
10	1,490	1,010	955	930	805	2,280	3,950	1,620	955	1,080	590	470
11	1,490	1,080	955	905	805	3,090	5,780	1,410	905	1,320	553	522
12	1,350	1,040	905	780	730	2,280	5,300	1,580	855	1,320	535	445
13	1,320	1,010	930	700	830	2,040	5,180	1,250	780	1,060	510	425
14	1,180	1,010	880	700	705	2,040	5,540	1,150	780	955	408	376
15	672	1,040	880	650	680	2,000	5,660	1,140	730	855	495	338
16	1,140	1,010	1,210	600	655	1,960	5,420	1,130	730	1,220	482	338
17	1,180	1,010	1,880	550	630	1,920	5,540	1,120	655	1,440	400	262
18	1,180	1,010	1,250	500	558	1,880	5,180	1,110	630	1,680	448	282
19	760	980	1,080	450	535	2,200	4,700	1,110	585	2,040	382	184
20	1,140	930	1,000	450	558	3,550	4,260	1,000	620	2,040	348	275
21	978	930	780	400	580	4,270	3,850	955	655	1,650	398	278
22	945	905	585	400	905	4,930	3,450	905	605	1,310	355	250
23	945	830	625	350	3,750	3,360	3,090	905	566	1,110	375	322
24	1,010	830	830	300	2,910	2,460	2,820	930	526	980	374	265
25	820	780	955	310	2,910	2,370	2,640	2,120	508	905	352	210
26	945	830	955	320	3,000	2,460	2,550	2,730	433	855	342	255
27	912	805	1,000	320	2,550	2,190	2,460	2,640	454	830	312	274
28	912	830	1,060	330	2,370	2,190	2,280	2,460	441	755	352	250
29	2,100	880	1,080	340	-------	2,110	2,190	2,370	425	780	320	158
30	1,780	855	1,030	340	-------	2,110	2,030	2,040	433	880	312	201
31	1,520	-------	1,000	340	-------	2,030	-------	1,720	-------	1,030	272	-------

NOTE.—Stage-discharge relation affected by ice Jan. 14–31. No gage-height record May 13–18; discharge for both periods based on discharge measurements, observer's notes, and weather records.

Monthly discharge of Iowa River at Iowa City, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 3,140 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,680	672	1,410	0.449	0.52
November	1,460	780	1,000	.318	.35
December	1,880	585	1,060	.338	.39
January	2,820	300	812	.259	.30
February	3,750	535	1,340	.427	.44
March	4,930	1,880	2,680	.854	.98
April	5,780	1,720	3,390	1.08	1.20
May	2,730	905	1,570	.500	.58
June	1,540	425	832	.265	.30
July	2,040	361	994	.317	.37
August	1,220	272	532	.169	.19
September	522	158	296	.091	.10
The year	5,780	158	1,320	.420	5.72

IOWA RIVER AT WAPELLO, IOWA

LOCATION.—In sec. 27, T. 74 N., R. 3 W., at highway bridge half a mile from railroad station at Wapello, Louisa County, and 20 miles from mouth of river. No important tributaries enter near station.

DRAINAGE AREA.—At gaging station, 12,480 square miles; at mouth 12,600 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—February 26, 1915, to September 30, 1922.

GAGE.—Chain gage attached to bridge near center of first span from right abutment; read by C. W. Warren.

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

CHANNEL AND CONTROL.—Bed composed of sand and gravel; subject to shift. Right bank high and will not be overflowed; levee along left bank, which broke during flood of June, 1918.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.6 feet, 6 p. m. March 2 (discharge, 26,500 second-feet), when affected only slightly by ice; minimum stage 0.05 foot, September 8, 9, 29, and 30 (discharge, 1,050 second-feet).

1915–1922: Maximum stage recorded, 14.94 feet, June 8, 1918 (discharge 63,100 second-feet); minimum discharge about 400 second-feet, December 15–17, 1916 (stage-discharge relation affected by ice). The flood of June, 1892, was probably much higher than the flood of 1918.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent; subject to gradual shift and affected by ice. Rating curve fairly well defined. Gage read to hundredths once daily. Daily discharge computed by indirect method for shifting channel except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Iowa River at Wapello, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 18	E. D. Burchard	1.97	3,830	July 15	J. B. Spiegel	1.98	4,030
Jan. 17	C. Herlofson	[a] 1.68	1,600	Aug. 31	Herlofson and Mercer	.41	1,460

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Iowa River at Wapello, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9,730	6,340	3,800	2,600	1,400	21,000	9,570	7,440	6,470	1,770	3,380	1,420
2	8,790	5,560	4,740	2,600	1,700	26,500	9,260	6,880	6,200	1,770	3,780	1,420
3	8,180	5,080	7,300	2,500	2,200	23,400	8,640	6,600	5,690	1,770	3,780	1,420
4	7,590	4,630	7,020	3,500	2,700	12,400	8,330	6,340	5,440	1,840	3,380	1,230
5	7,020	4,410	5,940	7,000	2,800	12,400	8,330	6,070	4,970	1,840	3,000	1,170
6	6,740	4,410	5,440	7,000	1,700	12,400	8,330	6,070	4,740	1,770	2,820	1,170
7	6,470	4,200	4,740	5,000	2,700	13,200	8,330	6,070	4,300	1,770	2,640	1,170
8	5,940	3,980	4,300	4,000	2,500	11,400	9,570	6,340	4,090	1,700	2,480	1,050
9	5,940	3,780	4,090	3,000	2,300	10,700	10,200	6,340	3,670	3,280	2,310	1,050
10	5,690	3,780	3,880	2,500	2,100	11,700	14,800	6,880	3,670	3,670	2,230	1,630
11	5,440	4,200	3,880	2,200	2,100	19,200	19,000	6,340	3,280	4,090	2,000	1,560
12	5,440	3,980	3,880	2,000	2,000	20,500	22,300	5,820	3,090	6,740	1,920	1,630
13	4,970	3,980	3,880	1,900	1,800	17,300	22,300	5,560	3,009	5,200	1,840	1,630
14	4,740	3,980	3,670	1,700	1,800	13,900	20,300	5,320	3,090	4,520	2,000	1,490
15	4,520	3,980	3,470	1,500	1,800	12,100	20,300	5,080	2,910	4,090	2,000	1,360
16	4,520	3,980	3,470	1,800	1,700	11,700	20,300	4,860	2,730	3,670	2,000	1,230
17	4,520	3,780	7,880	1,700	1,600	11,700	20,700	4,630	2,730	4,300	1,840	1,170
18	4,520	3,980	9,730	1,600	1,600	11,700	21,900	4,630	2,560	4,970	1,840	1,110
19	4,520	3,980	7,300	1,600	1,400	12,100	20,300	4,410	2,560	4,970	1,700	1,110
20	4,300	3,980	5,690	1,500	2,000	12,800	17,100	4,410	2,390	4,970	1,560	1,110
21	4,300	3,980	5,000	1,500	2,000	16,900	15,200	4,200	2,390	4,970	1,490	1,110
22	4,090	3,780	4,000	1,600	4,500	18,400	13,300	3,980	2,390	4,520	1,420	1,170
23	3,880	3,780	3,000	1,600	9,000	15,000	11,600	3,980	2,390	4,300	1,560	1,110
24	3,880	3,180	2,000	1,600	14,000	11,700	10,900	3,980	2,230	3,880	1,490	1,110
25	3,880	3,100	2,000	1,700	12,000	10,400	9,890	4,410	2,150	3,670	1,490	1,230
26	3,880	3,100	2,000	1,600	12,000	10,400	9,570	8,940	2,070	3,280	1,360	1,170
27	3,670	3,200	2,200	1,600	12,000	10,700	9,260	10,200	1,920	3,090	1,490	1,110
28	3,670	3,100	2,400	1,600	14,000	10,400	8,640	11,200	1,840	2,910	1,360	1,110
29	4,520	3,100	2,600	1,400	-------	10,000	8,330	9,890	1,840	2,910	1,420	1,050
30	6,740	3,000	2,600	1,400	-------	9,730	8,030	8,030	1,770	2,730	1,360	1,050
31	7,020	-------	2,600	1,400	-------	9,730	-------	6,880	-------	3,090	1,490	-------

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Mar. 2. Discharge based on gage heights corrected for effect of ice by means of one discharge measurement, observer's notes, and weather records. No gage-height record Nov. 25 to Dec. 2; discharge estimated.

Monthly discharge of Iowa River at Wapello, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 12,480 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	9,730	3,670	5,460	0.438	0.50
November	6,340	3,000	3,980	.319	.36
December	9,730	2,000	4,340	.348	.40
January	7,000	1,400	2,390	.192	.22
February	14,000	1,400	4,260	.342	.36
March	26,500	9,730	13,900	1.11	1.28
April	22,300	8,030	13,500	1.08	1.20
May	11,200	3,980	6,190	.496	.57
June	6,470	1,770	3,290	.264	.29
July	6,740	1,700	3,490	.280	.32
August	3,780	1,360	2,080	.167	.19
September	1,630	1,050	1,240	.099	.11
The year	26,500	1,050	5,350	.428	5.80

CEDAR RIVER AT JANESVILLE, IOWA

LOCATION.—In sec. 35, T. 91 N., R. 14 W., at highway bridge in Janesville, Bremer County, 3 miles above junction with Shellrock River.

DRAINAGE AREA.—1,660 square miles (measured by map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—April 27, 1905, to September 30, 1906; May 26, 1915, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of middle span of highway bridge; read by Mrs. Emma Cameron.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; the remains of an old mill dam forms probably a permanent control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet at 6.30 p. m., March 13 (discharge, 3,630 second-feet); minimum stage 1.50 feet at 7.30 p. m., September 6 (discharge, 100 second-feet).

1905–6 and 1915–1922: Maximum discharge about 27,000 second-feet, May 29, 1921; minimum discharge, 100 second-feet November 3, 1915, and September 6, 1922.

ICE.—Stage-discharge relation seriously affected by ice. Observation discontinued during winter.

REGULATION.—There is a slight diurnal fluctuation of stage during low water periods, due to operation of power plant at Waverly, 9 miles above station.

ACCURACY.—Stage-discharge relation changed during winter. Rating curve used October 1 to December 17 and curve used March 10 to September 30, well defined between 100 and 5,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Cedar River at Janesville, Iowa, during the year ending Sept. 30, 1922

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
June 15	1.82	258
16	2.10	420
Sept. 12	1.60	144

Daily discharge, in second-feet, of Cedar River at Janesville, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	505	334	260	-------	880	560	750	270	240	190
2	310	334	272	-------	970	670	790	240	294	176
3	328	340	328	-------	880	790	710	252	235	264
4	402	340	340	-------	970	1,110	330	282	880	186
5	370	340	340	-------	880	1,160	294	595	408	145
6	340	340	334	-------	970	1,160	240	595	360	122
7	316	340	299	-------	1,060	1,160	300	1,020	288	154
8	282	340	282	-------	970	970	390	560	235	163
9	328	310	272	-------	1,160	1,040	414	3,060	300	240
10	272	316	282	2,790	670	1,110	483	835	330	240
11	282	282	250	2,280	670	630	420	490	354	168
12	294	310	240	3,060	835	560	330	390	300	168
13	299	282	235	3,630	2,160	525	294	354	330	252
14	316	282	235	3,060	2,280	560	294	330	324	190
15	390	282	235	2,790	2,920	670	372	240	448	163
16	310	282	328	2,280	3,200	670	525	1,160	790	240
17	340	282	322	2,160	3,060	490	294	835	420	190
18	346	310	-------	2,040	3,200	560	324	970	420	230
19	334	316	-------	1,920	3,340	670	330	1,920	230	230
20	340	328	-------	1,700	3,060	525	215	835	215	414
21	322	340	-------	1,320	2,920	595	240	354	235	200
22	328	322	-------	1,060	3,060	750	215	560	215	186
23	328	299	-------	970	3,060	970	300	455	190	190
24	299	282	-------	1,020	3,480	1,160	270	414	200	240
25	304	282	-------	970	2,040	1,060	240	354	300	200
26	277	288	-------	970	2,040	790	252	294	240	168
27	294	288	-------	595	1,590	560	235	240	210	210
28	220	282	-------	1,020	1,260	630	122	235	186	240
29	310	277	-------	970	710	670	190	240	190	264
30	322	255	-------	925	560	790	264	270	190	215
31	322	-------	-------	925	-------	835	-------	294	190	-------

Monthly discharge of Cedar River at Janesville, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 1,660 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	505	220	324	0.195	0.22
November	340	255	307	.185	.21
December 1-17	340	235	286	.172	.11
March 10-31	3,630	595	1,750	1.05	.86
April	3,480	560	1,830	1.10	1.23
May	1,160	490	787	.474	.55
June	790	122	348	.210	.23
July	3,060	235	611	.368	.42
August	880	186	314	.189	.22
September	414	122	208	.125	.14

CEDAR RIVER AT CEDAR RAPIDS, IOWA

LOCATION.—In sec. 28, T. 83 N., R. 7 W., in central part of Cedar Rapids, Linn County, half a mile below dam and 1,000 feet above Eighth Avenue Bridge.

DRAINAGE AREA.—At gage station 6,640 square miles; at junction with Iowa River 7,930 square miles (measured on map issued by United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—February 14, 1903, to September 30, 1922.

GAGE.—Inclined staff gage fastened to post driven in right bank of river in rear of plant of Iowa Windmill & Pump Co. Gurley water-stage recorder installed at same site August 20, 1920. Elevation of zero of both gages from Northwestern Railroad levels, 723.03 feet above sea level. Gage read by R. S. Toogood.

DISCHARGE MEASUREMENTS.—Made from upstream side of Eighth Avenue Bridge.

CHANNEL AND CONTROL.—Bed composed of rock and gravel, free from vegetation and practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.15 feet at 5 p. m., February 26 (discharge, 33,300 second-feet); minimum stage, 2.33 feet 12.30 p. m. September 10 (discharge, 441 second-feet).

1903–1922: Maximum stage recorded, 17.2 feet April 1, 1912, and March 26, 1917 (discharge, 54,100 second-feet); minimum stage, 2.23 feet September 9, 1921 (discharge, 190 second-feet).

Greatest known flood probably occurred in June, 1851, when the maximum stage was about 20 feet (discharge, about 65,000 second-feet).

ICE.—Stage-discharge relation affected by ice, during extremely cold weather. The swift current and proximity to power plant keeps the river open at other times.

REGULATION.—Power plant half a mile above gage causes marked diurnal fluctuation, during all periods of low water.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height as obtained by inspection of recorder graph, except as explained in footnote to table of daily discharge. Records excellent except for periods when stage-discharge relation was affected by ice and when gage heights were missing for which they are fair.

Discharge measurements of Cedar River at Cedar Rapids, Iowa, during the year ending Sept. 30, 1922

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Apr. 23	4.58	4,830
July 14	3.54	1,980
Sept. 8	2.80	870

Daily discharge, in second-feet, of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,150	2,010	1,700	1,200	1,260	8,710	4,140	2,840	2,840	1,300	2,230	975
2	2,840	1,950	2,590	1,300	1,490	5,960	4,140	3,010	2,740	1,200	2,040	990
3	2,640	1,790	2,510	1,410	1,660	5,190	3,710	2,980	2,540	1,200	1,840	1,020
4	2,380	1,790	2,170	1,470	2,350	5,340	3,860	2,900	2,260	1,180	1,760	950
5	2,370	1,730	1,950	2,150	1,850	5,340	3,570	3,090	2,170	1,140	1,680	940
6	2,260	1,710	1,850	1,810	1,810	6,120	3,710	3,400	1,980	1,140	1,700	950
7	2,280	1,750	1,810	1,380	1,710	5,960	4,290	3,370	1,920	1,220	1,560	930
8	2,300	1,700	1,660	1,110	1,700	6,920	4,890	3,090	1,960	1,300	1,420	840
9	2,220	1,710	1,660	1,090	1,350	8,050	6,920	3,430	1,880	1,490	1,400	920
10	2,090	1,730	1,700	1,180	1,190	9,040	8,050	2,870	1,560	1,880	1,320	960
11	1,930	1,850	1,710	1,230	1,570	10,100	9,040	2,710	1,630	1,840	1,310	1,040
12	1,970	1,710	1,590	1,180	1,360	8,380	9,040	2,710	1,570	2,340	1,190	975
13	1,870	1,710	1,570	1,180	1,260	6,920	9,380	2,640	1,620	2,200	1,390	1,010
14	1,830	1,660	1,590	1,230	1,260	6,600	10,100	2,470	1,610	2,050	1,240	975
15	1,750	1,590	1,430	1,090	1,260	6,920	11,500	2,370	1,540	1,660	1,220	890
16	1,790	1,710	1,590	1,130	1,230	7,400	11,500	2,350	1,530	2,280	1,200	840
17	1,770	1,750	2,130	1,020	1,230	7,560	10,100	2,330	1,500	2,240	1,170	830
18	1,850	1,750	1,910	1,080	1,120	6,760	9,040	2,280	1,460	2,250	1,140	820
19	1,810	1,790	1,590	920	1,120	8,710	7,880	2,300	1,460	2,920	1,120	810
20	1,640	1,770	1,410	1,030	1,160	8,710	6,760	2,240	1,490	2,850	1,140	900
21	1,660	1,750	1,540	1,120	1,190	6,600	6,120	2,370	1,470	2,530	1,220	1,200
22	1,730	1,350	1,220	1,120	1,570	5,660	5,340	2,300	1,340	2,270	1,030	900
23	1,730	1,080	1,130	1,100	4,890	5,500	4,740	2,190	1,350	2,490	1,140	900
24	1,710	1,160	1,110	1,050	5,660	4,590	4,440	2,370	1,350	2,020	1,080	1,060
25	1,610	1,430	1,050	1,000	8,380	4,890	4,290	4,000	1,220	1,600	1,230	940
26	1,590	1,590	1,050	1,050	28,300	4,890	4,140	4,590	1,200	1,660	1,070	875
27	1,550	1,950	1,100	1,090	28,300	4,590	3,860	5,040	1,130	1,530	1,140	870
28	1,660	2,030	1,100	1,160	16,000	4,450	3,710	3,860	1,040	1,520	1,120	870
29	2,330	1,830	1,150	1,030	-------	4,590	3,430	3,430	1,110	1,440	1,080	875
30	2,490	1,750	1,150	1,030	-------	4,450	3,290	3,130	1,110	1,930	950	945
31	2,220	-------	1,200	1,020	-------	4,290	-------	2,870	-------	2,030	1,050	-------

NOTE.—Stage-discharge relation affected by ice Dec. 31 to Jan. 2, Jan. 22–26, Feb. 13 and 15. No gage-height record Dec. 25–30, Aug. 15–18, and Sept. 17–23; discharge based on weather records and comparison with flow at near-by stations. Discharge for period June 4 to Sept 30 obtained by discharge integrator.

Monthly discharge of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 6,640 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	3,150	1,550	2,030	0.306	0.35
November	2,030	1,080	1,700	.256	.29
December	2,590	1,050	1,580	.238	.27
January	2,150	920	1,190	.179	.21
February	28,300	1,120	4,400	.663	.69
March	10,100	4,290	6,430	.968	1.12
April	11,500	3,290	6,170	.930	1.04
May	5,040	2,190	2,950	.444	.51
June	2,840	1,040	1,650	.248	.28
July	2,920	1,140	1,830	.276	.32
August	2,230	950	1,330	.200	.23
September	1,060	810	933	.140	.16
The year	28,300	810	2,670	.402	5.47

SHELLROCK RIVER NEAR CLARKSVILLE, IOWA

LOCATION.—In T. 92 N., R. 16 W., at highway bridge 1¼ miles northwest of Clarksville, Butler County, and 25 miles above junction with Cedar River. No large tributary enters for several miles above and below.

DRAINAGE AREA.—1,660 square miles at station; 2,680 square miles at junction with Cedar River (measured on map issued by United States Geological Survey; scale, 1 : 500,000).

RECORDS AVAILABLE.—May 28, 1915, to September 30, 1922.

GAGE.—Chain gage attached to handrail on upstream side of bridge, 75 feet from right abutment; read by Mrs. H. H. Sherburne.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—Bed composed of rock and sand; fairly permanent. Right bank high; left bank will probably be overflowed at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.8 feet at 7 a. m. April 12 (discharge, 4,660 second-feet). Minimum stage, 0.69 foot at 1.30 p. m. September 12 (discharge, 77 second-feet).

1915–1922: Maximum discharge, 12,200 second-feet June 2, 1916; minimum stage that of 1922. In April, 1907, a stage of about 16.5 feet was reached (discharge, about 19,000 second-feet).

ICE.—Stage-discharge relation affected by ice. Observation discontinued during the winter.

REGULATION.—Slight diurnal fluctuation of stage may occur during low water, due to operation of power plant at Greene, 10 miles upstream.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 75 and 10,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Shellrock River near Clarksville, Iowa, during the year ending Sept. 30, 1922

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
June 16	1.14	191
Sept. 12	.69	75.6

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Daily discharge, in second-feet, of Shellrock River near Clarksville, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	275	235		1,200	540	565	315	154	255	128
2	298	220		1,300	540	540	315	121	218	128
3	298	235		1,400	615	615	294	116	184	110
4	275	205		1,500	722	865	294	116	154	80
5	275	200		1,570	750	805	294	110	154	106
6	255	196		3,760	695	668	274	106	154	138
7	220	192		3,160	750	590	255	184	140	86
8	205	160		2,210	925	540	255	168	168	81
9	255	170		1,420	1,260	540	218	357	184	154
10	205	192		1,340	3,060	540	218	357	184	184
11	180	192		1,490	2,960	492	218	274	168	78
12	170	192		1,340	4,660	469	218	236	168	101
13	160	170		1,420	3,660	446	200	218	200	121
14	170	170		1,420	3,060	446	160	200	184	114
15	220	160		1,490	2,570	424	121	184	168	101
16	160	220		1,340	2,210	424	168	1,730	154	133
17	220	220		985	1,890	401	154	1,120	140	99
18	180	235		805	1,570	401	140	424	118	106
19	170	235		1,120	1,340	446	140	315	154	154
20	160	220		1,260	1,190	492	140	236	128	154
21	235			1,120	1,120	424	154	200	116	168
22	255			805	925	401	154	200	168	138
23	275	160		805	865	357	154	236	168	128
24	220		5,980	805	805	357	168	200	168	110
25	220		1,890	778	750	401	184	184	140	106
26	220		1,570	805	695	401	106	184	140	135
27	220		1,190	805	668	379	103	184	154	133
28	220	250	1,100	750	640	357	95	168	154	128
29	235			668	590	336	95	168	140	128
30	255			615	565	336	99	236	140	140
31	235			590		315		294	133	

NOTE.—Stage-discharge relation affected by ice Nov. 21-30, and Mar. 3 and 4; discharge estimated. No gage-height record Nov. 5 and 6; discharge interpolated. Discharge estimated Feb. 28 and Mar. 1 and 2 because of no gage-height record.

Monthly discharge of Shellrock River near Clarksville, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 1,660 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	298	160	224	0.135	0.16
November			202	.122	.14
March	3,760	590	1,290	.777	.90
April	4,660	540	1,420	.855	.95
May	865	315	477	.287	.33
June	315	95	190	.114	.13
July	1,730	106	290	.174	.20
August	255	116	161	.097	.11
September	184	78	122	.074	.08

SKUNK RIVER NEAR AMES, IOWA

LOCATION.—In sec. 23, T. 84 N., R. 24 W., at site of old county bridge 2½ miles north of Ames, Story County, 5 miles above mouth of Squaw Creek, and 3½ miles below Keigley Branch.

DRAINAGE AREA.—320 square miles (measured on topographic map, and on United States post route map).

RECORDS AVAILABLE.—July 28, 1920, to September 30, 1922.

GAGE.—Inclined staff gage anchored in left bank. Stevens continuous water-stage recorder installed August 25, 1921; inspected by W. P. Coon.

DISCHARGE MEASUREMENTS.—Made from bridge one-quarter mile downstream and by wading.

CHANNEL AND CONTROL.—A rock ledge forms a permanent control. Both banks are high, but overflow will occur around right bank during extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet at 6.30 p. m. February 23 (discharge, 3,370 second-feet); minimum stage, 1.98 feet September 7, 8, and 17 (discharge, 5 second-feet).

1920–1922: Maximum stage recorded, that of 1922; minimum stage 1.60 feet July 31, 1921 (discharge, 1.5 second-feet).

ICE.—Stage-discharge relation affected by ice for brief periods during extremely cold weather.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 5 and 2,500 second-feet. Operation of water-stage recorder satisfactory. Mean daily gage height obtained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records excellent; winter records good.

Discharge measurements of Skunk River near Ames, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 25	E. D. Burchard	2.66	53.7	Feb. 9	E. D. Burchard	(a)	27.4
Nov. 28	do	2.61	46.3	May 19	J. B. Spiegel	2.59	51.0
Dec. 23	do	a 2.60	47.2	Aug. 10	do	2.45	42.2
Jan. 10	do	a 2.34	21.0	Sept. 2	do	2.07	10.6
28	do	a 2.12	8.4				

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Skunk River near Ames, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	178	72	56	36	107	212	151	105	105	17	132	11
2	170	70	50	33	55	161	154	102	92	14	93	10
3	149	67	26	34	44	111	156	102	84	11	74	10
4	135	63	29	34	35	102	183	103	75	8	62	8
5	131	60	52	26	35	132	199	105	65	10	53	7
6	122	56	54	24	27	140	191	107	52	338	46	7
7	114	56	48	22	27	147	227	109	51	634	40	6
8	106	54	36	21	25	126	233	107	46	426	37	6
9	101	56	28	21	27	126	455	102	44	239	33	13
10	99	56	41	21	35	128	634	96	42	160	39	25
11	93	60	45	21	35	166	1,030	90	40	120	37	18
12	84	42	41	21	34	216	1,400	85	35	93	34	12
13	79	57	41	21	33	273	1,030	79	32	62	31	11
14	77	62	35	21	32	202	730	72	30	60	27	9
15	77	58	35	20	31	154	524	68	27	55	25	9
16	72	58	50	18	31	118	430	64	24	658	22	7
17	72	62	90	16	30	96	353	64	23	1,290	19	6
18	75	62	57	15	33	96	290	62	23	779	17	17
19	72	57	97	15	37	345	245	58	23	398	16	28
20	68	41	63	14	38	498	205	54	23	248	14	26
21	63	41	37	13	37	270	213	51	20	176	25	21
22	63	28	40	12	261	216	170	48	17	136	25	18
23	60	51	47	11	2,420	210	154	48	14	107	21	15
24	60	52	50	10	1,830	196	147	107	11	90	21	12
25	60	48	44	9	1,030	188	143	196	11	76	17	11
26	60	50	44	8	542	196	143	188	13	71	23	9
27	60	52	43	8	314	196	136	163	14	68	18	9
28	60	50	43	8	263	183	126	136	14	64	14	8
29	67	42	41	8	-------	168	116	116	13	79	13	8
30	77	45	41	8	-------	156	109	105	14	170	12	8
31	74	-------	41	9	-------	154	-------	112	-------	158	12	-------

NOTE.—Stage-discharge relation affected by ice Dec. 22, 23, Jan. 5 to Feb. 15; discharge computed by means of four discharge measurements, observer's notes, and weather records. No gage-height record Feb 28 to Mar. 2 and Mar. 6; discharge interpolated.

Monthly discharge of Skunk River near Ames, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 320 square miles.]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	178	60	89.6	0.280	0.32
November	72	28	54.3	.170	.19
December	97	26	46.6	.146	.17
January	36	8	18.0	.056	.06
February	2,420	25	26.6	.083	.09
March	498	96	183	.572	.66
April	1,400	109	343	1.07	1.19
May	196	48	96.9	.303	.35
June	105	11	35.9	.112	.12
July	1,290	8	220	.688	.79
August	132	12	33.9	.106	.12
September	28	6	12.2	.038	.04
The year	2,420	6	115	.359	4.10

SKUNK RIVER AT COPPOCK, IOWA

LOCATION.—In sec. 1, T. 73 N., R. 8 W., at highway bridge one-eighth mile above Chicago, Burlington & Quincy Railroad bridge at Coppock, Henry County, and one-fourth mile above junction with Crooked Creek.

DRAINAGE AREA.—2,890 square miles (measured on map issued by United States Geological Survey; scale, 1 : 500,000).

RECORDS AVAILABLE.—October 21, 1913, to September 30, 1922.

GAGE.—Chain gage attached to downstream side of bridge; read by J. W. Ricks.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.85 feet at 11 a. m. March 11 discharge, 5,970 second-feet); minimum discharge, 200 second-feet January 28 to February 1, when stage-discharge relation was affected by ice.

1913–1922: Maximum stage recorded 19.7 feet, June 9, 1918 (discharge 19,600 second-feet); minimum stage, 2.10 feet August 15, 18, and 25–27, 1914 (discharge, 33 second-feet).

A stage of about 22 feet occurred on or about May 31, 1903 (discharge, 25,000 second-feet).

ICE.—Stage-discharge relation affected by ice.

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

Discharge measurements of Skunk River at Coppock, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 18	E. D. Burchard	4.39	738	July 15	J. B. Spiegel	4.92	1,120
Jan. 26	C. Herlofson	a4.00	255	Aug. 31	Herlofson and Mercer	3.52	426

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Skunk River at Coppock, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4,240	1,390	627	400	200	1,100	1,840	1,270	3,120	346	1,510	378
2	3,200	1,270	1,510	400	300	900	1,640	1,210	3,040	330	1,580	378
3	2,340	1,210	1,700	400	400	979	1,580	1,150	2,640	314	1,510	346
4	2,120	1,150	1,270	1,000	500	1,210	1,450	1,090	2,420	299	1,330	330
5	1,910	1,090	1,040	3,000	900	1,210	1,450	1,090	2,340	299	1,210	330
6	1,770	979	924	3,000	1,000	1,510	1,450	1,150	1,840	299	1,090	314
7	1,640	924	818	2,500	700	1,330	1,580	1,090	1,580	284	979	299
8	1,580	870	818	1,800	500	1,090	2,190	1,090	1,450	269	924	284
9	1,450	870	719	1,100	400	979	3,040	1,090	1,270	1,580	818	979
10	1,390	818	719	800	400	924	3,280	1,330	1,150	1,910	768	314
11	1,330	870	672	600	400	5,910	4,240	1,040	1,090	1,700	719	269
12	1,210	818	672	600	400	4,640	4,440	979	979	3,040	768	284
13	1,210	818	672	600	400	2,420	4,240	1,150	979	1,770	672	503
14	1,090	818	672	600	350	1,700	4,150	979	870	1,390	672	465
15	1,090	768	627	500	350	1,450	4,060	818	768	1,090	672	395
16	1,040	768	627	400	300	1,390	4,060	768	768	1,700	627	346
17	979	768	2,190	400	300	1,330	4,640	768	672	1,150	584	314
18	1,090	768	1,330	300	250	1,270	4,340	719	584	3,530	584	284
19	1,040	768	1,210	300	250	1,270	3,780	672	584	4,240	503	284
20	924	719	924	300	300	2,260	2,880	672	584	4,840	503	284
21	870	719	700	300	300	2,960	2,420	627	503	5,260	503	269
22	870	672	600	300	1,000	2,880	2,120	627	503	5,690	465	299
23	818	672	500	300	5,800	2,340	1,840	584	465	5,800	465	299
24	818	627	400	300	4,740	1,980	1,770	543	447	5,800	447	269
25	768	584	400	250	2,000	1,770	1,700	584	429	5,580	503	269
26	768	543	400	250	1,800	1,840	1,640	1,090	395	5,150	672	255
27	768	543	450	250	1,600	1,840	1,640	3,120	395	3,530	584	241
28	768	627	450	200	1,400	1,770	1,510	3,200	412	1,910	503	241
29	2,050	627	450	200	-------	1,840	1,450	3,120	346	1,770	447	228
30	1,910	627	450	200	-------	1,840	1,330	3,120	362	1,840	429	228
31	1,700	-------	450	200	-------	1,910	-------	3,040	-------	1,700	395	-------

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Feb. 22 and Feb. 25 to Mar. 2. Discharge based on a study of gage height, observer's notes, climatological records, one discharge measurement, and a comparison with record for Augusta. Gage not read Oct. 9; discharge estimated.

Monthly discharge of Skunk River at Coppock, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 2,890 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	4,240	768	1,440	0.498	0.57
November	1,390	543	823	.285	.32
December	1,700	400	806	.279	.32
January	3,000	200	702	.243	.28
February	5,800	200	974	.337	.35
March	5,910	900	1,870	.647	.75
April	4,640	1,330	2,590	.896	1.00
May	3,200	543	1,280	.443	.51
June	3,120	346	1,100	.381	.43
July	5,800	269	2,400	.830	.96
August	1,580	395	757	.262	.30
September	979	228	333	.115	.13
The year	5,910	200	1,260	.436	5.72

SKUNK RIVER AT AUGUSTA, IOWA

LOCATION.—In sec. 26, T. 69 N., R. 4 W., at highway bridge one-third mile from Augusta post office, Des Moines County, 12.2 miles above mouth of river, and 32.2 miles above dam of Mississippi River Power Co. at Keokuk.

DRAINAGE AREA.—At gaging station, 4,290 square miles; at mouth 4,350 square miles (measured on map issued by United States Geological Survey; scale, 1: 500,000).

RECORDS AVAILABLE.—October 1 to November 15, 1913; May 27, 1915, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of bridge 95 feet from left abutment; read by J. A. Schroder. Zero of gage is elevation 528.55 feet above mean sea level Memphis datum.

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

CHANNEL AND CONTROL.—Bed of stream sandy and subject to change. Right bank high and will not be overflowed; left bank will be overflowed only at extremely high stages. Remains of old mill dam 600 feet below gage forms control. The riffle at the dam causes a drop of about 3 feet at medium low stages. Backwater from Mississippi River probably will not occur oftener than once in 50 years.

REGULATION.—Natural discharge at extremely low stages occasionally affected by storage of water at Oakland mills, 26 miles upstream.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.6 feet at 9 a. m. February 24 (discharge, 10,100 second-feet); minimum stage, 2.0 feet September 28 to 30 (discharge, 265 second-feet).

1913; 1915–1922: Maximum stage recorded, 18.0 feet March 28, 1916 (discharge, 30,800 second-feet); minimum stage, 1.29 feet September 8, 1919 (discharge, 26 second-feet by current-meter measurement).

A stage of about 21 feet (discharge, 45,000 second-feet) was reached on or about June 1, 1903.

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

ACCURACY.—Stage-discharge relation changed during the breaking up of ice in the early part of January. Rating curve used before and after the ice-affected period is well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table, except as explained in footnote to table of daily discharge. Open-water records excellent; winter records fair.

Discharge measurements of Skunk River at Augusta, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 1	C. Herlofson	6.78	6,240	May 12	C. Herlofson	3.22	1,330
Nov. 17	E. D. Burchard	2.91	866	July 16	J. B. Spiegel	3.36	1,470
Jan. 18	C. Herlofson	[a] 4.58	709	Aug. 30	Herlofson and Mercer	2.44	531
Feb. 15	do	[a] 2.87	523				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Skunk River at Augusta, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6,360	2,440	812	450	400	4,000	2,720	1,660	3,420	430	1,920	430
2	3,980	2,020	2,580	450	350	5,000	2,440	1,540	3,420	412	1,790	430
3	3,140	1,740	3,700	400	350	6,500	2,310	1,540	3,280	412	1,660	400
4	2,580	1,540	2,580	1,000	400	6,640	2,310	1,420	2,860	382	1,540	370
5	2,300	1,400	2,020	3,000	700	5,240	2,310	1,360	2,860	354	1,480	370
6	2,020	1,270	1,600	4,000	800	2,310	2,180	1,420	2,440	354	1,360	342
7	2,020	1,150	1,470	3,500	1,500	2,310	3,140	1,420	2,180	382	1,180	342
8	1,740	1,150	1,270	2,500	1,200	1,790	2,720	1,540	1,790	354	1,070	315
9	1,600	1,030	1,090	2,000	1,000	1,540	4,120	1,420	1,660	326	960	315
10	1,540	975	1,030	1,700	800	1,660	5,380	1,360	1,480	382	908	538
11	1,470	975	1,030	1,500	600	6,080	5,940	1,540	1,300	2,440	855	465
12	1,340	975	975	1,100	500	9,860	6,500	1,420	1,180	3,140	805	342
13	1,270	975	975	1,000	400	7,620	5,800	1,180	1,130	5,380	755	338
14	1,150	975	920	800	600	4,260	5,240	1,300	1,130	2,860	708	315
15	1,090	920	865	800	500	3,420	4,960	1,130	1,070	2,180	708	515
16	1,090	920	812	900	300	2,440	5,000	1,020	960	1,480	708	465
17	1,030	920	1,210	800	300	2,180	6,000	1,020	855	2,310	708	400
18	1,090	920	4,260	700	350	1,920	6,920	1,020	805	1,660	660	342
19	1,270	865	2,580	600	300	2,440	5,660	960	708	4,120	575	342
20	1,150	812	2,020	500	250	2,720	4,540	855	708	4,540	538	315
21	1,030	865	1,100	500	1,000	3,420	3,700	855	708	5,100	538	290
22	975	865	800	450	1,500	3,700	3,140	805	618	5,660	500	290
23	920	812	600	400	6,000	3,140	2,860	755	575	5,940	1,020	290
24	865	760	500	400	10,100	2,860	2,720	708	575	5,940	2,040	290
25	812	760	500	400	6,500	2,580	2,440	855	538	5,800	908	290
26	812	712	550	350	3,140	2,860	2,310	1,180	500	5,800	755	290
27	812	665	600	350	2,580	3,000	2,040	3,280	465	5,100	755	290
28	760	712	600	300	2,580	2,720	2,040	3,980	465	3,420	660	265
29	975	712	500	300	-------	2,860	1,920	3,980	430	2,040	618	265
30	3,420	760	500	300	-------	2,860	1,660	3,700	430	1,920	755	265
31	3,420	-------	500	250	-------	2,860	-------	3,420	-------	2,040	465	-------

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Feb. 23 and Mar. 1 and 2. Discharge based on gage heights corrected for effect of ice by means of two discharge measurements, observer's notes, and weather records. Gage not read Apr. 16 and 17; discharge estimated.

Monthly discharge of Skunk River at Augusta, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 4,290 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	6,360	760	1,740	0.406	0.47
November	2,440	665	1,050	.245	.27
December	4,260	500	1,310	.305	.35
January	4,000	250	1,020	.238	.27
February	10,100	250	1,610	.375	.39
March	9,860	1,540	3,640	.848	.98
April	6,920	1,660	3,700	.863	.96
May	3,980	708	1,600	.373	.43
June	3,420	430	1,350	.315	.35
July	5,940	326	2,670	.622	.72
August	2,040	465	965	.225	.26
September	538	265	351	.082	.09
The year	10,100	250	1,750	.408	5.54

SQUAW CREEK AT AMES, IOWA

LOCATION.—In sec. 3, T. 83 N., R. 24 W., at footbridge 1,700 feet above Chicago & Northwestern Railway bridge in Ames, Story County, 2 miles above junction with Skunk River.

DRAINAGE AREA.—210 square miles (measured on topographic map and United States post route map).

RECORDS AVAILABLE.—May 24, 1919, to September 30, 1922.

GAGE.—Vertical staff gage attached to middle pile of left bent of bridge; read by George Foster.

DISCHARGE MEASUREMENTS.—Made from footbridge, by wading and from Northwestern Railway bridge.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Sand shifts during all periods of high water. Left bank high; right bank subject to overflow at a stage above 7 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.40 feet at 7.30 a. m. July 17 (discharge, 3,920 second-feet); minimum discharge, 4 second-feet, occurred January 25–27 (stage-discharge relation affected by ice).

Maximum stage in recent years, about 14.5 feet June 4, 1918 (discharge, about 6,900 second-feet). Occasionally the creek is dry for a short period during summer.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation changed during high water in May; affected by ice in winter and a slight shift in June. Rating curve used October 1 to May 24 and curve used May 25 to September 30 is well defined between 5 and 3,500 second-feet. Gage read to hundredths twice daily and frequently during periods of high water. Daily discharge ascertained by applying mean daily gage height to rating table and by indirect method for shifting control from June 13 to July 5 and as explained in footnote to table of daily discharge. Open-water records good; winter records fair.

Discharge measurements of Squaw Creek at Ames, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 25	E. D. Burchard	1.34	38.8	Feb. 18	E. D. Burchard	[a] 1.98	13.5
Nov. 30	do	1.17	31.4	24	do	[a] 6.00	571
Dec. 24	do	[a] 1.53	33.4	Mar. 4	do	[a] 1.91	52
31	do	[a] 1.53	28.2	May 20	J. B. Spiegel	1.27	32
Jan. 7	do	[a] 1.60	17.2	27	do	3.99	543
13	do	[a] 1.71	14.3	June 2	do	2.50	239
21	do	[a] 1.69	7.7	30	do	1.11	21.3
28	do	[a] 1.73	6.2	July 8	do	2.90	330
Feb. 4	do	[a] 2.99	36.7	Aug. 10	do	1.25	45.9
12	do	[a] 2.30	21.6	Sept. 2	do	.92	15.9

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Squaw Creek at Ames, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	147	55	32	30	55	78	90	64	278	24	134	18
2	132	53	29	30	45	66	90	64	230	20	112	17
3	117	47	34	30	45	60	90	66	212	16	104	16
4	103	45	27	28	37	52	110	66	176	15	86	15
5	103	40	33	21	32	53	103	66	150	12	78	14
6	96	40	32	21	32	55	96	147	134	327	70	12
7	84	36	25	17	30	55	132	84	119	545	134	12
8	78	37	27	21	30	53	117	72	104	278	96	16
9	78	37	32	20	28	52	335	66	96	203	48	16
10	72	38	30	20	27	52	324	57	89	167	44	25
11	60	40	24	19	24	52	704	51	89	126	40	20
12	58	32	22	17	22	55	737	47	81	104	44	18
13	56	40	21	14	18	57	464	40	60	89	40	16
14	54	38	21	14	15	59	356	38	52	72	32	16
15	52	36	19	12	12	63	274	36	51	72	30	14
16	50	39	27	11	12	65	235	39	43	840	26	11
17	47	37	60	10	12	66	198	36	41	3,220	24	14
18	45	36	60	10	13	66	163	36	39	1,460	22	21
19	44	40	45	10	13	294	147	37	38	737	20	28
20	40	28	40	8	13	274	132	33	36	480	20	22
21	40	30	40	8	13	155	124	30	31	417	42	20
22	38	24	38	7	90	147	110	30	28	357	34	19
23	37	21	36	6	314	117	103	33	21	297	29	16
24	36	21	33	6	572	110	96	356	20	259	24	20
25	36	21	34	4	377	110	96	1,060	20	221	20	16
26	38	28	36	4	254	124	84	840	20	134	21	14
27	35	28	34	4	163	110	78	523	20	119	22	14
28	32	28	34	6	103	103	78	377	18	112	21	14
29	49	28	33	6	-------	96	66	327	16	134	22	14
30	68	28	31	8	-------	90	66	278	21	212	20	14
31	63	-------	28	18	-------	90	-------	377	-------	167	19	-------

NOTE.—Stage-discharge relation affected by ice Nov. 21–30, Dec. 19 to Mar. 16; discharge based on gage heights corrected for effect of ice by means of eleven discharge measurements, observer's notes, and weather records.

Monthly discharge of Squaw Creek at Ames, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 210 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	147	32	64.1	0.305	0.35
November	55	21	35.0	.167	.19
December	60	19	32.8	.156	.18
January	30	4	14.2	.068	.08
February	572	12	85.8	.409	.43
March	294	52	92.9	.442	.51
April	737	66	193	.919	1.03
May	1,060	30	173	.824	.95
June	278	16	77.8	.370	.41
July	3,220	12	362	1.72	1.98
August	134	19	47.7	.227	.26
September	28	11	16.7	.080	.09
The year	3,220	4	100	.476	6.46

105449—25†—WSP 545——10

DES MOINES RIVER AT KALO, IOWA

LOCATION.—In sec. 17, T. 88 N., R. 28 W., at Kalo, Webster County, 1½ miles east of Otho, a station on Minneapolis & St. Louis Railroad and 1½ miles above mouth of Holiday Creek, which enters from left.

DRAINAGE AREA.—4,170 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—October 18, 1913, to September 30, 1922.

GAGE.—Gurley water-stage recorder on right bank 300 feet below highway bridge, to which chain gage formerly used is attached; inspected by S. C. Fuller.

DISCHARGE MEASUREMENTS.—Made from bridge and by wading.

CHANNEL AND CONTROL.—No well-defined control. Channel consists of gravel and is fairly permanent. Point of zero flow estimated to be at gage height −0.15 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 7.5 feet at 4 p. m. April 13 (discharge, 7,500 second-feet); minimum stage, −0.10 foot at 7.30 a. m. September 26 (discharge, 5 second-feet). A stage of 11.8 feet occurred at 7 a. m. February 24, when stage-discharge relation was affected by ice.

1913–1920: Maximum stage recorded, 14.0 feet May 30, 1915 (discharge, 18,500 second-feet); minimum stage, that of 1922.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Operation of city power plant, at Fort Dodge, 7 miles upstream causes diurnal fluctuation during periods of low water.

ACCURACY.—Stage-discharge relation changed during ice-affected period. Rating curve used October 1 to February 21 and curve used February 22 to September 30 well defined below 1,000 second-feet. Operation of water-stage recorder satisfactory except as explained in footnote to table of daily discharge. Mean daily gage height determined by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Des Moines River at Kalo, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 22	E. D. Burchard	1.70	695	May 26	J. B. Spiegel	1.94	1,020
Nov. 29	do	* 1.44	450	Aug. 24	do	.22	78
Jan. 17	do	* 1.00	73.3	25	do	.94	333

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Des Moines River at Kalo, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,800	530	335			2,200	1,260	1,640	685	175	500	178
2	1,730	488	332			2,100	1,260	1,560	671	150	475	106
3	1,660	512	300			2,100	1,260	1,510	644	125	450	126
4	1,570	440	300			2,100	1,260	1,460	644	125	400	160
5	1,480	400	295			2,150	1,340	1,420	554	150	360	74
6	1,440		295	200	185	2,250	1,380	1,380	524	150	340	56
7	1,310		296			2,350	1,420	1,300	638	400	300	100
8	1,270	380	296			2,470	1,460	1,340	596	1,200	275	130
9	1,250		300			2,600	2,500	1,300	524	1,100	250	124
10	1,230		300			2,800	4,030	1,300	524	1,020	240	115
11	1,150		316			3,000	5,810	1,220	422	988	225	110
12	1,150		350			3,000	6,700	1,180	410	1,060	210	105
13	1,110	350	316		165	2,700	7,340	1,180	410	1,180	200	100
14	1,030		316			2,900	7,180	1,140	370	1,060	200	100
15	950		328			2,700	6,700	1,100	434	1,020	175	95
16	950		350			2,800	6,400	1,100	416	1,460	150	90
17	1,570		340			2,500	5,810	1,060	405	1,020	125	90
18	1,310	380	288		180	2,230	5,110	1,060	390	428	115	145
19	875		300			2,230	4,420	1,140	410	380	110	100
20	770		272			2,180	3,900	1,100	385	375	110	130
21	805		280	195	220	1,960	3,540	900	395	338	125	133
22	700				3,000	1,820	3,200	996	370	328	150	133
23	574	310			4,000	1,690	2,800	932	346	338	178	115
24	609		220		5,000	1,600	2,500	948	307	307	178	100
25	616				4,500	1,640	2,320	948	295	295	178	66
26	574				3,700	1,690	2,140	924	250	275	74	48
27	548	350			3,000	1,740	2,050	892	200	250	124	53
28	548				2,400	1,640	1,920	853	175	220	56	48
29	500	360	210		-------	1,510	1,820	832	175	755	95	66
30	500	340			-------	1,380	1,690	818	175	720	154	66
31	500	-------			-------	1,340	-------	713	-------	620	142	-------

NOTE.—Stage-discharge relation affected by ice Nov. 5 to Dec. 1, Dec. 4–6, and Dec. 22 to Mar. 11; discharge computed by means of gage heights, two discharge measurements, observer's notes, weather records, and comparison with records on Des Moines River near Boone and at Des Moines. Discharge interpolated Oct. 2 and 9 and estimated Oct. 16, 30, and 31. Discharge June 26 to July 9 and July 27, 28, Aug. 2–22, and Sept. 11–17 based on study of records for Des Moines River near Boone.

Monthly discharge of Des Moines River at Kalo, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 4,170 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,800	500	1,030	0.247	0.28
November	530	-------	374	.090	.10
December	350	-------	279	.067	.08
January	-------	-------	197	.047	.05
February	5,000	-------	1,050	.252	.26
March	3,000	1,340	2,170	.520	.60
April	7,340	1,260	3,350	.803	.90
May	1,640	713	1,140	.273	.31
June	685	175	425	.102	.11
July	1,460	125	581	.139	.16
August	500	56	215	.052	.06
September	178	48	102	.024	.03
The year	7,340	48	907	.218	2.94

DES MOINES RIVER NEAR BOONE, IOWA

LOCATION.—In sec. 12, T. 84 N., R. 27 W., at highway bridge in Centerville, 2½ miles northwest of Boone, Boone County, 1 mile above Boone water works, and 3 miles above Bluff Creek.

DRAINAGE AREA.—5,480 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—April 1, 1920, to September 30, 1922. At site of old gage 3½ miles downstream at Chicago & Northwestern Railroad crossing, scattered records of stage have been obtained by the United States Weather Bureau from 1905 to 1917.

GAGE.—Chain gage attached to downstream side of bridge 20 feet from left end of right span; read by S. A. Elliott.

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

CHANNEL AND CONTROL.—Well-defined control is formed by the remains of an old dam, 300 feet below bridge. Channel consists of gravel and sand, and is fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 9.9 feet at 7 a. m., April 14 (discharge, 11,200 second-feet); minimum stage, 1.21 feet at 7 a. m., September 8 (discharge, 68 second-feet).

ICE.—Stage-discharge relation affected by ice during periods of extremely cold weather.

REGULATION.—The city power plant at Fort Dodge causes some diurnal fluctuation during periods of extremely low stages.

ACCURACY.—Stage-discharge relation probably permanent. Rating curve well defined between 100 and 18,000 second-feet. Gage read to hundredths once daily and frequently during days of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table and by indirect method for shifting control from April 14 to May 15 except as explained in footnote to table of daily discharge. Records excellent except for period during winter for which they are fair.

Discharge measurements of Des Moines River near Boone, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Oct. 27	E. D. Burchard	2.55	801	May 4	J. B. Spiegel	3.46	1,830
Jan. 18	do	[a] 1.64	209	26	do	3.14	1,450

[a] Stage-discharge relation apparently not affected by ice.

Daily discharge, in second-feet, of Des Moines River near Boone, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,310	802	500			1,900	1,730	2,020	950	292	1,380	176
2	1,880	802	500			1,400	1,730	2,020	950	343	1,000	197
3	1,880	755	500	190	180	1,300	1,730	1,880	850	257	850	186
4	1,880	755	404			1,300	1,730	1,880	800	249	710	176
5	1,880	665	486			1,400	1,730	1,730	800	233	540	204
6	1,880	665	540			1,900	1,880	1,730	755	900	500	75
7	1,730	665	580			3,470	1,880	1,730	665	1,310	472	70
8	1,590	665	710	185	190	3,760	2,020	1,730	755	2,160	458	68
9	1,590	580	622			3,320	2,310	1,590	710	1,380	458	127
10	1,520	580	500			2,890	4,200	1,450	622	1,000	479	225
11	1,450	500	430			2,600	7,680	1,310	580	755	444	257
12	1,310	430	417			3,180	10,400	1,310	580	665	430	208
13	1,310	465	444	195	170	4,480	11,200	1,310	622	580	404	166
14	1,240	500	472			4,200	11,200	1,240	486	710	354	141
15	1,180	500	500			4,200	10,700	1,240	580	622	326	117
16	1,180	580	540			3,900	10,400	1,240	493	3,900	296	90
17	1,120	540	580			3,900	9,270	1,180	622	7,240	257	85
18	1,450	540	378		200	3,470	8,260	1,180	580	3,760	249	102
19	850	580	378			3,180	7,100	1,180	500	1,880	241	141
20	1,000	500	365	190		3,470	6,520	1,060	540	1,310	332	120
21	950	665	274		300	3,040	5,640	1,450	540	1,000	354	113
22	950	365	204		1,500	2,600	4,920	1,010	472	850	310	127
23	950	301	204		4,000	2,460	4,340	1,060	404	850	354	114
24	900	332	190	190	6,600	2,310	3,760	1,310	398	850	343	90
25	900	365	175	183	6,370	2,160	3,180	1,590	444	580	338	75
26	850	391		176	4,480	2,160	3,180	1,590	410	622	365	80
27	850	458		172	3,500	2,160	2,740	1,450	274	665	391	75
28	850	486	200	169	2,700	2,160	2,600	1,240	261	580	225	85
29	850	540		170	-------	2,160	2,310	1,180	343	622	310	90
30	755	500		170	-------	2,020	1,730	1,120	296	2,460	208	155
31	802	-------		175	-------	1,880	--------	1,060	-------	2,020	169	-------

NOTE.—Stage-discharge relation affected by ice during greater part of periods Dec. 24 to Feb. 24 and Feb. 27 to Mar. 6; discharge computed by means of gage heights, discharge measurement, observer's notes, weather records, and comparison with Des Moines River at Kalo and Des Moines. Braced figures show mean discharge for periods indicated.

Monthly discharge of Des Moines River near Boone, Iowa, for the year ending Sep. 30, 1922

[Drainage area, 5,480 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,310	755	1,290	0.235	0.27
November	802	301	549	.102	.11
December	710	175	390	.071	.08
January	----------	169	186	.034	.04
February	6,600	----------	1,180	.215	.22
March	4,480	1,300	2,720	.496	.57
April	11,200	1,730	4,940	.901	1.01
May	2,020	1,010	1,420	.259	.30
June	950	261	576	.105	.12
July	7,240	233	1,310	.239	.28
August	1,380	169	437	.797	.92
September	257	68	131	.024	.03
The year	11,200	68	1,260	.230	3.05

DES MOINES RIVER AT DES MOINES, IOWA

LOCATION.—In T. 78 N., R. 24 W., at Walnut Street Bridge in Des Moines, Polk County, one-fourth mile below dam of Des Moines Electric Co. and 1 mile above mouth of Raccoon River.

DRAINAGE AREA.—6,180 square miles; effective area at high stages including Raccoon River, 9,770 square miles (measured on map issued by United States Geological Survey; scale, 1 : 500,000).

RECORDS AVAILABLE.—October 1, 1902, to August 3, 1903; October 1, 1914, to September 30, 1922, at the Walnut Street Bridge. May 27, 1905, to July 20, 1906, records were collected at the Interurban Bridge near Highland Park about 5 miles upstream. The United States Weather Bureau maintained a gage at the Locust Street Bridge from July, 1897, to January, 1912, and at the Walnut Street Bridge since January, 1912.

GAGE.—The original gage was a staff gage at the Locust Street Bridge. In January, 1912, a Friez water-stage recorder, replacing this, was installed, one block downstream, at the south end of the second pier from the east abutment of the Walnut Street Bridge, and set to read the same as the old gage. Gage zero is 774.74 feet above sea level.

DISCHARGE MEASUREMENTS.—Made at one of several bridges near the gage according to the stage.

CHANNEL AND CONTROL.—A low timber dam for purpose of improving appearance of river through the city was constructed about one-quarter mile below the gage, about September, 1913. This was partly destroyed in 1915, but still forms the control during medium stages. Since 1918, the back fill around the piers of the new Court Street Bridge, one block downstream, forms the control during low stages. Backwater may extend to the gage during periods of high water in Raccoon River. A new mouth to this river, dredged farther downstream in 1914, has greatly relieved backwater conditions at the gage.

EXTREMES OF DISCHARGE.—Maximum stage for the year ending September 30, 1922, 8.4 feet from noon to midnight September 17 (discharge, 12,000 second-feet); minimum stage, 1.2 feet at 8 a. m. August 9 (discharge about 100 second-feet).

1915–1922: Maximum discharge, about 41,500 second-feet June 7, 1918; brief periods of zero flow have occurred since construction of the dam above the gage.

ICE.—Stage-discharge relation not affected by ice since construction of dam above gage. Numerous bridges below the gage occassionally cause the formation of ice jams for short periods.

REGULATION.—Considerable diurnal fluctuation during low water is caused by operation of power plant at the dam one-fourth mile above gage.

ACCURACY.—Stage discharge relation fairly permanent between dates of shift; affected by ice during extremely cold periods. Rating curve used March 23, 1915, to June 10, 1917, well defined between 350 and 6,000 second-feet, fairly well defined between 6,000 and 17,000 second-feet, and extended below 350 second-feet; curve used June 11 to September 30, 1917, and June 8, 1918, to April 19, 1919, fairly well defined between 100 and 17,000 second-feet; curve used March 13 to June 17, 1918, fairly well defined between 100 and 2,500 second-feet; curves used April 20, 1919, to March 14, 1920, and March 15, 1920, to February 24, 1922, well defined between 300 and 17,000 second-feet; curve used February 25 to September 30, 1922, well defined between 200 and 17,000 second-feet. Daily discharge ascertained by applying mean daily gage height to rating table except for periods of ice

effect or backwater from Raccoon River noted in footnote to daily-discharge table. Records fair from 1915 to 1919, good from 1920 to 1922 except those for periods of ice effect or backwater which are fair.

COOPERATION.—Gage-height records furnished by United States Weather Bureau.

Discharge measurements of Des Moines River at Des Moines, Iowa, during the years ending Sept. 30, 1915–1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
1915		*Feet*	*Sec.-ft.*	1920		*Feet*	*Sec.-ft.*
Apr. 23	Bolster and Herlofson	4.87	3,520	Jan. 9	E. D. Burchard	2.42	665
May 29	A. Davis	15.21	23,300	Feb. 19	do	1.70	346
June 6	do	10.78	15,100	Mar. 30	do	6.06	5,620
				May 14	do	7.18	7,320
1916				June 9	do	4.31	2,630
July 18	C. Herlofson	2.68	900	July 8	do	8.15	11,700
Nov. 9	do	2.00	362	11	do	9.90	16,500
1917				1921			
June 28	Bolster and Herlofson	5.58	3,890	Jan. 19	do	2.52	900
Sept. 12	C. Herlofson	2.37	359	Apr. 29	do	3.78	2,120
				May 6	do	4.75	3,590
1918				June 29	do	4.15	2,670
Mar. 21	Bolster and Gregg	4.72	2,300	Sept. 20	do	7.85	7,690
Oct. 23	H. C. Beckman	1.62	108	22	do	6.62	6,800
1919				1922			
Apr. 29	E. D. Burchard	7.30	8,170	Apr. 12	J. B. Spiegel	8.95	10,000
May 29	do	4.38	2,730	June 5	do	3.25	1,450
June 7	do	8.85	8,780	Sept. 6	do	1.75	306
Aug. 25	do	2.45	666				
Dec. 5	do	2.90	1,070				

Daily discharge, in second-feet, of Des Moines River at Des Moines, Iowa, for the years ending Sept. 30, 1915–1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1915												
1							10,100	2,880	41,100	6,090	6,280	3,280
2							8,900	2,750	39,400	5,640	7,100	3,140
3							7,800	2,880	34,400	5,000	9,530	3,010
4							6,790	3,010	28,600	4,600	9,600	3,010
5							6,550	3,140	22,000	4,040	9,870	2,750
6							6,320	3,280	15,100	4,040	9,590	2,620
7							6,090	3,420	12,500	3,870	11,000	2,500
8							5,860	3,280	10,500	3,870	9,480	2,500
9							5,640	3,280	9,000	3,710	8,900	2,620
10							5,420	3,140	7,800	3,560	8,340	2,500
11							5,420	3,010	6,940	3,720	7,800	2,750
12							5,420	2,880	6,520	3,700	7,280	2,620
13							5,210	2,620	5,960	3,650	6,790	2,500
14							5,000	2,500	5,860	3,560	6,550	2,370
15							4,800	2,370	5,640	3,460	6,320	2,500
16							4,600	2,250	5,860	4,130	5,640	3,560
17							4,410	2,130	5,210	4,250	5,420	4,220
18							4,040	2,130	4,600	4,460	5,210	4,220
19							3,870	2,020	4,220	5,850	5,210	4,040
20							3,710	2,020	4,220	7,980	4,600	3,870
21							3,560	2,020	4,410	7,870	4,220	4,600
22							3,560	2,250	4,410	9,360	4,220	5,640
23						9,480	3,420	2,620	4,220	6,980	5,000	4,600
24						9,780	3,280	3,010	3,870	7,600	4,800	4,220
25						12,000	3,140	3,420	3,710	8,900	4,220	3,870
26						13,800	3,010	6,900	6,320	6,780	3,870	4,410
27						14,600	3,010	11,600	7,800	6,600	3,560	10,400
28						14,200	3,010	20,000	9,480	6,700	3,420	15,900
29						12,700	3,010	23,300	8,900	14,800	3,420	12,200
30						11,400	2,880	30,500	7,030	9,540	3,280	10,700
31						10,700		36,900		7,560	3,280	
1915–16												
1	9,200	3,560	3,420			3,420	12,400	5,210	5,640	2,020	560	305
2	7,700	3,280	3,280			3,010	11,700	5,420	5,210	1,900	635	305
3	6,240	3,140	3,140			2,250	10,400	5,640	5,210	1,780	560	305
4	5,650	3,140	3,140			2,130	9,480	5,420	6,550	1,680	560	305
5	5,400	3,010	3,010			2,750	8,900	5,000	7,800	1,680	490	265
6	5,700	2,880	2,880			2,370	8,070	4,600	7,800	1,560	490	305
7	5,740	2,880	2,880			2,500	7,540	4,220	6,790	1,560	490	305
8	5,090	2,880	3,010			2,250	6,790	3,870	5,420	1,460	490	305
9	4,700	2,880	3,010			2,370	6,090	3,710	4,600	1,350	490	305
10	4,580	2,880	3,010			2,500	5,860	3,420	4,040	1,240	490	265
11	4,400	3,280	2,880			3,140	5,640	3,280	3,560	1,050	560	305
12	4,130	3,710	2,880			4,600	5,420	3,010	3,420	960	560	360
13	4,130	6,140	1,900			6,550	5,210	3,010	3,140	960	635	490
14	4,130	7,300	2,750			12,000	4,800	3,010	3,010	1,140	560	560
15	4,400	6,780	1,900			15,000	4,800	4,040	2,880	1,050	560	490
16	4,260	6,420	1,460			15,300	4,800	6,570	2,620	960	490	490
17	4,260	6,060	1,460			15,700	4,600	8,100	2,500	960	490	490
18	4,940	5,560	1,460			11,000	5,000	7,870	2,370	875	490	425
19	6,420	5,600	1,350			11,000	5,420	6,710	2,250	790	490	360
20	7,140	5,240				10,700	5,640	5,960	2,130	790	425	360
21	6,960	5,000				10,100	7,030	5,600	2,020	790	360	360
22	5,980	4,600				9,480	9,780	8,220	1,900	790	360	305
23	5,380	4,220				9,190	10,100	9,310	1,780	710	360	305
24	5,240	4,040				8,900	8,340	9,340	1,780	710	360	305
25	4,790	4,040				8,900	7,540	9,340	1,780	635	360	305
26	4,490	3,870				11,400	6,790	7,930	1,900	635	360	305
27	4,340	3,870				15,300	6,320	7,510	2,020	635	305	305
28	4,220	3,870				18,000	5,860	7,100	2,250	635	305	425
29	4,040	3,710				18,000	5,420	7,200	2,370	635	305	360
30	3,870	3,560				16,500	5,210	6,790	2,130	490	305	360
31	3,560					16,100		6,090		560	305	

Daily discharge, in second-feet, of Des Moines River at Des Moines, Iowa, for the years ending Sept. 30, 1915–1922—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1916–17												
1	360	360	360	125			10,400	5,090	4,040	3,780	830	260
2	360	360	360	125			8,340	6,140	4,800	3,620	830	260
3	360	360	360	125			7,280	6,520	5,860	3,020	830	260
4	305	360	360	125			6,790	6,240	5,060	2,760	750	410
5	305	360	360	150			6,550	6,240	7,520	2,500	670	300
6	305	360	360	150			6,550	5,680	13,700	2,370	600	260
7	305	305	360	125			6,550	5,720	18,600	2,250	530	300
8	265	305	360	150			6,320	5,090	23,500	2,250	530	350
9	265	360	360	150			5,860	4,490	36,900	2,630	600	350
10	265	360	230	150			6,090	4,220	32,600	3,020	670	470
11	265	425	265	175			6,320	3,710	28,300	3,020	600	530
12	265	560	200	150			5,860	3,420	30,600	2,840	530	470
13	265	560	200	150		3,280	5,210	3,140	20,200	2,630	600	410
14	265	490	200	125		4,800	4,800	2,880	19,300	2,370	530	410
15	265	265	200	125		3,560	4,600	2,750	13,800	2,250	530	410
16	265	305	230			2,750	4,220	2,500	10,900	2,130	470	350
17	265	360	200			2,250	3,870	2,370	9,440	2,130	470	350
18	265	425	200			2,020	3,870	2,250	7,640	2,010	470	350
19	265	490	230			1,680	3,560	2,130	6,200	1,790	410	350
20	305	425	230			2,880	3,560	2,020	5,260	1,680	410	300
21	265	490	200			4,140	3,710	2,130	5,130	1,580	350	260
22	305	490	200			4,940	4,600	2,370	4,500	1,480	410	260
23	265	490	200			10,300	4,600	3,280	4,130	1,380	410	220
24	305	490	200			16,200	4,600	4,040	3,780	1,280	350	
25	305	425	150			24,500	4,220	4,220	3,620	1,280	410	
26	305	305	150			31,700	4,040	4,220	3,460	1,380	350	
27	305	305	150			30,800	3,870	4,220	3,780	1,380	300	280
28	360	360	150			25,300	3,870	4,220	3,780	1,380	300	
29	360	425	150			18,600	4,220	3,870	3,950	1,180	260	
30	360	425	150			16,100	4,490	3,710	3,950	1,090	260	
31	360		150			13,500		3,710		910	260	
1918												
1							1,030	820	9,140	1,380	1,180	2,130
2							960	820	7,780	1,280	1,090	1,900
3								820	6,220	1,180	830	1,680
4								750	9,440	1,180	830	1,480
5								750	15,800	1,280	830	1,280
6								750	35,200	1,180	830	1,180
7								630	41,000	1,180	750	1,000
8								630	40,400	1,280	670	910
9							750	630	35,000	1,180	670	830
10								570	24,800	1,000	750	750
11								570	11,300	670	670	670
12								570	6,560	1,000	750	670
13						1,300		1,030	5,240	1,000	600	670
14						1,300		1,400	4,370	1,180	600	670
15						1,500		1,500	4,130	1,280	750	670
16						1,300	890	1,400	3,700	1,180	830	750
17						1,200	890	1,400	3,620	1,090	750	830
18						1,200	890	1,300	3,020	1,000	670	750
19						1,400	890	1,110	2,760	1,000	670	750
20						1,700	890	1,030	2,370	1,000	670	670
21						2,130	890	960	2,130	1,000	750	670
22						2,500	960	960	2,370	1,000	1,180	670
23						2,760	890	1,030	2,370	910	1,480	670
24						2,900	890	1,550	2,250	910	1,680	670
25						2,630	890	2,380	1,790	910	2,010	670
26						2,130	820	2,010	1,790	750	2,370	600
27						1,800	820	2,000	1,680	750	3,020	600
28						1,500	820	2,300	1,580	750	2,760	600
29						1,300	820	2,230	1,480	830	2,630	530
30						1,200	890	3,380	1,380	750	2,500	600
31						1,110		7,280		910	2,250	

Daily discharge, in second-feet, of Des Moines River at Des Moines, Iowa, for the years ending Sept. 30, 1915–1922—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1918–19												
1	500	2,370	1,180	1,180	1,280	955	4,700	9,050	2,750	6,780	1,200	350
2	470	2,630	1,180	1,180	1,280	955	4,500	8,370	3,950	6,320	1,100	380
3	440	2,500	1,380	1,090	1,380	1,000	4,310	8,830	4,580	5,860	1,100	440
4	410	2,370	1,680	1,000	1,180	1,380	4,310	9,460	8,200	5,210	1,050	400
5	350	2,250	1,790	910	790	1,580	4,130	12,200	8,840	4,800	1,000	440
6	350	2,130	1,580	830	750	1,480	4,130	11,000	9,460	4,600	1,100	420
7	380	1,900	1,580	750	600	1,380	4,130	10,100	8,840	4,220	1,000	380
8	325	1,790	1,480	830	530	1,580	4,310	11,000	8,040	4,220	918	380
9	410	1,580	1,480	830	600	1,900	5,360	11,400	7,260	4,600	918	380
10	440	1,480	1,580	830	870	2,010	10,000	10,400	6,560	4,600	875	380
11	350	1,480	1,790	830	1,090	2,010	12,000	9,190	8,040	4,800	730	365
12	600	1,580	1,900	830	1,280	2,370	13,100	8,900	7,130	4,600	670	350
13	530	1,680	2,250	830	1,580	3,020	12,800	7,800	6,840	4,220	960	365
14	280	1,790	2,500	830	1,900	3,020	12,800	6,790	7,600	4,040	960	350
15	260	1,680	2,630	830	1,790	3,460	14,300	6,320	7,120	3,870	838	380
16	350	1,580	2,630	830	2,370	7,200	13,300	5,640	7,120	3,560	800	485
17	380	1,580	2,890	830	3,020	6,560	14,600	5,000	7,120	3,280	765	640
18	325	1,580	2,890	750	3,310	9,330	15,000	4,600	7,400	3,140	730	730
19	350	1,580	2,890	750	3,950	10,000	15,000	4,410	9,350	3,280	730	1,050
20	325	1,790	2,760	750	3,780	10,000	14,200	4,220	11,600	3,140	700	1,140
21	410	2,130	2,630	910	3,020	9,170	13,500	3,870	12,200	3,010	670	1,300
22	380	2,250	2,630	910	3,310	8,780	12,500	3,870	11,900	2,750	640	1,140
23	280	2,370	2,500	955	2,890	7,100	12,000	3,710	14,000	2,620	610	670
24	325	2,370	2,630	955	2,760	6,330	15,300	3,560	12,700	2,500	560	610
25	260	2,130	2,500	1,000	2,130	5,840	14,200	3,280	12,700	2,250	585	585
26	300	1,790	2,010	1,000	1,790	5,840	10,500	3,280	13,300	2,250	510	560
27	530	1,580	1,580	1,180	1,280	6,080	9,600	3,280	13,000	2,020	485	485
28	750	1,480	1,480	1,280	955	5,840	9,080	3,010	11,300	2,020	485	535
29	756	1,380	1,380	1,280	-------	5,600	8,340	3,010	9,050	1,680	460	875
30	910	1,280	1,180	1,280	-------	5,360	8,150	2,750	7,510	1,460	420	1,780
31	1,680	-------	1,280	1,280	-------	5,130	-------	2,620	-------	1,240	420	-------
1919–20												
1	3,580	800	960	770	510	400	5,560	6,120	3,600	2,720	2,580	2,450
2	2,850	960	960	670	730	510	5,380	6,120	3,450	3,300	2,450	3,150
3	2,130	960	960	690	460	1,140	4,870	6,530	3,300	4,370	2,320	2,720
4	2,370	918	960	710	420	2,250	4,370	6,320	3,450	5,560	2,190	2,450
5	4,020	838	960	730	380	2,020	4,210	5,740	3,450	5,930	2,060	2,320
6	2,850	730	960	715	460	1,460	3,900	5,380	3,300	6,530	2,060	2,450
7	2,250	730	960	700	460	1,100	3,900	5,040	3,150	7,230	3,450	2,860
8	1,780	730	960	685	510	838	3,600	4,700	2,860	10,000	4,050	3,300
9	1,460	1,460	875	670	560	875	3,450	4,370	2,860	13,800	3,600	4,700
10	1,350	4,020	875	600	510	1,350	3,300	4,210	2,720	16,600	3,000	4,530
11	1,240	4,200	875	530	560	2,370	3,300	4,370	2,320	17,400	2,580	5,380
12	1,140	3,960	800	460	510	4,600	3,300	7,000	2,060	18,200	2,450	5,380
13	1,000	3,560	800	460	460	10,100	3,300	7,800	1,940	17,400	2,190	4,870
14	918	2,750	800	460	460	12,000	3,450	7,500	1,820	15,800	1,940	4,210
15	875	2,020	730	460	420	12,000	3,450	7,200	1,600	14,200	1,820	3,900
16	800	1,900	800	420	380	11,500	3,450	8,000	1,600	12,000	1,710	3,600
17	765	1,900	800	420	380	11,500	3,300	8,260	1,820	10,400	1,710	3,300
18	765	1,900	800	350	350	11,000	3,300	7,480	2,190	8,260	1,600	2,860
19	730	1,780	730	420	380	10,000	3,600	6,990	2,580	6,990	1,500	2,450
20	730	1,780	730	460	365	8,830	4,530	6,320	2,720	6,120	1,600	2,190
21	700	1,680	670	460	365	7,230	6,990	5,930	2,860	5,930	1,820	1,940
22	700	1,680	670	420	380	5,930	8,260	5,740	2,860	5,210	4,210	1,820
23	670	1,680	670	420	380	5,210	7,730	5,380	2,720	4,700	5,380	1,940
24	610	1,680	730	460	380	5,210	6,530	5,210	2,720	4,370	5,210	1,820
25	610	1,680	800	460	380	5,210	5,560	5,210	2,720	4,060	4,700	1,710
26	610	1,460	800	460	400	6,530	5,210	4,870	2,580	3,900	4,050	1,820
27	585	1,240	800	420	365	6,990	5,380	4,700	2,450	3,600	3,300	1,820
28	560	960	800	420	365	6,750	5,380	4,370	2,320	3,450	2,720	1,820
29	560	960	875	380	380	6,120	5,560	4,210	2,320	3,150	2,320	1,820
30	560	960	875	350	-------	5,560	5,740	3,900	2,320	2,860	2,060	1,710
31	640	-------	875	420	-------	5,040	-------	3,750	-------	2,720	1,820	-------

Daily discharge, in second-feet, of Des Moines River at Des Moines, Iowa, for the years ending Sept. 30, 1915–1922—Continued

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920–21												
1	1,710	1,300	2,190	1,450	1,500	2,190	3,000	2,320	9,130	3,000	488	1,200
2	1,600	1,600	2,450	1,300	1,500	2,190	2,720	2,190	8,830	2,450	595	1,710
3	1,600	2,060	2,580	1,020	1,400	2,190	2,450	2,450	7,230	2,060	700	1,710
4	1,500	2,860	2,720	1,060	1,400	2,190	2,320	2,860	6,320	1,940	560	1,160
5	1,430	3,000	2,720	1,160	1,300	2,060	2,190	3,450	5,560	1,820	500	930
6	1,360	3,000	2,580	1,200	1,200	1,940	2,190	3,450	5,210	1,820	470	770
7	1,290	3,000	2,450	1,300	1,150	2,060	2,190	3,300	4,870	2,190	470	700
8	1,230	3,450	2,320	1,350	1,100	2,190	2,190	3,000	4,530	2,190	428	630
9	1,160	4,210	2,320	1,450	1,050	2,060	2,190	2,860	4,210	1,940	275	630
10	1,090	4,370	2,190	1,450	1,000	1,940	2,320	2,860	3,900	2,060	352	1,160
11	1,020	4,530	2,060	1,500	1,000	1,940	2,450	2,720	3,900	1,940	560	1,400
12	1,020	4,370	2,060	1,450	1,020	1,940	2,450	2,580	3,750	1,710	665	1,300
13	1,110	3,900	2,060	1,300	1,110	1,940	2,320	2,580	3,600	1,500	850	1,110
14	1,020	3,450	1,940	1,240	1,400	1,940	2,320	2,720	3,600	1,300	630	975
15	1,110	3,150	1,940	1,180	2,450	1,940	2,320	2,720	3,900	1,250	560	1,710
16	1,300	2,720	1,820	1,120	4,210	1,940	2,450	2,450	4,210	1,160	500	6,320
17	1,500	2,580	1,500	1,060	8,540	1,940	2,450	2,320	4,050	1,060	470	11,400
18	1,600	2,580	1,020	1,000	9,740	1,820	3,000	2,190	4,210	930	440	10,700
19	1,500	2,580		940	7,230	1,820	2,860	2,190	4,210	930	470	9,130
20	1,500	2,450		890	5,000	1,820	2,720	2,450	4,050	770	440	7,730
21	1,400	2,450		975	4,370	1,820	2,580	4,210	3,600	770	380	7,730
22	1,400	2,320		1,200	4,210	1,820	2,450	4,870	3,300	700	428	7,230
23	1,300	2,320		1,600	4,050	1,940	2,580	4,870	3,000	700	470	5,560
24	1,300	2,320		1,940	3,600	1,940	2,720	4,700	2,720	630	975	4,700
25	1,300	2,190	1,000	2,320	2,860	1,940	2,720	4,210	2,450	560	890	4,210
26	1,300	2,190		2,320	2,720	1,940	2,450	3,900	2,320	530	700	3,900
27	1,200	2,190		2,320	2,450	1,940	2,450	4,370	2,190	500	595	3,600
28	1,200	2,190		2,060	2,450	1,940	2,320	5,930	2,720	488	530	3,600
29	1,200	2,060		1,940	-------	2,450	2,190	8,260	3,450	440	470	3,300
30	1,110	2,060		1,820	-------	3,000	2,060	9,430	3,300	440	440	3,300
31	1,110	-------		1,710	-------	3,150	-------	9,130	-------	440	1,020	-------
1921–22												
1	3,000	1,160	770			2,220	2,090	2,620	2,760	860	2,620	510
2	2,860	1,200	700			1,500	1,960	2,480	2,350	860	2,090	450
3	2,720	1,200	735	285	205	1,400	1,840	2,350	2,090	860	1,720	340
4	2,580	1,160	630			1,400	1,840	2,350	1,840	860	1,500	340
5	2,450	1,110	595			1,610	1,840	2,220	1,720	860	1,350	340
6	2,320	1,060	630			1,610	1,840	2,220	1,500	940	1,160	340
7	2,190	1,020	810			1,840	2,350	2,090	1,400	2,350	1,060	290
8	2,190	1,020	770	265	215	2,900	2,350	2,090	1,300	2,480	1,020	240
9	1,940	930	700			3,370	2,900	1,960	1,250	2,620	1,020	240
10	1,940	930	630			3,370	4,170	1,840	1,200	2,090	1,300	340
11	1,820	930	630			3,210	8,800	1,840	1,160	1,720	1,200	290
12	1,820	930	665			3,210	10,500	1,720	1,110	1,400	1,110	290
13	1,820	850	630	240	200	3,530	11,500	1,610	1,300	1,200	900	290
14	1,710	770	665			3,850	11,500	1,610	1,110	1,060	640	240
15	1,710	810	630			4,010	11,000	1,610	940	1,060	570	240
16	1,710	810	700			3,850	10,400	1,500	940	1,500	570	240
17	1,500	850	700			3,690	9,900	1,500	860	7,560	570	150
18	1,500	850	500	225	225	3,690	9,000	1,400	900	6,650	450	290
19	1,500	850	488			4,010	7,560	1,400	860	4,680	390	450
20	1,350	810	325			3,850	6,210	1,400	860	3,210	390	390
21	1,400	770	325		410	3,690	5,410	1,400	860	2,350	510	340
22	1,350	600			530	3,210	4,860	1,400	820	1,840	605	340
23	1,300	510	300	200	1,710	2,900	4,510	1,160	860	1,610	1,110	290
24	1,300	510			4,530	2,620	4,010	2,350	860	1,500	940	240
25	1,200	540			7,090	2,480	3,690	4,010	860	1,500	710	190
26	1,200	630			6,650	2,350	3,530	4,170	860	1,400	605	190
27	1,200	700			4,860	2,350	3,210	4,170	860	1,300	745	240
28	1,200	700			3,210	2,350	3,050	3,690	860	1,160	745	190
29	1,200	735	310	205	-------	2,350	2,900	3,050	860	1,400	570	190
30	1,300	770			-------	2,350	2,620	2,900	860	1,840	570	150
31	1,300	-------			-------	2,090	-------	3,370	-------	2,620	570	-------

NOTE.—Discharge for following periods when stage-discharge relation was affected by backwater from Raccoon River determined from rating curves corrected for backwater effect on basis of the percentage which the discharge of Des Moines River at Des Moines was to the combined discharge of Des Moines and Raccoon rivers: May 26 to June 13, July 11 to Aug. 6, Sept. 27 to Oct. 27, Nov. 13–20, 1915; May 16–29, 1916; Mar. 21–25, 28–30, Apr. 30, to May 9 June 4–20, 1917; May 24, 25, 27–31, June 1–16, 1918; Mar. 16–21, Apr. 16, Apr. 22 to May 10, June 2 to July 1, Oct. 1, 2, 5, 6, Nov. 10–13, 1919. Discharge for following periods corrected for backwater from Raccoon River by comparison with records of flow at Boone and Ottumwa: Mar. 14–18, May 12–16, 1920; Feb. 17, 18, Sept. 20 and 21, 1921; Apr. 11–18, 1922. Discharge, Sept. 24–30, 1917, and Apr. 3–15, 1918, estimated because of unreliable gage heights. Discharge for following periods for which no gage heights are available, interpolated or estimated by comparison with records of flow at other stations on the river: Aug. 31, 1917; Jan. 1, 3, 4, 6–8, 10, 11, 13, 14, Oct. 5–10, 1920; Nov. 22–25, Dec. 22–31, 1921; and Jan. 21–31, 1922. Discharge for following periods estimated because of ice by comparison with records for other stations: Dec. 19–31, 1920; Jan. 2, 14–19, Feb. 7–11, 1921; Jan. 1–20 and Feb. 1–20, 1922.

Monthly discharge of Des Moines River at Des Moines, Iowa, for the years ending Sept. 30, 1915–1922

[Drainage area, 6,180 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
1915					
March 23–31			12,100	1.96	0.66
April	10,100	2,880	4,930	.798	.89
May	36,900	2,020	6,370	1.03	1.19
June	41,100	3,710	11,200	1.81	2.02
July	14,800	3,460	5,870	.950	1.10
August	11,000	3,280	6,250	1.01	1.16
September	10,700	2,370	4,570	.739	.82
1915–16					
October	9,200	3,560	5,200	.841	.97
November	7,300	2,880	4,250	.688	.77
December 1–19	3,420	1,350	2,570	.415	.29
March	18,000	2,130	8,790	1.42	1.64
April	12,400	4,600	7,030	1.14	1.27
May	9,340	3,010	5,890	.953	1.10
June	7,800	1,780	3,560	.576	.64
July	2,020	490	1,060	.172	.20
August	635	305	458	.074	.09
September	560	265	354	.057	.06
1916–17					
October	360	265	299	.048	.06
November	560	265	400	.065	.07
December	360	150	241	.039	.04
January 1–15	175	125	140	.023	.01
March 13–31	31,700	1,680	11,500	1.86	1.31
April	10,400	3,560	5,290	.856	.96
May	6,520	2,020	3,950	.639	.74
June	36,900	3,460	11,500	1.86	2.08
July	3,780	910	2,110	.341	.39
August	830	260	501	.081	.09
September	530		328	.053	.06
1918					
March 13–31	2,900	1,110	1,730	.280	.20
April	1,030		829	.134	.15
May	7,280	570	1,440	.233	.27
June	41,000	1,380	9,690	1.57	1.75
July	1,380	670	1,030	.167	.19
August	3,020	600	1,230	.199	.23
September	2,130	530	884	.143	.16
1918–19					
October	1,680	260	465	.075	.09
November	2,630	1,280	1,870	.303	.34
December	2,890	1,180	1,990	.322	.38
January	1,280	750	952	.154	.18
February	3,950	530	1,840	.298	.31
March	10,000	955	4,590	.743	.86
April	15,300	4,130	10,000	1.62	1.81
May	12,200	2,620	6,480	1.05	1.21
June	13,300	2,750	8,850	1.43	1.60
July	6,780	1,240	3,640	.589	.68
August	1,200	420	774	.125	.14
September	1,780	350	612	.099	.11
The year	15,300	260	3,500	.566	7.71
1919–20					
October	4,020	560	1,300	.210	.24
November	4,200	730	1,730	.280	.31
December	960	670	834	.135	.16
January	770	350	518	.084	.10
February	730	350	437	.071	.08
March	12,000	400	5,540	.896	1.03
April	8,260	3,300	4,660	.754	.84
May	8,260	3,750	5,770	.934	1.08
June	3,600	1,600	2,620	.424	.47
July	18,200	2,720	7,960	1.29	1.49
August	5,380	1,500	2,720	.440	.51
September	5,380	1,710	2,910	.471	.53
The year	18,200	350	3,100	.502	6.84

Monthly discharge of Des Moines River at Des Moines, Iowa, for the years ending Sept. 30, 1915–1922—Continued

Month	Discharge in second-feet.				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
1920–21					
October	1,710	1,020	1,310	0.212	0.24
November	4,530	1,300	2,780	.450	.50
December	2,720	----------	1,670	.270	.31
January	2,320	890	1,440	.233	.27
February	9,740	1,000	2,890	.468	.49
March	3,150	1,820	2,060	.333	.38
April	3,000	2,060	2,450	.396	.44
May	9,430	2,190	3,790	.613	.71
June	9,130	2,190	4,280	.693	.77
July	3,000	440	1,300	.210	.24
August	1,020	275	565	.091	.10
September	11,400	630	3,650	.591	.66
The year	11,400	275	2,330	.377	5.11
1921–22					
October	3,000	1,200	1,760	.285	.33
November	1,200	510	857	.139	.16
December	810	----------	525	.085	.10
January	----------	----------	236	.038	.04
February	7,090	----------	1,190	.193	.20
March	4,010	1,400	2,800	.453	.52
April	11,500	1,840	5,240	.848	.95
May	4,170	1,160	2,240	.362	.42
June	2,760	820	1,200	.194	.22
July	7,560	860	2,040	.330	.38
August	2,620	390	945	.153	.18
September	510	150	289	.047	.05
The year	11,500	150	1,610	.261	3.55

DES MOINES RIVER NEAR TRACY, IOWA

LOCATION.—In sec. 19, T. 75 N., R. 17 W., at highway bridge in Bellefontaine, Mahaska County, near Tracy, Marion County, 3 miles above mouth of Cedar Creek and 6 miles below mouth of English Creek, both of which enter from right.

DRAINAGE AREA.—12,400 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—March 1, 1920, to September 30, 1922. From about April 22 to December 31, 1910, the United States Army Engineers obtained daily gage readings at the same site.

GAGE.—Chain gage attached to downstream side of bridge near right end of second span from right end of bridge; read by D. M. Coleman. Sea level elevation of zero of gage is 671.78 feet.

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

CHANNEL AND CONTROL.—Solid rock bottom overlain in places with sand and gravel. Right bank high; left bank subject to overflow at high stages. Low-water control well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.1 feet at 7 a. m. May 27 (discharge, 25,600 second-feet); minimum discharge, probably occurred during January.

1920–1922: Maximum stage recorded, 14.74 feet May 14, 1920 (discharge, 31,900 second-feet); minimum discharge, that of 1922.

Maximum stage since 1851 about 25 feet May 31, 1903 (discharge, estimated 100,000 second-feet).

ICE.—Stage-discharge relation affected by ice during periods of extremely cold weather.

ACCURACY.—Stage-discharge relation changed during winter. Rating curve used October 1 to December 22 and curve used March 1 to September 30 are well defined between 700 and 30,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Open-water records excellent; winter records fair.

Discharge measurements of Des Moines River near Tracy, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 14	E. D. Burchard	3.82	1,990
Apr. 21	J. B. Spiegel	8.71	11,500
July 19	do	9.27	13,000

Daily discharge, in second-feet, of Des Moines River near Tracy, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,720	3,840	1,560			6,100	5,480	4,900	8,360	1,220	5,680	6,100
2	5,330	3,490	1,670			4,330	4,520	4,710	6,520	1,220	4,900	4,520
3	4,950	3,160	1,780	950	420	3,450	4,150	4,520	5,280	1,130	3,620	2,830
4	4,760	3,000	1,670			3,130	3,970	4,520	4,520	1,130	3,130	2,130
5	4,570	2,700	1,670			2,980	3,970	4,330	4,150	1,080	3,620	1,640
6	4,200	2,550	1,560			2,980	3,970	4,150	3,790	1,080	2,260	1,420
7	4,020	2,410	1,460			3,130	4,150	3,970	3,450	1,530	2,000	1,320
8	3,840	2,410	1,460	780		3,130	4,150	3,790	3,130	2,830	1,760	1,220
9	3,660	2,270	1,460			3,970	6,960	3,620	2,980	3,970	1,760	1,220
10	3,490	2,270	1,460			5,280	8,360	3,450	2,830	5,680	1,640	1,640
					375							
11	3,320	2,270	1,460			6,520	13,100	3,130	2,680	8,600	1,880	2,260
12	3,160	2,270	1,460			6,100	20,400	3,130	2,540	5,480	1,760	1,880
13	3,000	2,270	1,460	650		6,960	23,100	2,980	2,400	3,970	1,880	1,530
14	2,850	2,140	1,460			6,520	22,400	2,830	2,260	3,450	1,640	1,320
15	2,850	2,010	1,460			6,520	21,700	2,830	2,400	2,680	1,420	1,130
16	2,850	1,890	1,460			6,740	21,400	2,680	2,260	2,540	1,320	1,130
17	2,700	1,890	1,460			6,520	20,700	2,680	2,000	9,080	1,320	1,040
18	2,700	2,010	1,560	470	400	6,100	18,700	2,540	1,880	16,500	1,220	1,040
19	2,550	1,890	1,560			10,300	15,800	2,540	1,760	13,700	1,130	1,220
20	2,550	1,890	1,360			14,900	13,700	2,540	1,760	8,840	1,320	1,220
21	2,550	1,780	1,180		400	11,200	11,800	2,400	1,760	6,100	1,320	1,220
22	2,270	1,780	1,040		500	7,880	10,300	2,400	1,640	4,520	1,220	1,130
23	2,270	1,560	900	350	5,600	6,520	9,320	2,400	1,530	3,620	10,000	1,130
24	2,270	1,360	825		4,900	5,680	8,360	3,450	1,420	2,980	10,800	1,130
25	2,140	1,270	750		4,400	5,280	7,880	19,100	1,420	2,680	6,310	1,040
26	2,140	1,360	680		5,500	4,900	7,190	23,100	1,420	2,540	3,620	950
27	2,010	1,560	670		12,000	4,710	6,520	25,200	1,320	2,400	2,680	910
28	2,010	1,670	770		9,500	4,900	6,100	18,100	1,420	3,130	2,400	910
29	2,550	1,670	910	380	-------	5,280	5,680	11,800	1,320	2,980	1,880	870
30	3,160	1,670	1,000		-------	5,680	5,280	7,420	1,220	3,620	1,880	830
31	3,660	-------	1,000		-------	6,100	-------	6,520	-------	5,680	2,980	-------

NOTE.—Stage-discharge relation affected by ice Dec. 23–31. No gage-height record Jan. 1 to Feb. 28; discharge determined from a study of weather records and hydrographs of nearby stations. Braced figures show mean discharge for period indicated.

Monthly discharge of Des Moines River near Tracy, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 12,400 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	5,720	2,010	3,230	0.260	0.30
November	3,840	1,270	2,140	.173	.19
December	1,780	670	1,300	.105	.12
January			590	.048	.06
February	12,000		1,810	.146	.15
March	14,900	2,980	5,930	.478	.55
April	23,100	3,970	10,600	.855	.95
May	25,200	2,400	6,180	.498	.57
June	8,360	1,220	2,710	.219	.24
July	16,500	1,080	4,390	.354	.41
August	10,800	1,130	2,910	.235	.27
September	6,100	830	1,600	.129	.14
The year	25,200		3,630	.293	3.95

DES MOINES RIVER AT OTTUMWA, IOWA

LOCATION.—At Market Street Bridge, Ottumwa, Wapello County. No large tributary enters within several miles up or down stream.

DRAINAGE AREA.—13,200 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—March 28, 1917, to September 30, 1922. Fragmentary high-water observations 1902 to 1916.

GAGE.—Chain gage attached to downstream handrail of bridge. Staff gage painted on northeast face of north pier used prior to August 2, 1917.

DISCHARGE MEASUREMENTS.—Made from Vine Street Bridge, 1,500 feet below gage.

CHANNEL AND CONTROL.—Channel fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 10.0 feet, May 27 (discharge, 26,100 second-feet); minimum stage, 1.3 feet, January 31 (discharge, 560 second-feet).

1917–1922: Maximum stage recorded, 16.5 feet, June 11, 1917 (discharge, 58,700 second-feet); minimum stage, 1.2 feet to surface of ice sveral days during December, 1917 (discharge, estimated as less than 350 second-feet).

Maximum discharge since 1850, probably in the last century, occurred May 31, 1903 (discharge, about 100,000 second-feet).

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Power plant located short distance above the gage probably produces some diurnal fluctuation at low stages.

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

COOPERATION.—Gage-height record furnished by United States Weather Bureau.

Discharge measurements of Des Moines River at Ottumwa, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Nov. 15	E. D. Burchard	2.49	2,160
Apr. 22	J. B. Spiegel	5.95	11,400
July 18	do	7.69	17,500

Daily discharge, in second-feet, of Des Moines River at Ottumwa, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept
1	6,250	3,210	1,830		750	6,000	7,390	5,710	7,680	1,520	6,810	4,660
2	5,710	3,670	2,180		750	5,000	6,250	5,440	9,130	1,520	6,250	6,810
3	5,440	3,440	2,180	1,150		4,500	5,440	5,180	7,100	1,520	5,180	4,920
4	4,920	3,210	2,000			3,910	4,920	5,180	5,980	1,370	4,150	3,440
5	4,920	2,980	2,000			3,670	4,920	4,920	5,180	1,370	3,670	2,370
6	4,400	2,770	1,670			3,670	4,660	4,660	4,660	1,370	2,980	2,000
7	4,150	2,560	1,670			3,670	5,440	4,400	4,400	1,230	2,770	1,830
8	3,670	2,560	1,670	2,200		3,670	4,920	4,150	3,670	1,830	2,370	1,520
9	3,670	2,370	1,520			3,440	9,130	4,150	3,440	3,670	2,000	1,520
10	3,440	2,180	1,520		1,550	4,400	10,600	3,910	3,210	4,920	2,000	1,520
11	3,440	2,180	1,670			8,550	14,900	3,670	3,210	7,680	1,830	2,000
12	3,210	2,000	1,670			9,430	18,800	3,670	2,770	9,430	2,180	2,980
13	2,980	1,830	1,670	1,250		8,550	21,800	3,440	2,770	5,980	1,830	2,370
14	2,980	1,830	1,670			8,260	22,600	3,210	2,560	4,660	2,000	2,000
15	2,770	1,670	1,520			7,680	21,800	2,980	2,560	3,910	2,000	1,670
16	2,560	2,000	1,520			7,680	21,400	2,980	2,560	3,210	1,830	1,370
17	2,560	2,000	1,670		975	7,680	21,400	2,770	2,370	7,680	1,670	1,370
18	2,560	2,000	1,520	950	1,100	7,100	20,300	2,560	2,180	13,900	1,520	1,230
19	2,560	1,830	1,400		1,230	7,680	18,100	2,770	2,000	17,700	1,520	1,230
20	2,370	1,830	1,200		1,370	14,900	15,600	2,770	2,000	12,200	1,520	1,370
21	2,370	1,670			1,370	14,200	13,200	2,560	1,830	8,550	1,520	1,520
22	2,370	1,670			2,180	10,900	11,600	2,560	1,830	6,530	1,520	1,370
23	2,180	1,670		750	7,390	8,550	10,300	2,370	1,830	4,920	5,980	1,370
24	2,000	1,370			5,440	7,100	9,430	2,770	1,830	3,910	14,900	1,370
25	2,000	1,230			4,200	6,250	8,550	10,000	1,670	3,440	11,200	1,370
26	1,830	1,370	810		8,000	6,250	8,260	24,900	1,520	2,980	6,530	1,230
27	1,830	1,370			9,500	5,980	7,680	26,100	1,670	2,770	4,150	1,230
28	2,000	1,370		620	7,500	5,980	7,100	24,900	1,520	2,770	2,770	1,230
29	4,920	1,230			-------	6,250	6,530	16,600	1,370	3,910	2,770	1,100
30	6,250	1,830			-------	6,530	5,980	11,600	1,370	4,920	2,370	1,100
31	3,910	-------		560	-------	7,970	--------	7,970	-------	3,910	1,830	-------

NOTE.—Stage-discharge relation affected by ice Dec. 19 to Jan. 30 and Feb. 3–16, Feb. 25 to Mar. 3; discharge obtained from a study of weather records and comparison with flow for stations at Des Moines and Van Meter and the discharge from Jan. 31 to Feb. 2, which was not affected. Braced figures show mean discharge for period indicated.

Monthly discharge of Des Moines River at Ottumwa, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 13,200 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	6,250	1,830	3,430	0.260	0.30
November	3,670	1,230	2,100	.159	.18
December	2,180		1,380	.105	.12
January			1,130	.086	.10
February	9,500	750	2,620	.198	.21
March	14,900	3,440	6,950	.527	.61
April	22,600	4,660	11,600	.879	.98
May	26,100	2,370	6,800	.515	.59
June	9,130	1,370	3,200	.242	.27
July	17,700	1,230	5,010	.380	.44
August	14,900	1,520	3,600	.273	.31
September	6,810	1,100	2,040	.155	.17
The year	26,100		4,160	.315	4.28

DES MOINES RIVER AT KEOSAUQUA, IOWA

LOCATION.—In sec. 36, T. 69 N., R. 10 W., at county bridge in Keosauqua, Van Buren County, one-fourth mile above old dam site and Government locks. No important tributary enters for several miles up or down stream.

DRAINAGE AREA.—At gaging station 13,900 square miles; at mouth, 14,300 square miles (measured on map issued by United States Geological Survey; scale, 1 to 500,000).

RECORDS AVAILABLE.—May 29, 1903, to July 21, 1906; April 5 to December 31, 1910 (United States Engineer Corps); August 3, 1911, to September 30, 1922.

GAGE.—Chain gage attached to upstream handrail of bridge; read by Frank Schreckengast.

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

CHANNEL AND CONTROL.—Channel shifts considerably at flood stages. Control is a gravel riffle one-fourth mile below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.4 feet at 8 a. m. May 28 (discharge, 26,900 second-feet); minimum discharge about 600 second-feet January 29, 30 (stage-discharge relation affected by ice).

1903–1906 and 1910–1922: Maximum stage recorded, 27.85 feet June 1, 1903 (discharge, 97,000 second-feet); minimum stage, 0.0 foot August 28 to September 6, 1911 (discharge, 160 second-feet). Flood of June 1, 1851, reached a stage of about 24 feet (discharge, about 80,000 second-feet).

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

ACCURACY.—Stage-discharge relation changed during high water in May; also affected by ice. Rating curve used October 1 to May 28 and curve May 29 to September 30 well defined between 600 and 28,000 second-feet. Gage read to half-tenths once daily except Sunday. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Open-water records excellent; winter records good.

Discharge measurements of Des Moines River at Keosauqua, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 16	E. D. Burchard	1.21	2,090	Feb. 17	C. Herlofson	[a]2.45	1,180
Jan. 20	C. Herlofson	[a]3.60	808	July 18	Spiegel and Herlofson	5.43	14,000

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6,650	3,970	1,700	1,100	900	7,000	8,070	6,090	7,300	1,440	5,660	2,170
2	[a]5,820	4,480	3,490	1,100	800	6,000	[a]7,080	5,540	8,990	[a]1,300	6,480	6,480
3	5,000	4,220	3,020	1,200	1,100	5,000	6,090	5,270	8,140	1,160	6,200	6,200
4	5,000	3,730	[a]2,520	1,300	1,500	4,800	5,540	5,000	[b]7,000	1,260	4,620	4,380
5	5,000	3,490	2,020	1,600	2,000	[b]4,600	5,270	3,970	5,660	1,260	4,130	2,840
6	4,740	[a]3,140	1,800	5,000	2,500	4,220	5,270	5,000	4,880	1,160	[a]3,660	2,390
7	4,480	2,790	1,700	2,500	2,200	4,220	5,540	[a]4,740	4,620	1,260	3,180	1,960
8	4,220	2,560	1,700	1,800	1,900	3,970	8,360	4,480	3,180	1,080	2,610	1,640
9	[a]3,980	2,680	1,600	1,700	1,900	3,970	[b]11,000	4,480	3,650	[b]3,200	2,280	1,640
10	3,730	2,560	1,700	1,600	1,800	3,020	14,000	3,970	3,180	5,400	2,060	[a]1,540
11	3,490	2,240	[a]1,600	1,600	1,600	10,400	11,900	3,970	[a]3,180	7,580	1,850	1,440
12	3,490	2,240	1,500	1,400	1,500	10,700	18,200	3,730	3,180	15,900	1,850	2,170
13	3,250	[a]2,240	1,600	1,300	1,300	10,100	21,400	3,490	2,950	9,850	[a]1,960	2,840
14	3,020	2,240	1,500	1,200	1,200	8,940	22,800	[a]3,260	2,720	5,660	2,060	2,390
15	3,020	2,240	1,500	1,100	1,200	8,940	22,100	3,020	2,500	4,380	2,060	1,850
16	[b]3,020	2,120	1,500	1,100	1,200	8,070	[b]23,000	3,020	2,610	[a]4,020	1,960	1,640
17	[b]3,250	2,020	2,240	1,100	1,200	7,780	23,500	3,020	2,610	3,650	1,850	[a]1,450
18	3,490	2,020	[b]2,000	1,200	1,250	7,780	21,100	2,790	[a]2,390	13,700	1,640	1,260
19	3,020	2,020	1,500	1,000	1,400	[b]8,000	19,500	2,790	2,170	18,200	1,640	1,260
20	2,790	[a]1,910	1,300	800	1,500	13,100	16,900	2,680	1,850	15,000	[a]1,540	1,260
21	2,020	1,800	1,100	800	1,500	16,200	14,700	[b]2,680	1,850	10,100	1,440	1,440
22	2,460	1,800	900	800	3,020	13,100	12,800	[b]2,560	1,850	7,300	1,540	1,540
23	[a]2,350	1,910	800	800	11,300	9,520	[a]11,400	2,560	1,750	6,200	3,180	[b]1,450
24	2,240	1,700	750	800	9,520	7,780	10,100	2,560	1,750	4,620	13,100	[b]1,450
25	2,120	1,040	700	800	4,500	6,930	9,520	3,970	[b]1,750	3,890	13,400	1,350
26	2,120	1,500	700	800	5,000	[a]6,790	8,940	22,100	1,640	3,420	8,990	1,350
27	2,120	[a]1,400	700	800	10,000	6,650	7,780	25,500	1,350	2,500	[a]6,320	1,260
28	2,240	1,310	800	700	8,000	6,090	7,210	26,900	1,640	2,840	3,650	1,160
29	3,020	1,400	950	600	-------	6,090	6,930	19,500	1,440	3,650	3,180	835
30	6,650	1,700	1,100	600	-------	7,210	[a]6,510	13,400	1,350	4,880	2,720	992
31	5,000	-------	1,100	700	-------	8,360	-------	9,560	-------	5,930	2,170	-------

[a] Interpolated.
[b] Estimated on basis of records at Ottumwa.

NOTE.—Stage-discharge relation affected by ice Dec. 19 to Feb. 21 and Feb. 25 to Mar. 4; discharge based on gage heights corrected for effect of ice by means of two discharge measurements, observer's notes, weather records, and comparison with records at Ottumwa.

Monthly discharge of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 13,900 square miles.]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	6,650	2,020	3,640	0.262	0.30
November	4,480	1,040	2,350	.169	.19
December	3,490	700	1,520	.109	.13
January	5,000	600	1,250	.090	.10
February	11,300	800	2,960	.213	.22
March	16,200	3,020	7,590	.546	.63
April	23,500	5,270	12,400	.892	1.00
May	26,900	2,560	6,830	.491	.57
June	8,990	1,350	3,300	.237	.26
July	18,200	1,080	5,540	.399	.46
August	13,400	1,440	3,840	.276	.32
September	6,480	835	2,050	.147	.16
The year	26,900	600	4,450	.320	4.34

RACCOON RIVER AT VAN METER, IOWA

LOCATION.—In SW. ¼ sec. 22, T. 78 N., R. 27 W., at highway bridge one-third mile from railroad station in Van Meter, Dallas County, 1 mile below junction of North and South Raccoon rivers, and 30 miles above junction of Raccoon and Des Moines rivers.

DRAINAGE AREA.—At gaging station, 3,410 square miles; at mouth 3,590 square miles (measured on map issued by United States Geological Survey; scale, 1: 500,000).

RECORDS AVAILABLE.—April 25, 1915, to September 30, 1922.

GAGE.—Chain gage attached to downstream handrail of bridge 25 feet from right abutment; read by Hugh Smith. Gage readings discontinued during winter.

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

CHANNEL AND CONTROL.—Bed composed of sand and gravel; subject to change; river divided into two channels of low and medium stages by an island. Right bank high; left bank subject to overflow at a stage of 13 feet. At extremely high stages this overflow will extend for several hundred feet beyond left end of bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 12.0 feet at 7.15 a. m. April 11 (discharge, 11,200 second-feet); minimum discharge probably occurred during February.

1915–1920: Maximum stage recorded, 17.5 feet June 7, 1917 (discharge, 31,800 second-feet); minimum stage, 1.56 feet, October 22, 1918 (discharge, about 28 second-feet).

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 100 and 15,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, by indirect method for shifting control February 24 to April 10, and as explained in footnote to table of daily discharge. Open-water records good; winter records fair.

Discharge measurements of Raccoon River at Van Meter, Iowa, during the year ending Sept. 30, 1922

[Made by J. B. Spiegel]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Mar. 27	4.40	1,470	June 23	2.78	397
June 9	3.53	854	July 7	4.77	1,870

Daily discharge, in second-feet, of Raccoon River at Van Meter, Iowa, for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,400	1,580	632			1,860	1,310	1,580	1,580	340	1,490	1,100
2	1,310	1,400	572			1,670	1,310	1,580	1,230	318	1,580	764
3	1,230	1,230	514			1,670	1,230	1,490	1,060	279	1,230	572
4	1,020	1,060	486			1,670	1,230	1,490	907	318	955	318
5	1,020	1,020	486			1,580	1,310	1,400	907	210	764	279
6	983	945	486			1,580	1,310	1,230	764	279	665	279
7	983	870	514			1,490	3,220	1,230	765	2,140	543	279
8	834	799	514			1,670	1,860	1,060	1,140	1,310	459	279
9	834	799	486			2,050	2,430	1,060	907	2,050	459	279
10	834	764	486			2,430	4,300	1,020	764	2,330	543	459
11	764	764	486			2,050	11,200	945	633	1,950	730	408
12	633	697	486		150	2,050	8,590	907	633	1,400	459	434
13	633	697	543			1,950	8,300	870	514	1,580	408	279
14	633	697	514			1,950	8,300	764	602	870	384	279
15	633	665	486			2,240	8,300	730	572	764	318	279
16	633	633	486	180		2,240	7,730	665	486	633	279	279
17	633	633	486			1,860	6,380	665	486	2,330	298	298
18	633	633	434			1,490	4,880	665	434	1,490	459	318
19	572	633	384			2,330	4,190	665	514	1,230	408	361
20	514	602	300			2,050	3,540	665	459	1,490	261	279
21	514	514	250			1,860	3,120	665	434	1,140	514	318
22	459	243				1,760	2,820	665	434	870	945	384
23	459	243				1,490	2,530	799	408	665	2,140	298
24	572	240			4,530	1,400	2,430	1,630	408	665	764	279
25	514	459			4,760	1,310	2,330	2,720	384	764	1,060	243
26	543	572	225		4,760	1,490	2,140	2,720	318	1,400	1,230	226
27	665	572			3,750	1,490	2,050	2,920	318	870	543	210
28	633	572			2,820	1,490	1,950	2,140	318	665	434	210
29	870	514			------	1,400	1,760	1,860	318	1,490	764	210
30	1,580	514			------	1,400	1,580	1,580	361	1,310	1,670	210
31	1,580	------			------	1,310	------	1,760	------	1,670	1,400	------

NOTE.—Stage-discharge relation affected by ice Dec. 20 and 21. No gage record Dec. 22 to Feb. 23; discharge based on comparison with records at nearby stations. Braced figures show mean discharge for period indicated.

Monthly discharge of Raccoon River at Van Meter, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 3,410 square miles]

Month	Discharge in second-feet				Run off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,580	459	810	0.238	0.27
November	1,580	240	719	.211	.24
December	632	------	396	.116	.13
January	------	------	180	.053	.06
February	4,760	------	860	.252	.26
March	2,430	1,310	1,750	.513	.59
April	11,200	1,230	3,790	1.11	1.24
May	2,920	665	1,290	.378	.44
June	1,580	318	636	.187	.21
July	2,330	210	1,120	.328	.38
August	2,140	261	779	.228	.26
September	1,100	210	347	.102	.11
The year	11,200	------	1,050	.308	4.19

SUGAR CREEK NEAR KEOKUK, IOWA

LOCATION.—In sec. 7, T. 65 N., R. 5 W., at single-span highway bridge 6 miles northwest of Keokuk, Lee County, on road to Argyle, and 3½ miles above mouth of creek.

DRAINAGE AREA.—At gaging station 113 square miles; at mouth, 120 square miles (measured on topographic county map; scale, one-half inch=1 mile).

RECORDS AVAILABLE.—March 29 to September 30, 1922.

GAGE.—Chain gage attached to downstream side of bridge; 48 feet from right abutment; read by Mrs. J. B. Williams.

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

CHANNEL AND CONTROL.—Bed composed of sand; channel shifting. Left bank subject to overflow at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 8.05 feet at 7.15 a.m. July 12 (discharge, 1,830 second-feet); minimum discharge, creek dry during parts of June, July, August, and September.

Maximum known stage, about 20.6 feet June 9, 1905 (discharge, about 15,000 second-feet). This flood was caused by the same storm which passed over the adjoining drainage area of Devil's Creek and caused the destructive flood in that stream.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined between 100 and 1,800 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table and by indirect method for shifting control during the low stages. Records fair except at extremely low stages when they are subject to considerable error.

COOPERATION.—Station maintained by the Mississippi River Power Co., Keokuk, Iowa.

Discharge measurements of Sugar Creek near Keokuk, Iowa, during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Mar. 29	Davis and Herlofson	1.51	86.5	July 12	C. Herlofson	6.06	1,010
Apr. 5	C. Herlofson	6.86	1,430	12	do	5.52	944
May 3	do	.81	6.6	12	do	4.94	761
July 11	Herlofson and Mercer	3.53	414	12	do	4.51	587
11	do	3.56	408	17	Spiegel and Herlofson	1.02	5.2

Daily discharge, in second-feet, of Sugar Creek near Keokuk, Iowa, for the year ending Sept. 30, 1922

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1		103	8.4	3.6	0.0	0.3	0.1
2		63	7.2	2.9	.0	.2	.0
3		52	7.2	2.1	.0	.1	.0
4		320	7.2	2.1	.0	.0	.0
5		590	6.0	.9	.0	.0	.0
6		360	8.4	.8	.0	.0	.0
7		301	7.2	.7	.0	.0	.0
8		340	4.8	.6	.0	.0	.0
9		360	7.2	.6	.0	.0	.0
10		249	7.2	.5	.0	.0	41
11		103	84	.4	540	.0	12
12		65	41	.4	980	.0	1.0
13		52	18	13	171	.0	.7
14		42	9.8	.7	67	.0	.5
15		46	15	.6	27	.0	.3
16		32	7.2	.5	7.8	.0	.2
17		249	9.8	.4	5.4	.0	.2
18		129	59	.3	3.0	11	.1
19		67	31	.2	1.2	.1	.2
20		48	22	.1	1.0	.0	.2
21		40	9.8	.0	.8	.0	.1
22		32	3.6	.0	.7	.0	.1
23		28	4.8	.0	.3	30	.1
24		26	7.2	.0	.3	2.2	.0
25		30	2.1	.0	.2	.6	.0
26		20	2.7	.0	.2	.5	.0
27		16	72	.0	.2	.5	.0
28		15	37	.0	.2	.3	.0
29	78	13	18	.0	.5	.1	.0
30	301	9.8	6.0	.0	1.0	.1	.0
31	157		4.8		.5	.2	

Monthly discharge of Sugar Creek near Keokuk, Iowa, for the year ending Sept. 30, 1922

[Drainage area, 113 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
April	590	9.8	127	1.12	1.25
May	84	4.8	17.3	.153	.18
June	13	.0	1.05	.009	.01
July	980	.0	58.3	.516	.59
August	30	.0	1.49	.013	.02
September	41	.0	1.90	.017	.02

FOX RIVER NEAR WAYLAND, MO.

LOCATION.—In NE. ¼ sec. 25, T. 65 N., R. 7 W., at highway bridge 1 mile above Chicago, Burlington & Quincy Railway bridge, 1½ miles below nearest highway bridge, 2½ miles northwest of Wayland, Clark County, 3 miles below Brush Creek, and 10 miles below Atchison, Topeka & Santa Fe Railway bridge.

DRAINAGE AREA.—392 square miles (measured on maps compiled by United States Geological Survey, scale, 1:500,000, and on topographic maps.)

RECORDS AVAILABLE.—February 22 to September 30, 1922.

GAGE.—Chain gage bolted to handrail on upstream side of bridge; read by Lewis Schaaf.

DISCHARGE MEASUREMENTS.—Made from upstream or downstream sides of bridge at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 11.00 feet at 6.10 a. m. July 12 (discharge, 2,400 second-feet); minimum stage 2.06 feet September 30 (discharge, 1.6 second-feet).

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 16 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good, except for extreme low stages, for which they are fair.

Discharge measurements of Fox River near Wayland, Mo., during the year ending September 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Feb. 22	Reginald Waldo	5.00	480	June 9	V. L. Austin	2.32	11.6
Apr. 15	V. L. Austin	3.50	120	July 28	E. L. Williams	2.39	14.6

Daily discharge, in second-feet, of Fox River near Wayland, Mo., for the period Feb. 22 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		145	336	47	54	3.6	480	10
2		100	220	50	33	5	171	8
3		93	171	47	66	3.8	93	8
4		114	690	43	47	3.6	57	15
5		190	750	39	31	5	31	10
6		281	870	38	22	5	27	8
7		270	960	56	18	3.6	15	6
8		162	1,340	39	14	3.4	11	3.2
9		137	1,940	55	12	3.0	6	3.8
10		230	1,730	36	12	3.8	4.5	60
11		1,180	1,020	153	9	1,050	4.0	50
12		870	406	70	8	2,330	4.0	42
13		690	314	54	10	1,500	3.4	23
14		2,160	200	40	16	1,020	3.2	13
15		1,570	162	29	10	270	3.4	10
16		690	190	23	8	130	3.4	8
17		358	870	66	6	81	3.2	6
18		250	930	68	8	1,080	16	5
19		605	382	52	6	990	67	6
20		580	180	37	5	250	44	3.8
21		430	114	26	4.0	100	40	3.4
22	480	240	93	22	6	66	31	3.6
23	1,340	162	79	20	5	46	100	3.0
24	1,630	145	69	107	4.0	34	480	2.6
25	870	162	76	145	4.0	27	690	2.2
26	210	382	72	130	3.6	20	292	1.9
27	153	336	74	260	3.4	17	162	1.8
28	93	358	67	83	3.6	14	92	1.8
29		358	52	122	3.4	14	31	1.8
30		605	47	80	4.0	38	21	1.6
31		455		67		137	16	

Monthly discharge of Fox River near Wayland, Mo., for the period Mar. 1 to Sept. 30, 1922

[Drainage area, 392 square miles]

Month.	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
March	2,160	93	462	1.18	1.36
April	1,940	47	480	1.22	1.36
May	260	20	67.9	.173	.20
June	66	3.4	14.5	.037	.04
July	2,330	3.0	299	.763	.88
August	690	3.2	96.8	.247	.28
September	60	1.6	10.8	.028	.03

WYACONDA RIVER NEAR CANTON, MO.

LOCATION.—In SE. ¼ SW. ¼ sec. 33, T. 62 N., R. 6 W., at highway bridge three-fourths mile below Sugar Creek, 2 miles below north road highway bridge, 3 miles southwest of Canton, Lewis County, and 15 miles above mouth of river.

DRAINAGE AREA.—447 square miles (measured on maps compiled by United States Geological Survey, scale 1 : 500,000, and on topographic maps).

RECORDS AVAILABLE.—February 20 to September 30, 1922.

GAGE.—Chain gage attached to wooden beam between vertical members on upstream side of highway bridge; read by Fred Schroeder.

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

CHANNEL AND CONTROL.—Bed composed of sand and silt, clean, shifting. No well-defined control. Station is only 15 miles above Mississippi River and may be affected by backwater from that river.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 11.66 feet at 6 p. m., March 14 (discharge, 3,270 second-feet); minimum discharge, 1.4 second-feet at 8 a. m. and 6.15 p. m. September 30.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice during the winter. Rating curve fairly well defined above 14 second-feet. Gage read to hundredths twice daily; readings fairly reliable. Daily discharge until July 13 ascertained by applying mean daily gage height to rating table except as noted in footnote to table of daily discharge; indirect method for shifting control used July 14 to September 30. Records fair.

Discharge measurements of Wyaconda River near Canton, Mo., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Feb. 20	Waldo and Austin	1.56	20.5	June 10	V. L. Austin	1.43	7.2
Apr. 14	V. L. Austin	2.47	164	July 27	E. L. Williams	1.49	21.9

Daily discharge, in second-feet, of Wyaconda River near Canton, Mo., for the period Feb. 20 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		28	540	42	36	2.8	218	15
2		70	278	37	36	3.2	135	14
3		54	218	35	34	3.2	175	15
4		61	1,440	32	30	2.4	103	58
5		154	1,480	32	26	1.6	28	28
6		278	1,720	35	22	1.7	29	21
7		265	1,130	29	19	1.9	14	13
8		186	1,130	29	15	1.9	5	12
9		124	1,410	32	11	2.0	8	16
10		154	1,440	30	7	2.4	6	590
11		1,070	890	26	4.8	980	5	230
12		1,100	465	25	5	2,510	4.4	127
13		740	218	23	4.8	2,950	6	47
14		2,990	175	20	4.4	2,390	5	30
15		2,910	175	17	4.0	770	5	23
16		1,440	135	18	3.2	164	6	14
17		540	1,070	17	4.8	144	6	19
18		302	1,380	17	3.6	66	4.4	13
19		490	710	19	4.0	118	6	8
20	20	800	278	20	278	440	82	8
21	131	390	154	21	94	207	60	5
22	710	241	112	19	36	74	56	4.0
23	830	164	93	14	18	66	57	8
24	1,200	82	75	49	8	31	70	6
25	830	196	75	340	6	25	154	3.2
26	315	1,010	74	196	5	25	144	3.0
27	131	515	74	164	4.0	20	135	2.4
28	66	465	66	164	3.6	13	89	1.5
29		680	57	109	2.8	14	54	1.6
30		1,270	44	58	3.6	16	34	1.4
31		830		37		253	19	

NOTE.—Discharge, June 4–10, interpolated; gage readings in error.

Monthly discharge of Wyaconda River near Canton, Mo., for the period Mar. 1 to Sept. 30, 1922

[Drainage area, 447 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
March	2,990	28	632	1.41	1.63
April	1,720	44	570	1.28	1.43
May	340	14	55.0	.123	.14
June	278	2.8	24.5	.055	.06
July	2,950	1.6	364	.814	.94
August	218	4.4	55.6	.124	.14
September	590	1.4	44.6	.100	.11

NORTH FABIUS RIVER AT MONTICELLO, MO.

LOCATION.—In SE. ¼ sec. 6, T. 61 N., R. 7 W., at highway bridge 1 mile south of Monticello, Lewis County, 1½ miles northeast of bridge over Middle Fabius River, and 22 miles above junction with Middle Fabius River.

DRAINAGE AREA.—452 square miles (measured on maps compiled by United States Geological Survey, scale, 1:500,000, and on topographic maps).

RECORDS AVAILABLE.—February 18 to September 30, 1922.

GAGE.—Chain gage attached to wood beam between vertical members on upstream side of bridge; read by Floyd Nelson.

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

CHANNEL AND CONTROL.—Bed composed of rock, sand, and silt; clean and fairly permanent. Control is a coarse gravel bar 1½ miles below gage; clean and fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 18.60 feet at 4 p. m. July 13 (discharge, 4,500 second-feet); minimum stage, 0.52 foot at 4.30 p. m. July 9 (discharge, 1 second-foot).

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined above 12 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table or by indirect method for shifting control. Records fair.

Discharge measurements of North Fabius River at Monticello, Mo., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Feb. 18	Waldo and Austin	1.02	20.3	June 10	V. L. Austin	0.88	11.7
Apr. 19	V. L. Austin	3.53	451	July 27	E. L. Williams	1.17	22.0

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Daily discharge, in second-feet, of North Fabius River at Monticello, Mo., for the period Feb. 18 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		39	415	104	66	2	360	27
2		58	283	92	53	22	104	22
3		51	253	80	39	10	52	35
4		54	784	75	35	8	33	360
5		168	1,310	70	33	6	24	313
6		360	1,670	80	22	4	19	210
7		253	1,420	69	19	3	15	155
8		155	1,370	65	15	2	10	182
9		104	1,780	66	12	1	8	142
10		168	1,690	64	10	635	7	298
11		1,290	740	53	7	2,060	6	415
12		762	396	49	6	3,060	6	189
13		360	238	45	5	4,120	5	70
14		1,720	210	43	5	1,040	4	29
15		2,700	196	39	5	268	3	22
16		806	162	33	4	142	3	19
17		396	1,500	30	3	104	2	13
18	20	328	1,140	33	2	2,170	2	16
19	33	698	378	40	3	989	2	32
20	28	896	224	35	76	182	238	52
21	129	475	189	33	116	92	168	34
22	313	283	162	26	37	49	142	23
23	942	238	136	26	15	41	635	20
24	1,240	224	136	80	8	34	873	17
25	298	535	148	268	5	25	515	16
26	189	677	142	475	3	22	210	13
27	116	495	129	396	2	14	48	10
28	92	595	122	298	3	12	27	7
29		595	92	155	3	10	16	5
30		698	110	80	3	11	12	4
31		656		92		828	20	

Monthly discharge of North Fabius River at Monticello, Mo., for the period Feb. 18 to Sept. 30, 1922

[Drainage area, 452 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
February 18–28	1,240	20	309	0.684	0.28
March	2,700	39	543	1.20	1.38
April	1,780	92	584	1.29	1.44
May	475	26	99.8	.221	.25
June	116	2	20.5	.045	.05
July	4,120	1	515	1.14	1.31
August	873	2	115	.254	.29
September	415	4	91.7	.203	.23

SALT RIVER NEAR NEW LONDON, MO.

LOCATION.—In NE. ¼ NW. ¼ sec. 36, T. 56 N., R. 5 W., at highway bridge on Hannibal-New London road 1¼ miles below Turkey Creek, 1½ miles above St. Louis & Hannibal Railway bridge, 2 miles north of New London, Ralls County, and 8 miles above Spencer Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 16 to September 30, 1922.

GAGE.—Chain gage attached to handrail on upstream side of bridge; read by D. W. Lundberg.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge at gage or by wading 1 mile below gage.

CHANNEL AND CONTROL.—Bed composed of sand and silt; clean and fairly permanent. Control is a gravel bar 200 feet below gage; clean; fairly permanent.

EXTREMES OF STAGE.—Maximum stage recorded during period of record, 24.15 feet at 5 p. m. March 16; minimum stage, 1.38 feet at 7 a. m. August 21.

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

REGULATION.—None.

ACCURACY.—Rating curve not developed. Gage read to hundredths twice daily. Records excellent.

Discharge measurements of Salt River near New London, Mo., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Feb. 16	Waldo and Austin	2.00	125	June 10	V. L. Austin	2.30	102
Apr. 13	V. L. Austin	6.65	3,490	11	do	2.25	87.9

Daily gage height, in feet, of Salt River near New London, Mo., for the period Feb. 16 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		2.91	16.00	3.15	2.92	1.86	2.10	1.92
2		2.84	9.90	3.10	2.85	1.97	2.08	1.90
3		2.80	6.25	3.10	2.78	2.08	2.09	2.53
4		2.51	6.95	2.97	2.66	1.98	2.51	2.97
5		2.49	10.50	2.85	2.57	1.95	2.16	2.99
6		2.43	13.98	3.50	2.49	1.92	2.05	2.56
7		2.40	12.70	6.02	2.41	1.93	2.16	2.36
8		3.05	16.90	4.45	2.35	1.94	2.06	2.29
9		3.91	18.58	3.58	2.26	1.97	1.97	2.23
10		3.74	16.00	3.05	2.10	2.03	1.96	4.99
11		5.74	12.32	3.30	2.04	2.16	1.95	9.54
12		6.82	8.78	3.10	1.97	2.97	1.88	8.12
13		6.00	6.91	2.80	1.90	5.28	1.79	5.26
14		16.01	10.74	2.76	1.94	7.22	1.75	3.86
15		21.96	15.60	2.38	1.91	7.13	1.73	3.22
16	2.00	24.04	10.71	2.41	1.88	6.86	1.69	2.90
17	1.94	18.74	13.98	2.48	1.85	6.16	1.65	2.73
18	1.89	9.52	18.96	2.40	1.82	4.68	1.56	2.58
19	1.90	6.85	14.21	2.36	1.80	3.24	1.44	2.40
20	1.89	5.36	7.54	2.33	1.79	4.28	1.37	2.47
21	1.88	5.60	5.50	2.30	1.79	4.43	1.45	2.80
22	2.01	5.17	4.38	2.27	1.82	3.93	2.11	2.91
23	3.06	4.62	3.95	2.28	1.83	3.16	2.68	2.99
24	4.88	4.78	3.68	2.33	1.84	2.78	3.09	2.79
25	5.10	6.75	3.72	2.31	1.72	2.63	2.91	2.56
26	4.31	14.35	4.48	2.76	1.61	2.50	2.62	2.37
27	3.88	14.15	4.76	3.82	1.66	2.42	2.33	2.24
28	3.38	10.12	3.90	4.15	1.90	2.36	2.27	2.13
29		9.80	3.68	4.02	1.91	2.29	2.13	2.08
30		12.00	3.45	3.64	1.86	2.15	2.00	2.01
31		16.40		3.40		2.13	1.93	

CUIVRE RIVER NEAR TROY, MO.

LOCATION.—In SW. ¼ sec. 18. T. 49 N., R. 1 E., at Frenchman Bluff highway bridge, 1½ miles above Sugar Creek, 3 miles northeast of Troy, Lincoln County, 4 miles below West Fork, 10 miles above Big Creek, and 38 miles above mouth of river.

DRAINAGE AREA.—908 square miles (measured on topographic maps).

RECORDS AVAILABLE.—February 15 to September 30, 1922.

GAGE.—Chain gage attached to handrail on upstream side of bridge; read by C. D. Barrett.

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

CHANNEL AND CONTROL.—Bed composed of silt, sand, and gravel; clean except for drift. Left bank high and rocky; right bank wooded; subject to overflow at extremely high stages. Control is a coarse gravel bar 300 feet below gage; clean except for brush growing on exposed part; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 23.90 feet at 4 p. m. March 14 (discharge, 24,900 second-feet); minimum stage, 1.32 feet at 7 p. m. August 11 (discharge, 6 second-feet).

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water in March; not affected by ice. Rating curve well defined between 25 and 18,000 second-feet and extended above and below these limits. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except from February 15 to March 13 when indirect method for shifting control was used. Records good.

Discharge measurements of Cuivre River near Troy, Mo., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft*
Feb. 15	Waldo and Austin	2.11	86.4	April 12	V. L. Austin	10.46	4,630
Apr. 10	V. L. Austin	11.93	6,180	June 12	do	1.95	29.5
11	do	18.96	16,700				

Daily discharge, in second-feet, of Cuivre River near Troy, Mo., for the period Feb. 15 to Sept. 30, 1922

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		139	9,640	318	52	33	32	48
2		139	2,200	275	46	46	23	11
3		121	3,300	289	44	48	16	262
4		77	2,980	249	42	26	12	103
5		188	10,500	211	40	21	10	121
6		1,040	2,500	4,650	38	21	8	54
7		773	4,290	1,660	37	20	8	48
8		412	22,900	463	40	17	7	29
9		275	17,600	303	35	15	7	23
10		236	8,540	412	32	15	6	535
11		1,340	17,300	236	32	16	6	613
12		733	2,820	223	29	15	7	289
13		363	1,540	236	27	14	7	139
14		23,200	14,700	177	25	14	7	100
15	74	19,300	13,000	148	24	14	7	37
16	77	2,140	2,200	130	20	14	6	32
17	72	1,040	17,400	121	19	14	9	139
18	67	693	4,290	114	18	22	42	139
19	67	11,700	1,660	91	19	19	16	139
20	69	2,020	945	103	18	15	13	121
21	74	855	733	94	14	14	11	100
22	62	613	573	80	16	24	14	14
23	157	463	499	82	15	11	13	12
24	900	348	463	85	14	10	303	11
25	813	333	1,090	72	14	10	13	9
26	275	8,280	900	67	13	9	40	9
27	211	2,580	613	62	13	8	26	8
28	114	1,540	499	85	12	7	22	7
29		1,540	429	67	11	7	15	7
30		11,000	363	60	11	8	14	7
31		18,000		56		77	363	

Monthly discharge of Cuivre River near Troy, Mo., for the period Feb. 15 to Sept. 30, 1922

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
February 15–28	900	62	217	0.239	0.14
March	23,200	77	3,600	3.96	4.56
April	22,900	363	5,550	6.11	6.82
May	4,650	56	362	.399	.46
June	52	11	25.7	.028	.03
July	77	7	19.5	.021	.02
August	363	6	34.9	.038	.04
September	613	7	106	.117	.13

ILLINOIS RIVER AT MORRIS, ILL.

LOCATION.—In sec. 9, T. 33 N., R. 7 E. third principal meridian, at highway bridge in Morris, Grundy County, 7 miles below station formerly maintained near Minooka and 10 miles below mouth of Kankakee River.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—October 1, 1919, to September 30, 1922. January 1, 1903, to December 14, 1904, records were obtained at station near Minooka.

GAGE.—Chain gage attached to bridge installed March 1, 1916, by United States Weather Bureau; read by employee of United States Weather Bureau. A staff gage at practically the same site and datum was read once daily under the direction of United States Engineer Corps, December 10, 1899, to November 30, 1900, and April 20, 1903, to December 11, 1904.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Channel sandy. Dam at Marseilles, 16 miles below gage, forms control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 20.1 feet April 12 (discharge, 60,600 second-feet); minimum stage, 5.9 feet August 21, 25, and 28 (discharge, 9,000 second-feet).

1919–1922: Maximum stage recorded, that of 1922; minimum stage, 5.2 feet August 9, 1920 (discharge, 7,600 second-feet).

A discharge of 67,800 second-feet occurred at 8 a. m. March 26, 1904, at station near Minooka.

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

REGULATION.—The flow at this station includes the flow from the Chicago drainage canal. Operation of power plants at Lockport and Joliet above gage and at Marseilles below gage causes a considerable diurnal fluctuation at low and medium stages.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 8,000 and 50,000 second feet, and extended beyond these limits. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for medium and high stages, fair for low stages.

COOPERATION.—Gage-height record furnished by United States Weather Bureau.

Discharge measurements of Illinois River at Morris, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Apr. 6	Grosbach and Kane	15.48	36,800
13	Grosbach and Blanchard	17.90	48,500

Daily discharge, in second-feet, of Illinois River at Morris, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9,860	11,400	16,100	13,400	11,000	13,100	42,500	16,900	16,900	10,100	10,100	9,860
2	10,500	11,900	19,500	12,900	11,000	13,400	45,500	16,700	15,400	11,000	9,640	9,640
3	9,860	11,900	22,200	12,400	10,800	12,900	44,000	15,800	14,600	10,800	9,860	9,860
4	10,100	11,400	21,400	12,200	11,700	12,900	42,000	15,800	14,400	10,800	9,860	9,640
5	9,860	11,400	20,400	19,000	12,900	12,200	40,000	15,600	13,800	10,300	10,100	9,640
6	10,800	11,900	19,800	17,200	11,900	12,400	37,500	14,800	13,400	10,100	10,300	9,860
7	10,500	11,400	18,700	17,200	11,900	12,400	34,600	13,600	13,100	10,100	9,640	10,100
8	10,300	11,200	17,700	18,000	11,900	12,200	31,400	13,100	12,600	9,640	9,860	9,860
9	11,400	11,900	17,200	16,400	11,700	12,400	29,300	13,100	12,600	10,100	9,420	9,640
10	10,300	11,400	16,400	15,600	11,200	12,400	27,200	12,600	12,400	9,860	9,420	10,500
11	10,800	11,900	16,100	15,100	11,400	13,800	36,500	12,400	12,200	10,500	9,420	10,300
12	11,200	11,900	15,400	13,100	12,200	18,500	60,600	12,900	12,200	11,200	9,860	10,500
13	11,200	11,900	15,400	13,800	11,700	18,500	53,400	12,600	11,200	10,500	10,100	10,100
14	10,800	12,200	15,400	12,900	11,200	19,300	44,500	14,400	11,000	10,800	9,640	9,860
15	10,800	12,400	14,800	13,400	11,700	21,700	40,000	14,100	11,000	10,500	10,100	10,100
16	11,000	11,700	14,800	12,600	10,800	22,800	36,500	13,400	10,800	11,200	10,100	9,860
17	10,800	11,900	19,000	12,200	11,000	22,800	33,400	13,100	10,800	11,200	9,200	9,860
18	11,000	12,600	24,900	11,900	10,800	22,500	32,200	13,100	10,800	10,100	9,640	9,640
19	11,400	14,800	26,900	11,900	11,200	22,200	31,400	14,100	11,000	10,300	9,640	10,300
20	10,800	22,500	23,300	11,400	10,800	26,300	30,600	14,600	10,800	10,100	10,100	10,500
21	11,200	23,900	22,000	11,900	10,800	29,000	29,300	14,800	10,300	10,100	9,000	10,300
22	10,500	24,100	19,800	11,000	11,700	27,200	27,500	14,100	10,300	9,860	9,420	10,100
23	10,500	24,400	18,700	10,500	14,600	26,000	24,900	13,600	10,300	9,860	9,420	9,860
24	9,860	23,900	18,000	15,100	15,800	24,900	22,800	13,800	10,500	10,500	9,860	10,100
25	9,640	22,200	16,400	20,100	16,700	23,100	21,700	15,800	10,100	9,860	9,000	9,420
26	9,860	20,100	15,400	18,700	15,800	24,100	20,900	16,900	10,500	9,860	9,420	9,860
27	10,100	19,500	14,400	16,700	15,100	25,500	20,100	18,700	9,860	9,860	9,640	9,860
28	9,860	18,200	14,400	14,400	15,100	23,900	19,300	22,200	9,860	9,860	9,000	9,860
29	9,860	17,400	14,100	13,100	-------	23,600	18,500	20,900	9,860	9,860	9,640	10,300
30	11,000	16,900	13,100	10,500	-------	24,100	17,400	19,300	10,100	10,100	9,640	9,640
31	10,800	-------	14,100	10,500	-------	30,600	-------	18,500	-------	9,640	9,420	-------

Monthly discharge of Illinois River at Morris, Ill., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	11,400	9,640	10,500
November	24,400	11,200	15,300
December	26,900	13,100	17,900
January	20,100	10,500	14,000
February	16,700	10,800	12,300
March	30,600	12,200	19,900
April	60,600	17,400	33,200
May	22,200	12,400	15,200
June	16,900	9,860	11,800
July	11,200	9,640	10,300
August	10,300	9,000	9,660
September	10,500	9,420	9,960
The year	60,600	9,000	15,000

ILLINOIS RIVER AT PEORIA, ILL.

LOCATION.—In sec. 2, T. 8 N., R. 8 E., at foot of Grant Street, Peoria, Peoria County, 3½ miles above station formerly maintained at Peoria & Pekin Union Railroad bridge, and 4½ miles above mouth of Kickapoo Creek.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—March 8, 1910, to September 30, 1922; also March 10, 1903, to July 21, 1906, for station at Peoria & Pekin Union Railroad bridge.

GAGE.—Vertical staff gage attached to wooden pile; read by employee of United States Army Engineers.

DISCHARGE MEASUREMENTS.—Made from downstream side of Lower Free Bridge, 2 miles below gage.

CHANNEL AND CONTROL.—Bed of river, which forms control for medium and high stages, composed of mud; may shift. Dam at Copperas Creek probably forms control for lowest stages; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 24.80 feet April 15 to 17 (discharge, 56,700 second-feet); minimum stage, 9.70 feet September 1, 3, 6, and 7 (discharge, 9,580 second-feet).

1903–1906; maximum discharge recorded, 57,600 second-feet March 28 and 29, 1904; minimum discharge recorded, 6,170 second-feet July 18, 19, and 20, 1906.

1910–1922: Maximum stage recorded, that of 1922; minimum discharge somewhat less than 7,250 second-feet during period December 11, 1916, to January 10, 1917.

The highest known flood occurred in 1844, when a stage of about 26.6 feet on the present gage was reached.

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

REGULATION.—The flow at this station includes the water diverted from Lake Michigan through the Chicago Drainage Canal. No diurnal fluctuation is noticeable.

ACCURACY.—Stage-discharge relation practically permanent at low stages, but has changed at high water since last previous high-water measurements made in 1920, caused by construction of levees bordering channel below gage, changes apparently occurred prior to October 1, 1921. Rating curve used October 1 to March 13 and May 26 to September 30 well defined; during flood period rating curve used March 14 to April 17 well defined above and fairly well defined below 45,000 second-feet, curve used April 18 to May 25 fairly well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except for period April 18 to May 25 for which they are fair.

COOPERATION.—Gage-height record furnished by United States Engineer Corps. Measurements in cooperation with United States Public Health Service.

Discharge measurements of Illinois River at Peoria, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Apr. 7	Grosbach and Kane	23.01	48,700	May 12	Williams and Durnell	16.67	23,800
15	Williams [a] and Durnell	24.80	56,700	20	L. G. Williams	15.06	20,100
May 5	do	18.73	28,200				

[a] L. G. Williams, engineer, United States Public Health Service.

Daily discharge, in second-feet, of Illinois River at Peoria, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	12,500	13,900	22,500	22,200	17,000	17,500	35,600	34,700	22,200	12,000	10,600	9,58
2	12,900	13,300	23,400	21,800	17,000	17,200	38,400	33,200	22,000	12,100	10,600	9,58
3	12,900	13,300	24,300	21,000	16,800	17,000	41,600	32,100	21,500	12,100	10,600	9,58
4	12,900	13,100	24,900	21,000	16,800	17,000	44,400	30,700	21,000	11,800	10,600	9,72
5	12,500	13,700	25,800	21,500	16,500	16,800	46,400	29,400	20,500	11,500	10,400	9,72
6	12,500	13,300	26,100	22,000	16,500	16,300	48,000	28,200	20,000	11,400	10,300	9,58
7	13,100	13,700	26,700	22,500	16,300	17,000	48,800	27,900	19,500	11,000	10,300	9,58
8	12,700	13,700	26,400	22,500	16,100	17,200	49,200	26,800	19,000	11,400	10,400	9,72
9	12,500	14,300	26,100	22,800	15,900	17,000	46,800	25,800	18,500	11,000	10,300	9,72
10	12,900	13,300	25,800	23,100	16,100	17,500	48,400	25,000	18,000	11,200	10,300	10,30
11	12,700	13,700	25,500	23,400	16,100	17,800	48,400	24,500	17,500	11,600	10,000	10,60
12	12,700	13,700	25,200	22,800	16,100	17,500	50,400	23,800	17,500	11,800	10,200	10,40
13	12,500	13,700	24,900	22,200	15,700	18,000	53,000	23,000	16,800	11,800	10,200	10,40
14	12,500	13,900	24,300	21,500	15,300	19,500	55,700	22,200	16,500	11,800	10,200	10,30
15	12,500	13,700	23,700	20,800	15,100	20,000	56,700	21,700	16,300	12,000	10,000	10,60
16	12,500	14,100	23,100	20,500	14,900	21,200	56,700	21,100	15,700	11,800	10,000	10,60
17	12,500	14,100	23,100	20,000	14,500	22,400	56,700	20,600	15,700	11,800	10,000	10,40
18	12,900	14,300	23,400	19,500	14,300	23,000	55,600	20,600	15,300	11,800	10,000	10,40
19	12,900	14,900	24,300	19,200	14,500	23,900	52,000	20,200	14,900	11,800	10,000	10,30
20	13,300	15,100	25,500	18,800	14,700	25,200	51,400	19,700	14,900	11,600	9,860	10,60
21	13,100	16,100	26,700	18,500	14,500	26,200	50,800	19,500	14,500	11,500	9,720	10,40
22	12,900	18,000	26,700	18,200	14,700	27,200	48,500	19,300	14,100	11,200	9,720	10,40
23	13,100	19,000	26,700	18,000	14,900	28,300	46,500	19,000	13,500	11,400	10,000	10,30
24	12,900	20,200	27,000	18,000	15,900	29,700	45,100	18,800	13,300	11,400	9,860	10,40
25	13,100	21,000	25,800	18,000	16,100	29,700	43,900	18,600	13,300	11,200	10,200	10,30
26	13,100	22,000	25,500	17,500	16,500	31,100	42,700	19,000	12,900	11,200	9,860	10,30
27	12,900	22,500	24,900	17,500	17,000	31,400	41,500	20,500	12,700	11,000	9,860	10,20
28	12,900	22,800	24,300	17,200	17,500	31,800	39,500	20,800	12,700	10,900	9,720	10,20
29	12,900	22,000	23,700	17,000	------	32,600	37,500	21,500	12,500	10,800	9,720	10,20
30	13,100	22,500	23,100	17,000	------	33,200	35,900	21,800	12,100	10,900	9,720	10,00
31	13,300	------	22,500	17,000	------	34,600	------	22,000	------	10,600	9,720	------

Monthly discharge of Illinois River at Peoria, Ill., for the year ending Sept. 30, 192

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	13,300	12,500	12,80
November	22,800	13,100	16,10
December	26,700	22,500	24,90
January	23,400	17,000	20,10
February	17,500	14,300	15,80
March	34,600	16,300	23,10
April	56,700	35,600	47,20
May	34,700	18,600	23,60
June	22,200	12,100	16,50
July	12,100	10,600	11,50
August	10,600	9,720	10,10
September	10,600	9,580	10,10
The year	56,700	9,580	19,30

ILLINOIS RIVER AT HAVANA, ILL.

LOCATION.—In sec. 1, T. 21 N., R. 9 W., at highway bridge in Havana, Mason County, half a mile below mouth of Spoon River.

DRAINAGE AREA.—Prior to January 17, 1900, 17,200 square miles; since that date increased by diversion from St. Lawrence River basin through the Chicago Drainage Canal.

RECORDS AVAILABLE.—October 1, 1921, to September 30, 1922. Gage readings October, 1878, to May, 1881, January, 1896, to December, 1904, published in House Document No. 263, Fifty-ninth Congress; gage readings since December, 1904, in files of United States Engineer Corps.

GAGE.—Vertical staff gage attached to pile 30 feet downstream from draw pier of bridge.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Channel sandy and somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.4 feet April 20 (discharge, 65,000 second-feet); minimum stage, 7.2 feet August 31 to September 10 (discharge, 9,720 second-feet). Maximum stage recorded since 1844, that of April 20, 1922.

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

REGULATION.—Flow at this station includes the flow of the Chicago Drainage Canal.

ACCURACY.—Stage-discharge relation practically permanent at low stages; probably affected by backwater when high stages occur in Sangamon River. Rating curve used October 1 to March 13 and May 23 to September 30 well defined above 10,000 second-feet and extended below this limit; rating curve used March 14 to May 22 fairly well defined. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for low and medium stages; fair for high stages.

COOPERATION.—Gage-height record furnished by United States Engineer Corps Measurements made by United States Public Health Service.

Discharge measurements of Illinois River at Havana, Ill., during the year ending Sept. 30, 1922

[Made by L. G. Williams.[a]]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Apr. 6	18.98	48,400	May 16	14.31	28,200	June 8	12.60	23,800
17 and 18	22.26	63,500	17	14.13	27,400	29	9.66	14,900
29	20.28	49,200	25	12.78	24,100			
May 9	16.44	35,600	25	12.77	23,700			

[a] Engineer, United States Public Health Service.

Daily discharge, in second-feet, of Illinois River at Havana, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14,000	14,000	24,600	26,600	19,300	19,600	40,100	46,400	25,200	14,500	11,500	9,720
2	13,700	14,000	25,600	25,600	19,300	19,600	41,300	44,800	25,200	14,500	11,300	9,720
3	14,000	14,200	26,600	25,200	19,600	19,300	42,500	43,300	24,900	14,200	11,100	9,720
4	14,000	14,200	27,300	25,200	19,600	19,300	42,900	42,200	24,900	14,000	10,900	9,720
5	13,700	14,200	27,600	26,600	19,000	19,300	45,300	40,800	24,900	13,500	10,700	9,720
6	13,700	14,200	28,000	26,600	19,000	19,300	47,700	39,500	24,600	13,200	10,700	9,720
7	13,700	14,200	28,300	26,600	19,000	19,300	49,700	38,500	23,900	13,200	10,700	9,720
8	13,700	14,200	28,300	26,200	19,000	19,600	48,500	37,200	23,600	13,000	10,600	9,720
9	13,700	14,200	28,300	26,200	18,700	19,600	50,900	36,200	23,700	12,500	10,600	9,720
10	13,700	14,200	28,300	26,200	18,400	19,600	52,200	34,600	22,700	12,300	10,600	9,720
11	13,700	14,200	28,300	26,200	18,400	19,900	50,100	34,000	22,000	12,300	10,400	11,100
12	13,700	14,200	28,000	26,200	18,400	20,500	53,000	32,700	21,700	13,700	10,400	12,300
13	13,700	14,200	27,600	25,900	18,100	20,800	54,700	31,800	21,100	14,200	10,200	12,100
14	13,500	14,200	27,600	25,900	18,100	22,000	57,000	30,800	21,100	14,700	10,200	11,700
15	13,500	14,200	27,600	26,200	17,800	23,000	59,500	29,800	20,800	14,700	10,200	10,900
16	13,500	14,200	27,300	25,600	17,500	24,000	61,100	29,200	20,500	14,200	10,000	10,700
17	13,200	14,500	26,900	24,600	17,200	25,000	63,500	28,000	19,900	14,200	10,000	10,600
18	13,700	14,700	26,600	23,900	16,900	26,100	64,200	27,700	19,300	14,200	9,880	10,600
19	13,700	15,600	26,600	23,000	16,600	26,800	63,500	27,100	19,000	13,700	9,880	10,600
20	13,700	16,100	26,900	23,000	16,400	28,300	65,000	26,500	18,700	13,500	9,880	10,600
21	14,000	16,400	27,600	23,000	16,600	29,800	61,000	25,900	18,100	13,000	9,880	10,600
22	14,000	17,200	28,000	22,000	18,400	31,000	59,000	25,000	17,500	12,800	9,880	10,600
23	14,000	18,100	28,300	22,000	19,600	31,700	58,200	24,900	17,200	12,300	9,880	10,600
24	14,000	19,300	28,300	22,000	19,900	32,500	57,500	24,600	16,400	12,300	9,880	10,600
25	13,700	19,900	28,300	22,000	19,900	33,700	56,800	24,300	16,400	12,100	10,000	10,600
26	13,700	21,100	28,300	22,000	19,600	35,300	54,800	23,900	15,800	12,100	10,200	10,400
27	13,500	22,300	28,000	21,700	19,300	36,100	53,200	24,300	15,800	11,900	9,880	10,400
28	13,500	23,000	27,600	21,700	19,300	36,900	51,200	24,600	15,300	11,700	9,880	10,400
29	13,500	24,300	27,600	20,200	-------	37,300	49,800	24,900	15,000	11,500	9,880	10,400
30	13,500	24,600	27,300	19,900	-------	37,700	48,000	24,900	14,700	11,500	9,880	10,400
31	13,700	-------	26,600	19,900	-------	38,500	-------	24,900	-------	11,500	9,720	-------

Monthly discharge of Illinois River at Havana, Ill., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	14,000	13,200	13,700
November	24,600	14,000	16,500
December	28,300	24,600	27,500
January	26,600	19,900	24,100
February	19,900	16,400	18,500
March	38,500	19,300	26,200
April	65,000	40,100	53,400
May	46,400	23,900	31,400
June	25,200	14,700	20,300
July	14,700	11,500	13,100
August	11,500	9,720	10,300
September	12,300	9,720	10,400
The year	65,000	9,720	22,100

ILLINOIS RIVER AT BEARDSTOWN, ILL.

LOCATION.—In sec. 15, T. 18 N., R. 12 W., at highway bridge on State Street, Beardstown, Cass County, 9½ miles below mouth of Sangamon River.

DRAINAGE AREA.—Prior to January 17, 1900, 23,445 square miles; since that date the natural run-off increased by diversion from St. Lawrence River basin through the Chicago Drainage Canal.

RECORDS AVAILABLE.—October 1, 1920, to September 30, 1922. Gage read October 28, 1878, to May 30, 1881, November 9, 1881, to June 26, 1884, January 5, 1885, to June 30, 1891, by employees of United States Engineer Corps, and July 1, 1891, to September 30, 1922, by employees of United States Weather Bureau; gage height records 1878 to 1904 published in House Document No. 263, 59th Congress, since 1904 in annual reports of United States Weather Bureau.

GAGE.—Vertical staff gage attached to pile on inside of cribbing 40 feet above center span of bridge; read by employee of United States Weather Bureau.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and mud. Control at low and medium stages formed by LaGrange dam 11 miles downstream, probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 25.1 feet April 20 (discharge, 109,000 second-feet); minimum stage, 8.0 feet September 3 to 10 (discharge, 10,700 second-feet). Maximum stage, subsequent to 1844, that of April 20, 1922; on April 4, 1904, discharge was determined by United States Engineer Corps as 115,000 second-feet (gage height, 20.0 feet).

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

REGULATION.—The flow at this station includes the flow of the Chicago Drainage Canal. The stage at Beardstown is slightly affected, in occasional seasons of high water in the Mississippi by backwater from the latter stream, and occasionally by backwater from Crooked Creek which enters about 5 miles below Beardstown.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 10,000 and 36,700 second-feet, and fairly well defined between 36,700 and 70,000 second-feet. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for low and medium stages, fair for high stages.

COOPERATION.—Gage-height records furnished by United States Weather Bureau. Measurements in cooperation with United States Public Health Service.

Discharge measurements of Illinois River at Beardstown, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 2	L. G. Williams [a]	13.37	30,700	May 26	L. G. Williams	13.45	29,300
Apr. 3	H. E. Grosbach	19.62	51,300	July 26	H. E. Grosbach	8.87	13,600
8	L. G. Williams	22.00	67,800				

[a] Engineer United States Public Health Service.

Daily discharge, in second-feet, of Illinois River at Beardstown, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	15,800	15,400	29,100	31,400	17,600	22,400	53,800	71,800	30,600	16,200	12,900	11,100
2	15,800	15,400	30,200	31,400	19,100	22,100	55,200	69,000	30,600	16,200	12,500	11,100
3	15,800	15,000	31,400	31,000	19,100	22,100	56,600	67,200	30,200	15,800	12,500	10,700
4	15,400	15,000	32,100	29,900	18,700	21,700	57,500	64,200	30,200	15,800	12,500	10,700
5	15,400	15,000	32,500	32,500	20,200	21,300	59,500	61,500	29,900	15,400	12,500	10,700
6	15,400	14,700	32,900	32,500	21,000	20,600	63,600	60,000	29,500	15,000	12,500	10,700
7	15,400	14,700	32,900	32,900	21,300	20,600	67,800	58,000	29,100	14,700	12,100	10,700
8	15,800	14,300	32,900	32,900	21,300	20,600	69,700	55,600	28,400	14,300	11,800	10,700
9	16,200	14,300	32,900	32,900	21,300	21,700	69,700	53,800	27,600	14,300	11,400	10,700
10	16,200	14,300	32,900	32,900	21,300	22,800	71,800	52,000	26,900	13,900	11,100	10,700
11	15,400	15,000	32,900	32,500	21,300	22,100	71,800	50,200	26,100	13,900	11,100	11,800
12	15,000	15,400	32,500	32,100	21,300	22,400	73,900	48,400	25,800	14,300	11,400	13,200
13	15,000	15,000	32,100	31,800	21,000	23,200	77,000	46,700	25,000	15,800	11,400	12,500
14	14,700	15,000	31,800	31,000	19,800	25,400	73,900	45,000	24,700	16,900	11,400	13,200
15	14,700	14,700	31,400	30,200	19,500	29,100	89,600	43,800	23,900	17,600	11,400	12,500
16	14,300	14,700	31,000	29,500	19,100	31,000	98,600	42,200	23,600	17,600	11,400	12,100
17	14,300	14,700	30,600	29,500	18,400	32,500	92,900	40,600	22,800	17,300	11,100	11,800
18	15,400	14,300	30,600	28,000	17,600	34,000	92,900	39,400	22,100	16,500	11,100	11,400
19	15,800	16,500	30,200	27,200	18,000	35,900	103,000	37,900	21,700	15,800	11,100	11,400
20	15,800	17,300	30,200	26,100	18,000	38,600	109,000	36,700	21,000	15,400	11,100	11,400
21	15,400	18,000	30,200	24,300	18,000	41,400	94,700	35,900	20,200	15,000	11,100	11,400
22	15,000	19,100	29,900	22,400	20,200	43,400	98,600	34,400	19,800	14,700	11,100	11,400
23	14,700	19,800	30,600	21,700	21,300	44,600	98,600	33,300	19,100	14,300	11,400	11,400
24	14,700	21,300	31,400	21,000	23,600	45,400	96,600	32,100	18,700	14,300	11,400	11,400
25	14,300	22,800	31,400	19,800	24,300	46,700	92,900	31,400	18,400	13,900	11,400	11,400
26	14,300	23,900	31,400	18,000	23,900	48,800	88,100	30,600	18,000	13,600	11,400	11,400
27	14,300	25,400	31,800	16,200	23,200	50,200	85,200	30,600	17,300	13,600	11,400	11,400
28	14,300	26,500	32,100	16,900	22,400	50,600	81,600	31,000	16,900	13,200	11,400	11,400
29	14,700	27,600	32,500	17,600	-------	51,000	77,800	31,000	16,500	13,200	11,400	11,400
30	15,000	28,400	32,100	17,600	-------	51,500	74,600	31,900	16,200	13,200	11,100	11,100
31	15,000	-------	31,800	17,600	-------	52,400	-------	31,000	-------	12,900	11,100	-------

Monthly discharge of Illinois River at Beardstown, Ill., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	16,200	14,300	15,100
November	28,400	14,300	17,800
December	32,900	29,100	31,600
January	32,900	16,200	26,800
February	24,300	17,600	20,400
March	52,400	20,600	33,400
April	109,000	53,800	79,900
May	71,800	30,600	45,000
June	30,600	16,200	23,700
July	17,600	12,900	15,000
August	12,900	11,100	11,600
September	13,200	10,700	11,400
The year	109,000	10,700	27,600

KANKAKEE RIVER AT MOMENCE, ILL.

LOCATION.—In sec. 24, T. 31 N., R. 13 E., at highway bridge in Momence Kankakee County, half a mile below Chicago & Eastern Illinois Railroad bridge and 1½ miles above Tower Creek.

DRAINAGE AREA.—2,340 square miles.

RECORDS AVAILABLE.—February 24, 1905, to July 20, 1906; December 3, 1914, to September 30, 1922.

GAGE.—Chain gage attached to bridge over left channel; read by Henry Hanson.

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

CHANNEL AND CONTROL.—Bed composed of coarse gravel, somewhat shifting; river at gage divided into two channels by an island. Aquatic plants sometimes grow in bed of river during summer.

EXTREMES OF DISCHARGE.—Maximum open-water stage recorded during year, 5.48 feet April 12 (discharge, 9,650 second-feet); minimum stage, 1.48 feet September 9 (discharge, 342 second-feet). A stage of 5.83 feet occurred January 22 (discharge not determined because of backwater from ice).

1905–6 and 1915–1922: Maximum stage recorded, 7.75 feet January 4, 1919 (discharge not determined because of backwater from ice); maximum open-water stage, 6.4 feet January 22, 1916 (discharge estimated from extension of rating curve, 12,600 second-feet); minimum stage, 1.37 feet September 1, 16, and 17, 1919 (discharge, 306 second-feet).

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

ACCURACY.—Stage-discharge relation not permanent; changed slightly during winter; seriously affected by ice, slightly affected by vegetation in channel during October and May to September. Rating curve used October 1 to February 21 well defined between 400 and 3,000 second-feet; curve used February 22 to September 30 well defined between 335 and 6,500 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table with correction determined from results of discharge measurements during periods October 1–31 and May 16 to September 30 when there was vegetation in channel and as explained in footnote to table of daily discharge. Records good for open-water period and fair for winter.

Discharge measurements of Kankakee River at Momence, Ill., during the year ending Sept. 30, 1922

[Made by H. E Grosbach]

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Dec. 14	2.95	2,280	Apr. 10	4.24	5,780	Sept. 7	1.51	363
Mar. 9	2.47	1,540	June 22	2.00	879			

Daily discharge, in second-feet, of Kankakee River at Momence, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	640	1,030	2,770			1,590	6,850	5,670	2,200	820	530	380
2	640	1,090	2,770	1,960		1,590	6,850	5,380	2,200	878	580	380
3	690	1,150	2,970			1,520	6,850	5,100	2,200	820	560	388
4	640	1,220	2,970			1,590	6,850	4,820	2,100	820	520	402
5	640	1,220	2,970	2,570	2,200	1,520	6,550	4,270	2,010	765	500	388
6	640	1,220	2,770	2,970		1,520	6,250	4,000	1,920	710	491	372
7	745	1,220	2,770	2,570		1,520	6,250	3,480	1,840	710	540	365
8	910	1,150	2,770	2,380		1,520	5,960	2,980	1,750	655	520	358
9	855	1,280	2,570	2,200		1,590	5,960	2,740	1,670	655	491	342
10	855	1,090	2,570			1,590	5,670	2,620	1,520	655	473	350
11	800	1,090	2,570			1,920	9,650	2,400	1,440	765	464	372
12	910	1,090	2,570			2,300	9,650	2,300	1,300	765	446	388
13	910	1,090	2,380	1,750		2,510	8,690	2,100	1,300	765	455	402
14	571	1,150	2,290			2,620	8,690	2,010	1,170	765	437	402
15	800	1,150	2,290			2,980	8,690	1,920	1,170	710	437	395
16	910	1,150	2,200		1,150	3,230	8,370	1,840	1,110	710	395	380
17	970	1,220	2,380			3,230	8,050	1,750	1,050	655	410	372
18	970	1,220	2,770			2,980	8,050	1,750	992	655	410	372
19	910	1,620	2,770			3,230	7,750	1,840	992	600	402	372
20	855	2,030	2,970			4,820	7,450	1,840	935	600	419	388
21	1,030	2,380	2,770		1,440	4,820	7,150	1,840	878	655	395	395
22	970	2,570	2,770		1,670	4,820	6,850	1,840	878	655	380	410
23	910	2,570	2,770		1,840	4,820	6,550	1,840	878	655	402	402
24	910	2,380	2,770		1,840	4,540	6,550	1,920	820	655	395	395
25	855	2,380	2,770			4,270	6,550	2,100	820	600	550	372
26	855	2,380	2,570	1,550	1,750	4,270	6,250	2,510	765	590	520	380
27	800	2,380			1,670	4,270	6,250	2,980	765	560	455	372
28	855	2,570			1,670	4,270	6,250	2,860	765	590	428	380
29	855	2,570	2,350		-------	4,540	5,960	2,620	765	560	410	372
30	910	2,570			-------	4,540	5,670	2,400	765	550	395	372
31	970	-------			-------	5,960	-------	2,400	-------	550	388	-------

NOTE.—Stage-discharge relation affected by ice Dec. 27 to Jan. 4 and Jan. 10 to Feb. 21. Discharge estimated from gage heights, weather records, observer's notes, and gage heights on Kankakee River at Custer Park, Ill. Braced figures show mean discharge for periods indicated.

Monthly discharge of Kankakee River at Momence, Ill., for the year ending Sept. 30, 1922

[Drainage area, 2,340 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,030	571	832	0.356	0.41
November	2,570	1,030	1,640	.701	.78
December	2,970	2,200	2,620	1.12	1.29
January	----------	----------	1,830	.782	.90
February	----------	1,440	1,820	.778	.81
March	5,960	1,520	3,110	1.33	1.53
April	9,650	5,670	7,100	3.03	3.38
May	5,670	1,750	2,780	1.19	1.37
June	2,200	765	1,300	.556	.62
July	878	550	681	.291	.34
August	580	380	458	.196	.23
September	410	342	381	.163	.18
The year	9,650	342	2,040	.872	11.84

KANKAKEE RIVER AT CUSTER PARK, ILL.

LOCATION.—In sec. 19, T. 32 N., R. 10 E., at Wabash Railroad bridge in Custer Park, Will County, half a mile above Horse Creek and 15 miles below dam and power plant at Kankakee.

DRAINAGE AREA.—4,870 square miles.

RECORDS AVAILABLE.—November 6, 1914, to September 30, 1922.

GAGE.—Chain gage, attached to bridge; read by J. H. Swords.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of solid rock strewn with boulders and gravel; right half of channel deep with fissures in bed; left half shallow; vegetation grows during summer.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.05 feet at 4 p. m. April 11 (discharge, 31,200 second-feet); minimum stage, 4.85 feet at 4 p. m. September 29 (discharge, 385 second-feet).

1914–1922: Maximum stage recorded, that of April 11, 1922; minimum stage, 4.09 feet November 15, 1914 (discharge, 250 second-feet).

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Operation of power plant at Kankakee causes slight fluctuation at gage.

ACCURACY.—Stage-discharge relation not permanent, changed slightly during year by growth of vegetation in channel; affected by ice for short periods. Rating curve used October 1 to November 30, curve used December 1 to May 31, and curve used June 1 to September 30, are fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records good for medium stages, fair for high and low stages during open water; poor for ice periods.

Discharge measurements of Kankakee River at Custer Park, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Nov. 3	5.93	1,680
Mar. 10	6.72	3,180
July 21	5.36	805

Daily discharge, in second-feet, of Kankakee River at Custer Park, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	940	1,340	5,650			3,350	20,800	7,880	4,630	1,000	770	580
2	1,060	1,410	6,170	7,000		3,150	22,700	7,290	3,900	1,130	880	580
3	1,130	1,640	6,440			2,760	23,100	7,000	3,440	1,000	670	620
4	1,130	1,720	6,440	7,290		2,950	22,300	6,720	3,010	1,000	770	580
5	880	1,640	6,720	7,880		2,760	20,800	6,170	2,800	1,000	720	580
6	880	1,560	6,170	9,410	4,100	2,760	19,700	5,400	2,610	880	770	540
7	940	1,480	5,650	10,700		2,760	17,500	4,910	2,420	820	770	540
8	1,060	1,480	5,400	9,100		2,950	15,700	4,440	2,240	770	770	500
9	1,130	1,480	4,910	7,580		3,150	14,700	3,990	2,060	770	770	500
10	1,270	1,410	4,670			3,150	14,000	3,770	2,060	770	720	540
11	1,410	1,410	4,670			4,210	30,200	3,560	1,890	1,130	670	580
12	1,410	1,340	4,440			5,650	27,400	3,350	1,720	1,000	670	540
13	1,340	1,410	3,990			7,000	24,700	3,150	1,640	1,130	670	500
14	1,130	1,410	3,990			8,480	23,500	3,150	1,560	1,270	670	540
15	880	1,410	3,770	3,750		11,300	22,300	3,150	1,480	1,270	620	540
16	1,000	1,480	3,560		2,300	12,300	20,100	2,950	1,410	1,130	620	540
17	1,060	1,720	3,990			12,600	20,100	2,760	1,340	1,000	580	540
18	1,000	2,060	5,910			12,300	20,100	2,950	940	1,000	580	500
19	1,130	5,130	6,720			12,000	20,400	3,150	1,200	940	580	500
20	940	9,410	7,000			15,000	20,100	3,150	1,200	1,000	620	500
21	940	11,300	7,000			14,600	18,600	3,150	1,200	880	580	500
22	1,130	12,600	6,170		3,150	14,300	16,800	2,950	1,060	880	580	500
23	1,000	12,300	5,650		5,150	14,000	14,700	2,950	1,000	1,000	580	540
24	940	11,300	5,400		7,000	12,600	13,000	3,350	1,000	880	580	580
25	880	9,720	5,150		5,650	11,600	12,000	3,560	1,000	880	580	500
26	880	8,480	4,910	2,300	5,150	10,400	10,700	4,670	940	880	670	484
27	880	7,580	4,670		4,440	9,720	10,700	8,180	880	820	670	444
28	880	7,000	4,210		3,560	9,410	10,000	8,790	940	770	620	420
29	1,000	6,440	5,400		-------	10,400	9,100	8,480	880	820	620	392
30	770	5,900	6,170		-------	10,700	8,480	7,290	940	770	540	392
31	1,130	-------	5,650		-------	15,700	-------	5,910	-------	770	580	-------

NOTE.—Stage-discharge relation affected by ice Dec. 30 to Jan. 3 and Jan. 10 to Feb. 21, discharge estimated from gage-height record, observer's notes, and climatic record. Braced figures indicate mean discharge for period included.

Monthly discharge of Kankakee River at Custer Park, Ill., for the year ending Sept. 30, 1922

[Drainage area, 4,870 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,410	770	1,040	0.214	0.25
November	12,600	1,340	4,490	.922	1.03
December	7,000	3,560	5,380	1.10	1.27
January	10,700	----------	4,500	.924	1.07
February	7,000	----------	3,590	.737	.77
March	15,700	2,760	8,520	1.75	2.02
April	30,200	8,480	18,100	3.72	4.15
May	8,790	2,760	4,780	.982	1.13
June	4,630	880	1,780	.366	.41
July	1,270	770	947	.194	.22
August	880	540	661	.136	.16
September	620	392	520	.107	.12
The year	30,200	392	4,520	.928	12.60

DES PLAINES RIVER AT LEMONT, ILL.

LOCATION.—In sec. 20, T. 37 N., R. 11 E., at concrete highway bridge at Stephens Street, a quarter of a mile north of main section of Lemont, Cook County, and 8 miles above junction of Des Plaines River and Chicago Drainage Canal.

DRAINAGE AREA.—705 square miles.

RECORDS AVAILABLE.—November 4, 1914, to September 30, 1922.

GAGE.—Staff gage attached to bridge; read by William Weck, jr.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge and by wading below dam.

CHANNEL AND CONTROL.—A concrete dam, forming a new control and changing the former stage-discharge relation, was built across the channel 500 feet below the gage August 20, 1916; permanent except for slight repairs in August, 1920.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.7 feet December 19 (discharge, 3,540 second-feet); minimum stage, 2.43 feet on January 27 (discharge, 1 second-foot).

1915–1922: Maximum stage recorded, 6.6 feet February 16, 1918 (discharge not determined because of backwater from ice). Maximum open-water stage, 6.5 feet March 18, 1919 (discharge, 5,520 second-feet); minimum discharge, no flow, occurred September 7, 8, 14–21, and 24–27, 1919, and July 25–31, 1921.

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

DIVERSIONS.—During extremely high stages part of flow spills over into the Chicago Drainage Canal at Willow Springs 7 miles above the station.

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 50 and 5,500 second-feet; fairly well defined below 50 second-feet. Gage read to quarter-tenths once daily and twice a week during winter. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium and high stages, fair for low stages.

The following discharge measurement was made by H. E. Grosbach:

October 21, 1921: Gage height, 3.18 feet; discharge, 362 second-feet.

Daily discharge, in second-feet, of Des Plaines River at Lemont, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept
1	212	500	745	835	a 62	a 420	2,620	301	180	25	31	18
2	212	524	1,080	700	93	500	2,790	280	180	31	48	2
3	212	524	1,300	620	a 106	460	2,620	259	150	31	60	4
4	180	460	2,310	540	120	422	2,310	245	150	31	68	4
5	150	385	2,040	1,190	a 120	422	2,170	245	150	18	93	4
6	150	350	1,780	1,190	120	350	2,040	280	150	6	60	2
7	120	350	1,540	1,540	120	245	1,910	280	120	6	48	2
8	120	350	1,300	1,300	117	180	1,910	350	120	18	68	2
9	120	385	1,140	1,080	114	315	2,040	385	68	18	93	2
10	120	880	980	700	111	460	2,310	315	48	25	68	18
11	120	930	980	745	108	1,300	3,150	301	48	31	68	93
12	150	980	880	790	105	1,780	2,620	345	48	40	48	108
13	150	980	835	600	102	1,480	2,460	212	31	48	31	93
14	150	880	790	450	99	1,030	2,310	180	31	68	18	78
15	150	835	700	400	96	1,030	2,310	150	31	68	6	68
16	150	790	1,080	350	93	880	1,910	150	48	93	12	68
17	150	835	2,170	300	a 93	980	1,660	180	48	120	18	68
18	180	980	2,970	250	93	1,480	1,300	180	48	68	18	60
19	212	1,420	3,540	200	a 93	1,600	1,080	212	48	68	18	48
20	245	1,600	2,970	100	93	1,420	980	212	48	60	10	37
21	315	2,040	2,310	18	a 93	1,300	930	212	48	68	6	31
22	315	1,780	2,170	a 12	93	1,080	790	212	40	68	6	31
23	245	1,600	2,040	6	a 106	880	660	212	31	120	6	25
24	245	1,300	1,780	a 4	120	790	620	120	31	93	25	18
25	245	1,080	1,660	2	a 150	700	500	150	6	68	18	18
26	212	1,030	1,600	a 2	180	1,190	460	315	6	68	6	12
27	212	880	1,600	1	260	1,420	422	385	18	60	10	12
28	212	790	1,540	a 7	340	1,540	385	350	18	48	25	18
29	245	745	1,540	12	-------	1,910	350	315	18	31	18	18
30	245	700	1,480	26	-------	2,170	315	315	18	31	6	18
31	385	-------	1,030	31	-------	2,310	-------	245	-------	18	25	-------

a Gage not read, discharge interpolated.

NOTE.—Stage-discharge relation affected by ice Jan. 13-20, Feb. 7-15, and 27-28. Discharge estimated from gage heights, observer's notes, and weather records. Discharge estimated Jan. 30 because of no gage-height record.

Monthly discharge of Des Plaines River at Lemont, Ill., for the year ending Sept. 30, 1922

[Drainage area, 705 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	385	120	198	0.281	0.32
November	2,040	350	896	1.27	1.42
December	3,540	700	1,610	2.28	2.63
January	1,540	1	452	.641	.74
February	340	62	121	.172	.18
March	2,310	180	1,030	1.46	1.68
April	3,150	315	1,600	2.27	2.53
May	385	120	251	.356	.41
June	180	6	66.0	.094	.10
July	120	6	49.9	.071	.08
August	93	6	33.4	.047	.05
September	108	2	32.7	.046	05
The year	3,540	1	530	.752	10.19

DES PLAINES RIVER AT JOLIET, ILL.

LOCATION.—In NE. ¼ sec. 9, T. 35 N., R. 10 E., at Jackson Street Bridge, Joliet, Will County, 1,200 feet upstream from Cass Street Bridge.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—December 4, 1914, to September 30, 1922; on original chain gage September 5 to December 19, 1914.

GAGE.—Gurley 7-day water-stage recorder installed December 3, 1914. Chain gage attached to upstream side of bridge at Cass Street read from September 5 to December 19, 1914.

DISCHARGE MEASUREMENTS.—Made from upstream side of Cass Street Bridge.

CHANNEL AND CONTROL.—Channel excavated in solid rock, with a concrete wall on either side; permanent.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during days of record for the year, 14,400 second-feet, April 1–3, and 11; minimum mean daily discharge 7,040 second-feet, February 5.

1914–1922: Maximum mean daily discharge during days of record, 18,400 second-feet, March 18, 1919; minimum mean daily discharge, 5,420 second-feet, April 25, 1915.

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

REGULATION.—Flow past the gage is largely regulated by the operation of the power plant of the Chicago Sanitary District at Lockport, which utilizes the flow of the Chicago Drainage Canal and, to a lesser extent, by the operation of the Economy Light & Power Co.'s plant, about 100 feet above gage.

DIVERSIONS.—Water is diverted to the Illinois and Michigan canal at Dam No. 1 about 100 feet above the gage.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of the water-stage recorder satisfactory except as explained in footnote to table of daily discharge. Daily discharge ascertained by discharge integrator. Records excellent, except for a few short periods when recording gage was not operating, for which records are fair.

The following discharge measurement was made by H. E. Grosbach:

September 21, 1922: Gage height 4.08 feet; discharge measured at Ruby Street Bridge, 800 feet above gage, 7,710 second-feet. This includes flow of Illinois and Michigan Canal estimated at 400 second-feet.

Daily discharge, in second-feet, of Des Plaines River at Joliet, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7,520	10,300	[a] 9,500	8,520	8,370	9,050	[a] 14,400	7,740	9,600	[a] 8,750	8,440	8,820
2	7,540	9,950	[a] 10,000	8,340	[a] 7,800	[a] 8,900	14,400	8,070	9,800		8,480	[a] 8,800
3	8,260	9,080	10,700	8,720	[b] 7,700	[a] 9,000	14,400	8,000	9,730	[b] 8,800	8,300	
4	8,370	9,080	11,200	9,280	[a] 7,600	7,900	12,600	8,230	9,660		8,620	
5	8,430	[a] 9,100	11,100	9,360	7,040	8,860	[a] 13,300	8,340	9,360	[a] 8,750	8,390	[b] 8,800
6	8,780		11,000	[b] 9,400	8,590	8,490	[a] 12,000	7,470	9,660	8,720	8,560	
7	8,540		10,400	[a] 9,500	8,360	8,600	11,200	7,220	[a] 9,570	8,930	8,750	[a] 8,900
8	8,660		10,300	9,470	8,050	8,640	10,600	8,060	[a] 9,650	8,640	8,340	8,810
9		[b] 9,500	10,300	9,390	8,020	8,580	10,300	8,300	9,800	8,980	8,080	8,690
10			9,790	9,120	8,280	8,880	11,000	8,500	9,320	8,640	8,040	9,200
11	[b] 8,700		9,480	9,220	[a] 8,200	10,500	14,400	8,600	9,830	8,940	8,370	9,540
12		[a] 10,500	9,680	[a] 9,000	[a] 8,200	10,300	12,900	8,560	9,800	8,500	8,540	9,120
13		10,200	9,880		8,160	10,400	12,600	9,920	9,200	8,960	8,220	9,350
14	[a] 8,800	10,200	9,760		8,660	10,000	11,200	9,760	8,650	8,540	8,910	9,220
15	8,700	9,560	9,620	[b] 8,900	8,510	9,980	9,500	9,250	9,000	9,040	8,980	9,310
16	9,190	9,300	10,000		8,570	9,500	9,510	9,100	8,700	9,820	8,450	8,120
17	9,050	9,760	12,100		[a] 8,250	9,060	10,100	9,170	9,260	9,000	8,240	8,800
18	10,100	9,740	12,800	[a] 8,900		9,560	9,800	9,420	10,100	8,960	8,620	9,440
19	9,260	[a] 10,000	13,200	[a] 8,400		[a] 9,000	8,620	9,040	9,320	8,500	8,200	[a] 9,160
20	9,460	[a] 10,000	12,600			[a] 10,400	[a] 8,300	9,070	9,050	8,600	7,680	[b] 8,800
21	9,080	[b] 10,000			[b] 8,500	10,200	[b] 7,900	9,780	9,160	8,560	8,500	[a] 8,500
22	8,590	[b] 10,000	[b] 11,000			10,100	[a] 7,500	9,300	8,880	8,000	8,420	8,960
23	8,570	[b] 10,500		[b] 8,250		9,470	[a] 7,500	9,220	9,250	8,380	8,630	8,700
24	8,580	10,200	[a] 10,000			9,480	8,010	9,480	[a] 8,920	8,550	8,220	8,170
25	8,960	9,770			[a] 8,800	[a] 9,000	7,970	9,900	[b] 8,900	8,670	8,280	9,180
26	8,840	[a] 9,800	[b] 9,900		8,840		[a] 7,700	9,740	[a] 8,670	[a] 8,640	7,760	8,860
27	8,790			[a] 8,250	8,780		[b] 7,550	10,100	8,680	[b] 8,500	7,640	8,820
28	8,640	[b] 9,700	[a] 9,800	[a] 8,100	8,850	[b] 11,500	[a] 7,400	10,400	8,820	[b] 8,500	8,240	8,930
29	[a] 9,000		9,560	8,090	-------		[a] 7,100	9,190	8,560	[a] 8,300	8,260	8,590
30	9,640	[a] 9,500	8,780	8,100	-------		7,190	10,500	8,730	8,260	8,460	7,780
31	9,340	-------	8,100	8,290	-------		-------	9,860	-------	8,600	8,540	-------

[a] Discharge partly estimated because of incomplete gage record.
[b] No record, discharge estimated; braced figures indicate mean discharge for period included.

NOTE.—Daily discharge in the above table does not include the flow in the Illinois and Michigan Canal (see "Diversions" in the station description).

Monthly discharge of Des Plaines River at Joliet, Ill., for the year ending Sept. 30, 1922

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
October	10,100	7,520	8,780
November	10,500	9,080	9,750
December	13,200	8,100	10,400
January	9,500	8,090	8,700
February	8,850	7,040	8,330
March		7,900	9,770
April	14,400	7,100	10,200
May	10,500	7,220	9,010
June	10,100	8,560	9,250
July	9,820	8,000	8,700
August	8,980	7,640	8,360
September	9,540	7,780	8,860
The year	14,400	7,040	9,180

FOX RIVER AT ALGONQUIN, ILL.

LOCATION.—In NW. ¼ sec. 34, T. 43 N., R. 8 E. third principal meridian, at Chicago Street Bridge in Algonquin, McHenry County, 100 feet above Public Service Co.'s dam and 500 feet above Crystal Lake outlet.

RECORDS AVAILABLE.—October 1, 1915, to September 30, 1922.

DRAINAGE AREA.—1,340 square miles (measured on map of United States Geological Survey; scale, 1:500,000).

GAGE.—Enamel staff gage attached to concrete abutment of bridge; read by Edward Pedersen.

CHANNEL AND CONTROL.—Control is a concrete dam 100 feet below gage; permanent since August, 1919.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge and by wading below dam.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.04 feet at 6 p. m. April 15 (discharge, 2,820 second-feet); minimum stage, 0.86 foot August 31 and September 1 (discharge, 111 second-feet).

1916–1922: Maximum stage recorded, 5.3 feet March 31, 1916 (discharge 7,120 second-feet); minimum stage, 0.59 foot August 31, 1918 (discharge, 67 second-feet).

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

REGULATION.—Grist mill at dam runs on average of about 4 hours a day except Sundays during September to March, inclusive, and one day a week during remainder of year. Effect of operation of mill on gage heights is appreciable only at low stages and gage is usually read when mill is not running.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above and fairly well defined below 400 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good for medium and high stages, fair for low stages.

The following discharge measurement was made by H. E. Grosbach:
August 14, 1922: Gage height, 1.00 foot; discharge, 189 second-feet.

Daily discharge, in second-feet, of Fox River at Algonquin, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,370	1,510	1,650	1,580	750	2,420	2,100	1,510	570	291	245	111
2	1,370	1,440	1,650	1,510	750	2,580	2,260	1,370	530	275	245	123
3	1,370	1,440	1,720	1,440	695	2,580	2,580	1,230	512	260	230	123
4	1,370	1,440	1,880	1,440	695	2,750	2,750	1,100	464	245	230	135
5	1,370	1,440	1,950	1,370	640	2,750	2,580	1,040	445	230	215	135
6	1,370	1,370	1,950	1,370	640	2,580	2,580	980	445	215	215	148
7	1,370	1,370	2,100	1,440	620	2,420	2,580	920	436	200	208	168
8	1,370	1,370	1,950	1,440	600	2,260	2,580	860	436	200	200	194
9	1,370	1,370	1,950	1,510	580	2,260	2,580	805	427	194	200	222
10	1,370	1,370	1,880	1,580	560	2,100	2,580	805	427	436	194	275
11	1,300	1,370	1,880	1,580	540	2,100	2,580	750	427	454	194	339
12	1,300	1,370	1,800	1,510	521	1,950	2,580	640	418	418	187	382
13	1,300	1,440	1,800	1,510	502	1,950	2,750	610	418	382	187	373
14	1,300	1,440	1,800	1,440	492	1,950	2,750	580	418	347	187	355
15	1,300	1,440	1,720	1,370	483	1,950	2,750	570	409	315	194	355
16	1,230	1,510	1,800	1,300	483	1,950	2,750	560	409	283	187	339
17	1,230	1,510	1,800	1,300	502	1,880	2,750	560	409	252	187	347
18	1,300	1,510	1,800	1,230	502	1,880	2,580	560	418	260	187	355
19	1,300	1,580	1,880	1,230	512	1,800	2,580	550	427	268	180	355
20	1,370	1,650	1,880	1,230	530	1,800	2,580	550	427	275	180	373
21	1,440	1,650	1,950	1,230	570	1,800	2,420	540	418	283	174	373
22	1,580	1,650	1,950	1,160	620	1,720	2,420	540	409	291	168	391
23	1,650	1,650	2,100	1,160	695	1,800	2,420	540	409	299	161	391
24	1,720	1,720	2,100	1,100	805	1,800	2,260	521	391	307	154	409
25	1,720	1,650	1,950	1,100	1,040	1,800	2,260	512	373	299	148	409
26	1,720	1,650	1,880	1,040	1,300	1,880	2,260	560	355	291	142	427
27	1,650	1,650	1,800	980	1,580	1,950	2,100	640	355	291	135	409
28	1,650	1,650	1,800	920	1,950	1,950	2,100	695	339	275	129	382
29	1,580	1,650	1,720	920	-------	1,950	1,950	695	323	275	123	347
30	1,580	1,580	1,720	860	-------	2,100	1,720	640	307	260	117	315
31	1,510	-------	1,650	805	-------	2,100	-------	610	-------	260	111	-------

Monthly discharge of Fox River at Algonquin, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,340 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,720	1,230	1,430	1.07	1.23
November	1,720	1,370	1,510	1.13	1.26
December	2,100	1,650	1,850	1.38	1.59
January	1,580	805	1,280	.955	1.10
February	1,950	483	720	.537	.56
March	2,750	1,720	2,090	1.56	1.80
April	2,750	1,720	2,460	1.84	2.05
May	1,510	512	743	.554	.64
June	570	307	418	.312	.35
July	454	194	288	.215	.25
August	245	111	181	.135	.16
September	427	111	302	.225	.25
The year	2,750	111	1,110	.828	11.24

FOX RIVER AT WEDRON, ILL.

LOCATION.—In sec. 9, T. 34 N., R. 4 E., at highway bridge in Wedron, La Salle County, 1,000 feet above Buck Creek.

DRAINAGE AREA.—2,500 square miles.

RECORDS AVAILABLE.—November 5, 1914, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by Charles Davis.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge.

CHANNEL AND CONTROL.—Bed of river at measuring section is soft and probably shifts. Control 1,000 feet downstream composed of coarse gravel and large boulders; practically permanent; affected at times by growth of aquatic plants.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.1 feet January 7 due to ice jam, maximum open-water stage 11.0 feet at 6 p. m. April 11 (discharge, 8,400 second-feet); minimum stage, 5.48 feet at 6 p. m. September 6 (discharge, 149 second-feet).

1915–1922: Maximum stage recorded, 17.22 feet January 22, 1916 (discharge not determined because of backwater from ice). Maximum open-water stage, 14.2 feet March 26, 1920 (discharge, 17,900 second-feet). Minimum discharge, 105 second-feet, November 20, 1914 (measured by current meter).

REGULATION.—Slight diurnal fluctuation is caused by operation of power plants at and above Aurora.

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

ACCURACY.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined above and fairly well defined below 400 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium and high stages, fair for low stages during open water; winter records poor.

Discharge measurements of Fox River at Wedron, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Oct. 20	7.65	1,750
Feb. 9	[a] 8.03	898
Apr. 4	9.60	4,950
July 19	6.30	557

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Fox River at Wedron, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,690	1,930	2,600			2,060	6,330	2,060	1,160	390	315	268
2	1,570	1,810	5,390			2,600	5,620	1,930	1,020	390	445	232
3	1,570	1,690	5,620			3,390	5,170	1,930	980	365	445	222
4	1,690	1,690	4,750			3,570	5,170	1,810	860	365	390	245
5	1,570	1,690	3,940			3,060	4,960	1,690	785	340	390	166
					{1,100							
6	1,460	1,570	3,750			2,600	4,750	1,570	785	340	365	153
7	1,460	1,570	3,390			2,460	4,750	1,360	750	390	340	232
8	1,570	1,810	3,220			2,320	4,140	1,260	715	390	290	245
9	1,460	2,060	3,060			2,460	4,340	1,260	680	365	315	245
10	1,360	1,930	3,060			2,750	5,170	1,160	615	340	390	1,020
11	1,460	1,930	2,900			4,960	7,860	1,160	555	365	390	615
12	1,460	1,930	2,750			4,140	7,080	1,160	472	1,020	365	365
13	1,460	1,930	2,750			3,220	5,850	1,070	445	1,160	340	390
14	1,360	1,810	2,750			2,900	5,390	980	585	1,070	290	472
15	1,360	1,930	2,600			2,750	4,960	785	555	860	245	418
				{2,200	750							
16	1,360	1,810	2,750			2,750	4,750	900	555	680	340	472
17	1,260	1,810	6,090			2,600	4,340	820	528	615	340	418
18	1,370	1,930	7,340			2,460	4,340	900	500	500	315	365
19	1,690	2,750	5,390			2,460	3,940	940	472	528	315	365
20	1,690	3,390	4,750			3,570	3,570	900	445	500	315	615
21	1,690	2,900	3,940			3,220	3,570	860	555	445	268	528
22	1,690	2,900	2,750			2,750	3,570	785	528	445	222	528
23	1,810	2,600	3,060			2,600	3,390	940	500	418	204	472
24	1,810	2,460	2,900		{1,300	2,460	3,220	900	472	445	315	390
25	1,930	2,320	2,460			2,460	3,060	1,070	472	500	340	418
26	1,930	2,320	2,460			2,900	3,060	4,140	418	500	290	390
27	1,810	2,190			2,060	3,390	2,900	3,570	390	528	268	528
28	1,810	2,190			2,900	3,220	2,600	2,600	445	418	245	528
29	1,810	2,190	{2,300		-------	4,340	2,460	1,570	418	472	218	528
30	1,810	2,060			-------	4,750	2,320	1,360	445	445	222	528
31	1,810	-------			-------	6,830	-------	1,160	-------	390	290	-------

NOTE.—Stage-discharge relation affected by ice Dec. 27 to Feb. 26; discharge estimated from gage heights, one discharge measurement, observer's notes, and weather records. Braced figures indicate mean discharge for periods included.

Monthly discharge of Fox River at Wedron, Ill., for the year ending Sept. 30, 1922

[Drainage area, 2,500 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,930	1,260	1,610	0.644	0.74
November	3,390	1,570	2,100	.840	.94
December	7,340	----------	3,480	1.39	1.60
January	----------	----------	2,200	.880	1.01
February	2,900	----------	1,120	.448	.47
March	6,830	2,060	3,160	1.26	1.45
April	7,860	2,320	4,420	1.77	1.98
May	4,140	785	1,440	.576	.66
June	1,160	390	604	.242	.27
July	1,160	340	515	.206	.24
August	445	204	317	.127	.15
September	1,020	153	412	.165	.18
The year	7,860	153	1,790	.716	9.69

VERMILION RIVER NEAR STREATOR, ILL.

LOCATION.—In sec. 1, T. 30 N., R. 3 E. third principal meridian, at highway bridge known as Bridge No. 3, 1½ miles south of Streator, La Salle County and 100 feet below Santa Fe Railway bridge.

DRAINAGE AREA.—1,080 square miles.

RECORDS AVAILABLE.—July 27, 1914, to September 30, 1922.

GAGE.—Chain gage attached to highway bridge; read by Andrew Gall.

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

CHANNEL AND CONTROL.—Channel composed of gravel and rocks. Brush and timber growing on banks above low-water stages. Control loose rocks at low stages, shifts occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.8 feet April 11 (discharge, 12,400 second-feet); minimum stage, 0.5 foot August 17, 28, and September 1 (discharge, 0.4 second-foot).

1914–1922: Maximum stage recorded, 22.9 feet April 20, 1920 (discharge, 16,500 second-feet); minimum discharge, no flow, August 25–28 and September 16–30, 1920.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent, changed slightly during summer and affected by ice during winter. Rating curve used October 1 to May 31 and curve used June 1 to September 30 well defined above and fairly well defined below 700 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium and high stages; fair for low stages; winter records poor.

Discharge measurements of Vermilion River near Streator, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Oct. 20	2.05	111
Apr. 4	11.35	5,420
July 20	1.47	26.4

Daily discharge, in second-feet, of Vermilion River near Streator, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	310	26	1,100	340		430		820	560	65	3	0.4
2	355	50	2,710	280		525	6,500	700	460	51	2	.6
3	400	123	2,270	370		460		665	370	39	2	.6
4	220	105	1,250	1,250	550	400	5,400	630	340	39	2	1
5	195	101	1,200	1,750		400	5,080	595	250	34	1	.6
6	170	97	1,150	1,600		430	4,760	560	195	29	1	.6
7	220	89	1,100	1,150	460	400	4,440	490	220	29	2	1
8	235	82	1,020	370	400	400	3,640	430	170	21	1.5	1
9	280	89	860	355	370	400	3,340	400	145	12	1	3
10	250	105	740		310	560	3,880	370	122	51	.6	2
11	220	114	700		250	2,390	12,400	370	81	900	1	1
12	220	123	630		310	2,090	7,370	340	73	340	2	1
13	145	102	595		340	2,030	5,930	340	81	122	1	.6
14	114	97	525		280	3,060	5,660	370	58	100	1	1
15	105	97	490	220	220	3,880	5,840	340	18	65	.6	1
16	97	89	490		220	3,720	4,920	325	122	15	.6	.6
17	82	560	595		145	3,130	4,040	310	145	51	.4	.6
17	114	665	1,600		145	2,570	3,410	400	170	39	.6	.6
19	105	1,150	1,800		235	2,920	3,270	400	134	39	.6	1
20	109	3,200	1,550		265	5,000	2,640	400	122	29	.6	.6
21	89	3,130	1,400		340	3,640	2,150	460	145	21	1	.6
22	82	2,710	1,200		1,600	2,640	1,750	400	100	15	1	.6
23	82	2,510	1,100		2,030	1,650	1,500	400	100	29	1	.6
24	82	2,390	1,060		1,500	2,390	1,250	460	73	21	.6	.6
25	75	1,700	1,100		1,200	2,090	1,300	490	65	10	1	.6
26	68	1,400	1,060	110	900	4,120	1,450	1,350	51	8.5	1	.6
27	62	1,150	665		700	2,640	1,400	2,210	51	7	.6	.6
28	56	740	490		560	2,510	1,200	1,500	39	3	.4	1
29	50	940	460		-------	2,450	1,020	1,100	39	2	.6	.6
30	44	860	430		-------	4,760	900	980	51	3	.6	.6
31	39	-------	400		-------	5,500	-------	780	-------	2	.6	-------

NOTE.—Stage-discharge relation affected by ice Jan. 10 to Feb. 6; discharge estimated from gage heights and weather records. Braced figures show mean discharge for periods indicated. Discharge interpolated November 5, 11, and April 5; estimated by comparison with flow of Mackinaw River Apr. 1–3.

Monthly discharge of Vermilion River near Streator, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,080 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	400	39	151	0.140	0.16
November	3,200	26	820	.759	.85
December	2,710	400	1,020	.944	1.09
January	1,750		358	.331	.38
February	2,030	145	574	.531	.55
March	5,500	400	2,240	2.07	2.39
April	12,400	900	3,980	3.69	4.12
May	2,210	310	625	.579	.67
June	560	18	152	.141	.16
July	900	2	70.7	.065	.07
August	3	.4	1.06	.00098	.001
September	3	.4	.84	.00078	.0009
The year	12,400	.4	831	.769	10.44

MACKINAW RIVER NEAR GREEN VALLEY, ILL.

LOCATION.—In sec. 15, T. 23 N., R. 5 W., at Chicago & Northwestern Railway bridge 3 miles north of Green Valley, Tazewell County.

DRAINAGE AREA.—1,100 square miles (measured on United States Geological Survey map; scale, 1:500,000).

RECORDS AVAILABLE.—March 9, 1921, to September 30, 1922.

GAGE.—Chain gage attached to guard rail on downstream side of bridge; read by John Eggena. Temporary staff gage on old crib near left bank 40 feet above bridge used March 9–27, 1921.

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

CHANNEL AND CONTROL.—No well-defined control, channel is sandy and probably shifting; may be affected by backwater at high stages of Illinois River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.11 feet April 2 (discharge, 6,690 second-feet); minimum stage, 0.87 foot September 28–30 (discharge, 30 second-feet).

1921–1922: Maximum stage recorded, that of April 2, 1922; minimum stage, that of September 28–30, 1922.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 25 and 5,500 second-feet and extended above. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for low and medium stages, fair for high stages.

Discharge measurements of Mackinaw River near Green Valley, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Nov. 19	L. G. Williams [a]	5.39	1,930	Mar. 20	L. G. Williams	6.56	2,840
Dec. 6	do	4.83	1,380	31	do	8.89	5,000
Mar. 16	do	7.45	3,760	July 25	H. E. Grosbach	1.33	68

[a] Engineer, United States Public Health Service.

Daily discharge, in second-feet, of Mackinaw River near Green Valley, Ill. for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	298	200	730	440	325	325	6,560	1,140	730	147	60	42
2	685	190	2,710	310	515	285	6,680	950	595	260	60	40
3	515	272	2,980	298	1,210	340	6,560	1,210	515	272	56	40
4	440	248	2,100	890	1,210	370	5,000	1,010	515	190	70	40
5	370	210	1,560	3,890	595	370	3,560	950	440	172	65	38
6	298	190	1,420	1,860	515	340	4,220	950	422	147	60	37
7	298	172	1,210	1,280	370	355	4,110	950	388	132	56	35
8	475	172	950	1,070	325	325	3,360	830	355	124	56	34
9	475	181	890	780	298	310	2,980	730	340	117	52	34
10	405	190	830	730	272	310	2,710	730	310	110	52	40
11	355	190	780	640	310	555	5,840	595	298	94	48	38
12	340	190	685	555	272	1,210	6,440	830	298	155	48	35
13	260	190	640	475	190	1,350	6,440	640	298	164	48	34
14	235	200	640	405	248	2,890	5,960	685	422	164	46	37
15	210	210	555	475	235	4,220	5,600	640	475	147	46	35
16	181	222	475	475	222	3,670	5,000	640	355	132	46	33
17	200	272	1,140	325	235	2,980	4,440	685	298	97	46	33
18	210	370	2,180	388	248	2,020	4,000	640	285	91	46	33
19	325	1,940	1,940	422	190	2,020	3,460	780	235	85	48	33
20	248	2,890	1,630	340	190	2,710	2,800	640	222	85	48	33
21	222	3,160	1,420	260	340	3,360	2,440	595	200	85	48	33
22	181	2,620	1,070	310	2,800	3,160	2,020	515	190	75	52	33
23	181	1,780	950	298	1,700	2,100	1,860	475	181	75	52	33
24	172	1,560	950	260	1,490	1,780	1,630	475	172	70	48	33
25	172	1,350	730	260	830	1,630	1,630	515	164	70	46	31
26	164	1,140	555	260	685	2,100	1,780	685	147	65	45	31
27	155	1,070	595	235	555	2,890	1,700	830	147	65	45	31
28	147	950	555	235	440	2,440	1,630	1,210	147	65	45	30
29	181	830	555	222	-------	2,530	1,420	1,210	147	65	45	30
30	200	780	440	210	-------	2,980	1,280	1,010	147	70	43	30
31	222	-------	475	222	-------	5,240	-------	830	-------	65	43	-------

Monthly discharge of Mackinaw River near Green Valley, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,100 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	685	147	285	0.259	0.30
November	3,160	172	798	.725	.81
December	2,980	440	1,110	1.01	1.16
January	3,890	210	607	.552	.64
February	2,800	190	601	.546	.57
March	5,240	285	1,840	1.67	1.92
April	6,680	1,280	3,770	3.43	3.83
May	1,210	475	793	.721	.83
June	730	147	315	.286	.32
July	272	65	118	.107	.12
August	70	43	50.6	.046	.05
September	42	30	34.6	.031	.03
The year	6,680	30	858	.780	10.58

SPOON RIVER AT SEVILLE, ILL.

LOCATION.—In sec. 24, T. 6 N., R. 1 E. fourth principal meridian, at Toledo, Peoria & Western Railway bridge a quarter of a mile east of railway station at Seville, Fulton County.

DRAINAGE AREA.—1,600 square miles.

RECORDS AVAILABLE.—July 24, 1914, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by R. M. Boales.

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

CHANNEL AND CONTROL.—A loose rock and timber dam 1½ miles below gage probably forms control at medium stages; at other stages control is clay and sand, somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.1 feet February 22 (discharge, 6,540 second-feet); minimum stage, 2.52 feet September 9 (discharge, 18 second-feet).

1914–1922: Maximum stage recorded, 26.0 feet January 23, 1916 (discharge not determined because of backwater from ice); maximum open-water stage recorded, 23.0 feet January 24, 1916 (discharge, 17,800 second-feet); minimum stage, 1.35 feet July 31 and August 27–29, 1914 (discharge, 3.8 second-feet).

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation changed after high water in April; affected by ice during short periods in winter. Rating curve used October 1 to April 15 and curve used April 16 to September 30 well defined between 25 and 3,000 second-feet and fairly well defined to 10,000 second-feet. Gage read to hundredths once daily and twice a week from January 1 to March 19. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for low and medium stages and fair for high stages during open-water period; poor for period of ice effect.

Discharge measurements of Spoon River at Seville, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Mar. 14	L. G. Williams [a]	8.04	2,380	Apr. 27	L. G. Williams	5.68	1,030
31	H. E. Grosbach	10.02	3,250	27	do	5.68	1,040

[a] Engineer, United States Public Health Service.

Daily discharge, in second-feet, of Spoon River at Seville, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	300	580	315			348	3,620	765	950	168	210	30
2	400	505	1,130			[a] 339	3,120	720	810	210	174	25
3	300	330	1,660	1,000		330	2,580	765	720	145	168	27
4	255	348	2,040			[a] 810	2,700	765	640	132	150	24
5	225	330	1,380			[a] 1,290	2,880	680	560	120	145	43
6	210	300	1,030	2,340	600	1,770	4,530	1,310	520	98	109	21
7	1,230	255	880	[a] 1,870		[a] 1,520	4,110	1,150	480	81	120	20
8	300	225	435	[a] 1,400		1,280	3,240	1,150	445	70	109	19
9	240	240	660	930		[a] 890	3,060	600	410	79	98	18
10	210	255	620	[a] 815		505	2,940	600	410	77	94	2,100
11	185	285	580	700		[a] 970	4,530	950	410	4,530	87	6,290
12	172	240	580	[a] 620		[a] 1,420	5,230	1,530	375	6,450	98	855
13	160	210	540	540		1,880	4,180	1,000	1,150	6,450	72	392
14	150	188	505	[a] 580		2,340	2,880	640	1,050	2,760	81	135
15	140	210	435	[a] 620	330	2,100	2,460	600	765	1,150	74	168
16	130	210	418	660		[a] 1,770	2,160	640	410	765	98	156
17	185	188	382	[a] 550		1,440	2,400	560	340	560	63	120
18	435	210	620	435		[a] 1,360	2,220	1,200	288	462	60	94
19	505	435	1,030			1,280	1,800	1,480	255	410	70	132
20	580	505	780			1,380	1,530	810	240	340	46	125
21	348	620	400			[a] 3,640	1,280	1,360	680	210	322	46	94
22	255	580	660			6,540	1,130	1,310	560	225	288	40	87
23	210	435	580			[a] 4,560	980	1,150	560	210	270	145	87
24	188	418	505			2,580	880	1,100	560	195	240	60	77
25	185	505			275	[a] 2,060	830	1,150	810	174	240	57	74
26	172	400				[a] 1,540	1,770	1,150	2,040	159	210	48	67
27	160	382	600			1,030	2,220	1,050	4,180	145	195	63	60
28	150	365				[a] 690	2,100	950	4,320	145	174	57	52
29	172	330				-------	2,100	855	1,800	145	195	52	48
30	255	315				-------	2,400	810	1,260	145	174	48	48
31	540	-------				-------	3,550	-------	1,000	-------	270	40	-------

[a] Gage not read; discharge interpolated.

NOTE.—Stage-discharge relation affected by ice Dec. 25 to Jan. 5 and Jan. 19 to Feb. 20; discharge estimated from gage heights, observer's notes, and weather records.

Monthly discharge of Spoon River at Seville, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,600 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,230	130	289	0.181	0.21
November	620	188	347	.217	.24
December	2,040	315	721	.451	.52
January	2,340	----------	666	.416	.48
February	6,540	----------	1,140	.712	.74
March	3,550	330	1,430	.894	1.03
April	5,230	810	2,440	1.52	1.70
May	4,320	560	1,150	.719	.83
June	1,150	145	433	.271	.30
July	6,450	70	891	.557	.64
August	210	40	89.7	.056	.06
September	6,290	18	383	.239	.27
The year	6,540	18	828	.518	7.02

SANGAMON RIVER AT MONTICELLO, ILL.

LOCATION.—In sec. 12, T. 18 N., R. 5 E. third principal meridian, at Illinois Central Railroad bridge half a mile west of Monticello, Piatt County.

DRAINAGE AREA.—550 square miles.

RECORDS AVAILABLE.—February 4, 1908, to December 31, 1912; June 23, 1914, to September 30, 1922.

GAGE.—Chain gage attached to downstream side of bridge; read by David Coay.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge and wooden trestle approach, and by wading.

CHANNEL AND CONTROL.—Measuring section is at a pool; control consists of fine gravel; likely to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.45 feet April 13 (discharge, 5,820 second-feet); minimum stage, 1.85 feet September 14 to 30 (discharge, 9 second-feet).

1908–1912 and 1914–1922: Maximum stage recorded, 15.2 feet May 14 1908 (discharge, 9,280 second-feet); minimum stage, 1.5 feet July 31 to August 3, 1914 (discharge, 1 second-foot). Maximum stage during flood of March to April, 1913, 17.7 feet March 25 (discharge not known).

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

ACCURACY.—Stage-discharge relation permanent, not materially affected by ice during winter. Rating curve well defined between 2 and 1,000 second-feet, and fairly well defined above this limit. Gage read to half-tenths once daily except Sundays. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for low and medium stages; fair for high stages.

Discharge measurements of Sangamon River at Monticello, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Feb. 27	6.65	486
Mar. 15	11.67	3,250
Aug. 31	2.06	17.9

Daily discharge, in second-feet, of Sangamon River at Monticello, Ill., for the year ending Sept. 30, 1922

Day	Dec.	Jan.	Feb	Mar.	Apr.	May	June	July	Aug.	Sept.
1	------	a 287	374	400	4,590	660	560	135	29	15
2	------	275	1,150	299	a 4,450	560	452	a 274	26	15
3	------	275	895	299	4,310	560	400	413	13	a 14
4	------	680	560	299	3,230	530	a 350	a 294	13	a 14
5	------	770	a 526	a 281	2,280	504	299	175	20	13
6	575	1,010	491	263	2,180	491	273	126	a 19	11
7	517	1,050	374	263	2,180	a 446	239	109	18	11
8	439	a 790	374	263	3,100	400	311	85	18	11
9	426	530	323	263	3,360	374	263	a 74	13	11
10	413	465	323	263	2,730	361	215	63	13	a 11
11	a 394	426	299	452	4,310	361	a 190	135	13	11
12	374	400	a 263	a 750	4,030	400	165	165	13	11
13	348	299	227	1,050	5,750	530	205	335	a 12	11
14	323	348	185	1,580	3,890	a 491	299	195	11	9
15	299	a 312	165	3,490	2,850	452	287	135	11	9
16	299	275	165	3,490	a 3,240	426	215	a 108	11	9
17	335	227	155	3,750	3,620	413	175	81	11	a 9
18	a 508	251	145	2,500	3,100	413	a 150	70	11	9
19	680	205	a 140	a 2,500	2,850	387	126	63	11	9
20	770	145	135	2,500	2,850	361	117	52	a 11	9
21	611	145	135	2,730	2,500	a 330	109	49	11	9
22	530		374	a 2,620	1,880	299	97	46	11	9
23	504		800	2,500	a 1,620	287	89	a 42	43	9
24	560		1,250	a 2,040	1,350	263	81	38	165	a 9
25	a 418	150	1,010	1,580	1,200	239	a 78	35	135	9
26	275		a 744	a 1,440	1,200	439	74	32	74	9
27	374		478	1,300	1,200	1,200	66	32	a 51	9
28	348		452	1,350	1,010	1,400	66	29	28	9
29	311	a 145	------	1,400	930	1,520	63	a 29	22	9
30	299	145	------	1,880	a 795	1,800	60	a 29	20	9
31	299	145	------	4,870	------	895	------	29	18	------

a Gage not read; discharge interpolated.

NOTE—Stage-discharge relation affected by ice Jan. 22-28; discharge estimated. No record Oct. 1 to Dec. 5.

Monthly discharge of Sangamon River at Monticello, Ill., for the year ending Sept. 30, 1922

[Drainage area, 550 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
December 6-31	770	275	432	0.785	0.74
January	1,050	145	344	.625	.72
February	1,250	135	447	.813	.85
March	4,870	263	1,570	2.85	3.29
April	5,750	795	2,750	5.00	5.58
May	1,800	239	574	1.04	1.20
June	560	60	202	.367	.41
July	413	29	112	.204	.24
August	165	11	28.2	.051	.06
September	15	9	10.4	.019	.02

SANGAMON RIVER AT RIVERTON, ILL.

LOCATION.—In southeast corner of SW. ¼ sec. 9, T. 16 N., R. 4 W. third principal meridian, at Wabash Railroad bridge a quarter of a mile west of Riverton, Sangamon County, and 2½ miles below mouth of South Fork.

DRAINAGE AREA.—2,560 square miles.

RECORDS AVAILABLE.—February 13, 1908, to December 31, 1912; August 7, 1914, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by J. J. Washburn.

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

CHANNEL AND CONTROL.—Measuring section is at a pool; control consists of fine gravel; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 28.22 feet April 11 (discharge, 22,700 second-feet); minimum stage, 7.24 feet September 17 (discharge, 16 second-feet).

1908–1912 and 1914–1922: Maximum stage recorded, that of April 11, 1922; minimum stage, 6.9 feet October 3–15, 1915 (discharge, 3 second-feet). High water of 1883 reached a height of about 32 feet on the present gage, and that of 1875 is said to have been half a foot lower (discharge not determined).

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

ACCURACY.—Stage-discharge relation not permanent; changed during high water of November; affected by ice for a short period. Rating curve used October 1 to November 30 fairly well defined, curve used after November 30 is fairly well defined between 15 and 24,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Sangamon River at Riverton, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Oct. 6	10.57	808	Aug. 30	7.27	16.7
Feb. 27	12.80	1,500	30	7.28	17.2
Mar. 20	24.92	15,200			

Daily discharge, in second-feet, of Sangamon River at Riverton, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,820	240	4,290	1,830	710	1,320	13,200	4,290	1,740	200	153	
2	1,540	230	3,420	1,200	1,520	1,120	14,500	3,540	1,740	220	144	
3	1,260	230	2,700	1,360	2,640	970	14,500	3,180	1,780	220	110	
4	943	210	2,530	1,520	2,380	900	14,300	2,940	1,520	220	88	
5	812	200	2,230	3,420	2,180	935	14,300	2,480	1,200	210	83	
6	748	190	2,030	4,010	2,080	935	13,200	2,330	900	210	80	
7	656	190	1,830	3,870	1,980	970	12,000	2,280	830	240	77	25
8	597	190	1,600	3,660	1,640	1,010	12,600	1,980	740	270	68	
9	1,660	181	1,480	3,480	1,520	1,010	16,100	1,830	680	312	65	
10	1,540	181	830	3,480	1,320	1,080	20,300	1,600	650	312	65	
11	976	172	830	3,120	1,120	900	22,700	1,400	650	334	58	
12	1,045	181	935	2,530	1,040	1,480	20,800	1,440	530	312	51	
13	686	190	1,280	2,080	865	1,520	20,000	1,520	455	312	37	27
14	597	190	1,280	1,440	710	7,260	18,400	1,880	455	334	31	20
15	486	190	1,200	1,480	620	15,600	17,200	1,600	530	334	29	18
16	486	190	1,010	1,040	590	20,300	16,500	1,560	530	356	27	20
17	486	230	1,080	1,160	560	20,300	16,300	1,480	530	356	26	16
18	435	364	1,160	1,360	560	18,400	18,600	1,400	650	290	26	20
19	321	1,780	1,200	1,010	560	15,200	19,300	1,360	455	270		21
20	300	5,600	1,240	935	590	15,400	18,800	1,240	380	240		23
21	300	7,260	1,240	900	590	15,600	16,300	1,200	356	240		24
22	280	7,130	1,200	770	650	15,000	13,700	1,080	334	210	30	21
23	280	7,390	1,640	710	650	13,400	11,800	1,040	240	230		27
24	280	8,080	3,420		770	12,200	10,600	1,080	230	180		21
25	280	8,080	3,540		935	11,200	9,620	1,120	220	144		22
26	260	8,080	3,800		1,120	10,600	8,670	1,240	220	118		18
27	260	7,800	3,660	625	1,520	9,620	7,800	1,600	210	118		18
28	240	6,500	3,480		1,400	9,300	6,150	1,640	220	126		20
29	220	6,150	3,300		-------	8,670	5,820	1,640	270	126	20	18
30	230	4,360	3,000		-------	8,670	4,740	1,600	250	135		16
31	240	-------	2,080		-------	10,600	---------	1,740	-------	153		-------

NOTE.—Stage-discharge relation affected by ice Jan. 24–31; discharge estimated from gage-height record, observer's notes, and weather records; discharge estimated Aug. 19 to Sept. 12, because of some missing and some apparently erroneous gage readings, from results of one discharge measurement and weather records.

Monthly discharge of Sangamon River at Riverton, Ill., for the year ending Sept. 30, 1922

[Drainage area, 2,560 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,820	220	654	0.255	0.29
November	8,080	172	2,730	1.07	1.19
December	4,290	830	2,080	.812	.94
January	4,010	----------	1,660	.648	.75
February	2,640	560	1,170	.457	.48
March	20,300	900	8,110	3.17	3.66
April	22,700	4,740	14,300	5.59	6.24
May	4,290	1,040	1,820	.711	.82
June	1,780	210	650	.254	.28
July	356	118	237	.093	.11
August	153	----------	49.9	.019	.02
September	----------	16	22.3	.0087	.01
The year	22,700	16	2,790	1.09	14.79

SANGAMON RIVER NEAR OAKFORD, ILL.

LOCATION.—In sec. 6, T. 19 N., R. 7 W. third principal meridian, at highway bridge 3 miles northeast of Oakford, Menard County, 2¼ miles above Chicago, Peoria & St. Louis Railway Bridge, and 1¼ miles above mouth of Crane Creek.

DRAINAGE AREA.—5,000 square miles.

RECORDS AVAILABLE.—October 26, 1909, to June 30, 1911; December 10, 1911, to March 31, 1912; August 25, 1914, to June 11, 1919, and March 18, 1921, to August 19, 1922, when station was discontinued.

GAGE.—Chain gage attached to bridge; read by J. E. Moss from October 1 to May 6; by F. Ferry after June 7.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 19.84 feet April 14 (discharge, 35,800 second-feet); minimum stage, 1.54 feet August 18 and 19 (discharge, 164 second-feet).

1909–1912; 1914–1919; 1921–1922: Maximum discharge recorded, that of April 14, 1922; minimum discharge, 85 second-feet August 30 and 31, November 28, and December 2, 1914.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent; changed after high water of April; affected by ice for short period in winter. Rating curve used October 1 to May 15 well defined between 400 and 10,000 second-feet, fairly well defined beyond these limits; curve used June 1 to September 30 well defined between 330 and 3,000 second-feet. Gage read to quarter-tenths once daily except the latter part of January and all of February when it was read twice a week. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Sangamon River near Oakford, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Mar. 8	L. G. Williams [a]	4.30	2,130	June 9	L. G. Williams	4.53	1,810
21	H. E. Grosbach	17.46	25,400	July 27	H. E. Grosbach	2.18	426
June 8	L. G. Williams	4.65	1,910				

[a] Engineer, United States Public Health Service.

Daily discharge, in second-feet, of Sangamon River near Oakford, Ill., for the year ending Sept. 30, 1922

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	2,790	240	7,540	5,790	1,320	2,840	17,700	9,200	------	575	330
2	2,700	220	6,560	4,680	1,460	2,700	17,700	8,640	------	860	290
3	2,540	402	6,120	2,880	2,940	2,620	25,900	9,200	------	980	272
4	2,140	320	5,790	3,690	4,410	2,540	27,100	6,560	------	800	290
5	1,820	300	5,580	4,680	3,960	2,380	27,500	6,230	------	650	272
6	1,670	280	5,380	5,680	3,700	2,220	26,700	5,580	------	600	255
7	1,460	240	5,080	6,920	3,330	1,940	24,300	------	------	575	238
8	1,320	212	4,590	7,800	3,240	1,670	23,100	------	1,910	525	255
9	1,320	204	4,230	7,410	3,150	1,820	21,300	------	1,830	500	238
10	1,390	280	3,870	6,800	3,060	2,460	21,300	------	1,750	575	238
11	1,530	360	3,420	5,580	2,970	2,540	29,800	------	1,590	650	220
12	1,670	520	3,240	5,280	2,540	2,380	32,900	------	1,450	800	238
13	1,530	495	2,970	4,230	2,300	3,240	34,700	------	1,450	920	220
14	1,320	425	2,790	3,690	2,060	6,340	35,600	------	1,450	800	202
15	1,390	445	2,540	3,060	1,690	9,950	33,800	------	1,310	700	220
16	1,110	495	2,620		1,320	14,100	32,000	------	1,180	600	202
17	970	545	2,380		1,390	18,200	30,200	------	1,180	650	182
18	910	545	3,240		1,460	25,900	29,300	------	1,040	600	164
19	850	2,540	3,420		1,390	28,400	28,800	------	1,040	525	164
20	850	3,690	4,140		2,580	27,100	28,800	------	920	525	------
21	790	7,800	3,870		3,780	25,500	29,800	------	920	478	------
22	730	8,360	4,050		4,530	26,300	29,300	------	860	455	------
23	730	8,640	4,140		5,280	25,100	26,300	------	800	432	------
24	730	10,400	4,050	1,500	4,530	24,300	23,900	------	800	410	------
25	645	9,800	3,870		3,780	23,500	20,300	------	700	478	------
26	595	9,650	3,690		3,510	20,600	18,500	------	525	455	------
27	670	8,920	4,320		3,240	18,200	19,400	------	575	410	------
28	730	8,500	4,880		2,970	16,300	15,300	------	600	350	------
29	495	8,220	4,980		------	15,300	12,600	------	575	330	------
30	425	7,800	5,280		------	13,700	10,400	------	650	350	------
31	360	------	5,480		------	16,100	------	------	------	390	------

NOTE.—Stage-discharge relation affected by ice Jan. 16 to Feb. 1; discharge estimated from gage readings, observer's notes, and weather records. Gage not read Feb. 3, 6, 8, 9, 13, 15, 17, 20, 22, 24, 27 Mar. 1, 3, and 7; discharge interpolated. No gage record May 7 to June 7; discharge not determined.

Monthly discharge of Sangamon River near Oakford, Ill., for the year ending Sept. 30, 1922

[Drainage area, 5,000 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	2,790	360	1,239	0.246	0.28
November	10,400	204	3,360	.672	.75
December	7,540	2,380	4,330	.866	1.00
January	7,800	------	3,300	.660	.76
February	5,280	1,320	2,920	.584	.61
March	28,400	1,670	12,500	2.50	2.88
April	35,600	10,400	25,100	5.02	5.60
June 8–30	1,910	525	1,090	.218	.19
July	980	330	579	.116	.13
August 1–19	330	164	236	.047	.03

SOUTH FORK OF SANGAMON RIVER AT POWER PLANT, NEAR TAYLORVILLE, ILL.

LOCATION.—In sec. 14, T. 13 N., R. 3 W., at Chicago & Illinois Midland Railroad bridge 6 miles northwest of Taylorville, Christian County, 500 feet east of power plant of Central Illinois Public Service Co., 5 miles below mouth of Bear Creek, and 8 miles below station formerly maintained at Wabash Railroad bridge.

DRAINAGE AREA.—510 square miles.

RECORDS AVAILABLE.—May 18, 1917, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by H. Hendricks.

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

CHANNEL AND CONTROL.—Bed composed of soft mud; likely to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 26.6 feet at 9.30 a.m. March 15 (discharge, 11,800 second-feet); minimum discharge, no flow August 29.

1917–1922: Maximum discharge recorded, that of March 15, 1922; minimum discharge, that of August 29, 1922.

A stage of about 27.3 feet on present gage is said to have been reached January 31, 1916 (discharge, 11,300 second-feet).

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

DIVERSIONS.—An average of about half a second-foot is used for boiler feed and other purposes at power plant just above gage.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read to half-tenths once daily, except Sundays. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium stages; fair for low and high stages.

Discharge measurements of South Fork of Sangamon River at power plant, near Taylorville, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Oct. 5	6.39	150
Mar. 19	17.37	2,710
Aug. 30	3.19	[a].03

[a] Estimated.

Daily discharge, in second-feet of South Fork of Sangamon River at power plant, near Taylorville, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,250	128		475	415	121	6,000	300	142	39	67	0.02
2	333	121		415	680	121	7,200	311	121	73	107	.02
3	250	107	450	300	631	73	5,640	300	100	86	20	.04
4	223	107		415	587	172	3,500	403	79	61	11	.02
5	156	[a]102		[a]772	[a]513	196	[a]2,560	[a]322	[a]73	[a]55	[a]8.4	[a].03
6	172	[a]97	300	1,130	439	[a]248	1,620	241	49	62	5.9	.04
7	223	88	300	1,220	300	300	2,210	[a]241	79	36	4.9	.04
8	300	90	300	[a]1,080	214	300	4,650	241	70	29	3.2	[a].04
9	415	93	290	950	188	270	9,230	214	79	23	3.2	.04
10	415	93	270	733	196	290	9,120	188	[a]76	21	2.6	.10
11	300	100	270	547	196	250	6,900	223	73	29	2.6	.20
12	223	107	250	415	[a]148	270	6,720	214	[a]72	21	2.6	.04
13	180	107	241	300	100	290	5,730	205	70	142	1.5	.04
14	149	107	223	164	76	3,640	[a]4,870	196	[a]99	172	1.0	.04
15	135	90	205	[a]180	93	10,900	4,010	172	128	93	1.0	.04
16	128	90	180	196	55	11,300	4,250	149	86	39	.6	.04
17	121	300	180	180	114	8,100	5,550	142	[a]62	39	.6	.04
18	107	270	205	290	135	5,190	8,100	142	39	25	.3	.02
19	107	1,440	223	223	142	3,080	8,100	149	44	23	.15	.10
20	107	2,260	[a]218	128	[a]135	[a]3,660	[a]5,440	[a]142	[a]42	[a]18	[a].08	[a].07
21	107	3,640	214	205	128	4,250	2,780	135	39	12	.01	.04
22	93	3,780	172	188	135	3,850	2,060	121	34	9.5	.03	.04
23	93	3,020	300	156	149	2,600	1,370	100	32	18	.03	[a].03
24	90	[a]2,780	680	135	300	1,770	1,080	149	29	20	.03	.02
25	86	2,540	771	[a]128	300	1,370	715	250	29	27	.01	.04
26	79	1,280	1,000	121	250	[a]1,110	647	[a]510	29	16	.01	.04
27	79	1,000	1,190	142	205	853	601	771	25	16	.01	.04
28	82	680	1,510	[a]137	205	791	547	547	27	16	.01	.04
29	[a]94	547	1,220	[a]132	-------	791	415	355	27	39	.00	.04
30	107	415	950	128	-------	1,340	[a]358	[a]256	29	29	.04	.04
31	114	-------	535	142	-------	2,060	-------	156	-------	16	.01	-------

[a] Interpolated.

NOTE.—No gage-height record Dec. 1–5; discharge estimated by comparison with Mackinaw and Kaskaskia rivers.

Monthly discharge of South Fork of Sangamon River at power plant, near Taylorville, Ill., for the year ending Sept. 30, 1922

[Drainage area, 510 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,250	79	204	0.400	0.46
November	3,780	90	853	1.67	1.86
December	1,510	172	466	.914	1.05
January	1,220	121	378	.741	.85
February	680	55	251	.492	.51
March	11,300	73	2,240	4.39	5.06
April	9,230	358	4,070	7.98	8.90
May	771	100	253	.496	.57
June	142	25	63.4	.124	.14
July	172	9.5	41.7	.082	.09
August	107	.0	7.87	.015	.02
September	.2	.02	.046	.0001	.0001
The year	11,300	.0	734	1.44	19.51

CROOKED CREEK AT RIPLEY, ILL.

LOCATION.—In sec. 33, T. 1 N., R. 2 W., at highway bridge one-fourth mile east of Ripley, Brown County.

DRAINAGE AREA.—1,310 square miles (measured on United States Geological Survey map of Illinois; scale, 1:500,000).

RECORDS AVAILABLE.—March 12, 1921, to September 30, 1922.

GAGE.—Chain gage attached to downstream side of bridge; read by Mrs. Darius Seckman to December 31 and by Mrs. John Hess thereafter.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of soft mud and clay; control not well defined, likely to shift. Banks high; subject to overflow at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.2 feet April 11 (discharge, 6,370 second-feet); minimum stage, 1.98 feet September 8 and 9 (discharge, 9 second-feet).

1921–1922: Maximum stage recorded, that of April 11, 1922; minimum discharge, that of September 8 and 9, 1922. Old high-water mark, date unknown, is at a stage of about 26.0 feet on gage.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent; changed after high water in May; affected by ice for a short period and by backwater from Illinois River during parts of March, April, and May. Rating curve used October 1 to May 19 well defined between 30 and 4,000 second-feet, fairly well defined beyond these limits; curve used May 20 to September 30 fairly well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium stages, fair for very low and for high stages when there was no backwater; poor for periods of ice effect and of backwater.

Discharge measurements of Crooked Creek at Ripley, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Mar. 13	L. G. Williams [a]	7.86	1,400
July 26	H. E. Grosbach	3.06	122

[a] Engineer, United States Public Health Service.

Daily discharge, in second-feet, of Crooked Creek at Ripley, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	195	360	880	300		380	5,230	610	325	29	100	205
2	210	340	1,460	590		280	3,970	510	285	33	168	46
3	210	320	2,370	880		460	2,640	440	265	38	68	26
4	195	240	2,200	1,680		460	1,330	400	225	44	62	22
5	172	210	1,500	1,330		460	4,690	820	205	48	62	20
6	158	165	710	1,330	660	485	6,250	400	190	58	57	19
7	142	150	585	1,300		485	5,770	210	175	38	54	13
8	142	135	510	1,060		735	5,830	240	160	31	47	9
9	1,210	128	420	1,060		380	5,650	260	152	30	45	9
10	685	142	400	1,030		380	5,110	195	145	27	43	1,500
11	300	135	380	760	225	510	6,370	225	115	385	38	1,640
12	280	135	340	760	210	1,840	5,770	260	108	2,460	35	2,420
13	225	135	320	760	180	1,120	6,010	320	100	3,040	38	1,720
14	195	135	320	880	165	5,650	4,990	225	92	3,180	39	285
15	128	142	300		158	6,010	3,770	240	115	3,420	42	130
16	121	240	340		128	5,170	2,120	380	205	3,370	38	92
17	121	260	340		108	3,370	3,820	535	205	1,060	34	68
18	1,180	610	360		108	1,720	4,170	560	122	820	26	40
19	635	710	380		102	1,570	3,180	440	92	305	20	56
20	280	970	340		95	1,460	1,360	385	68	265	37	44
21	225	660	320		2,500	1,180	1,460	385	85	205	85	190
22	128	560	320	500	2,960	790	1,270	325	79	175	60	100
23	136	400	320		3,920	585	1,270	305	79	152	60	58
24	142	300	300		3,920	485	1,240	325	73	145	475	58
25	225	280	300		2,960	420	1,180	600	52	100	525	40
26	150	240	380		1,460	5,350	1,330	1,600	58	115	190	26
27	142	240	280		510	4,520	1,030	1,180	62	108	85	20
28	135	225	240		460	4,170	1,090	625	55	85	46	13
29	280	225			-------	2,780	970	500	55	73	34	23
30	660	225	220		-------	5,110	710	475	33	85	23	26
31	510	-------			-------	5,170	-------	365	-------	92	92	-------

NOTE.—Stage-discharge relation affected by ice Dec. 29 to Jan. 2 and Jan. 15 to Feb. 10; discharge estimated from gage heights, observer's notes and weather records. Discharge estimated because of backwater from Illinois River Mar. 20–25, 29, Apr. 2–5, 7, 9, 10, and Apr. 12 to May 19, from gage-heights at Ripley and on Illinois River at Beardstown.

Monthly discharge of Crooked Creek at Ripley, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,310 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,210	121	307	0.234	0.27
November	970	128	301	.230	.26
December	2,370	-------	564	.431	.50
January	1,680	300	717	.547	.63
February	3,920	95	956	.730	.76
March	6,010	280	2,050	1.56	1.80
April	6,370	710	3,320	2.53	2.82
May	1,600	195	463	.353	.41
June	325	33	133	.102	.11
July	3,420	27	646	.493	.57
August	525	20	86.1	.066	.08
September	2,420	9	297	.227	.25
The year	6,370	9	816	.623	8.46

105449—25†—WSP 545——13

MACOUPIN CREEK NEAR KANE, ILL.

LOCATION.—In sec. 7, T. 9 N., R. 11 W., at Chicago & Alton Railway bridge 3 miles northwest of Kane, Greene County.

DRAINAGE AREA.—865 square miles (measured on United States Geological Survey map; scale, 1:500,000).

RECORDS AVAILABLE.—March 11, 1921, to September 30, 1922.

GAGE.—Vertical staff; lower section on old piling between piers, intermediate section on left pier, high-water section on transmission line pole on left bank 20 feet above bridge; read by Claude Linn.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading; during high water at bridges over flood channels one-fourth mile south and one-eighth mile north of main channel.

CHANNEL AND CONTROL.—Control is clay and heavy mud, somewhat shifting. At high stages creek overflows above gage into two high-water channels; affected by drift and vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 21.6 feet, March 15 (discharge, 15,000 second-feet); minimum stage, 0.50 foot September 29 (discharge, 1 second-foot).

1921–1922: Maximum stage recorded that of March 15, 1922; minimum stage, that of September 29, 1922.

High water of 1915 reached a stage of 26.5 feet on present gage.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent; changed slightly during high water of April; affected by ice for a short period. Rating curve used October 1 to April 25 well defined between 20 and 1,500 second-feet, fairly well defined between 1,500 and 10,000 second-feet, and extended above and below these limits; curve used after April 25 well defined between 5 and 600 second-feet, where it joins previous curve. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good for medium stages; fair for high and extremely low stages.

Discharge measurements of Macoupin Creek near Kane, Ill., during the year ending Sept. 30, 1922

Date	Made by—	Gage height	Discharge
		Feet	*Sec.-ft.*
Mar. 9	L. G. Williams [a]	3.50	293
Apr. 2	H. E. Grosbach	17.58	7,000
July 28	do	.78	5.0

[a] Engineer, United States Public Health Service.

Daily discharge, in second-feet, of Macoupin Creek near Kane, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	425	62	234	276	970	130	7,600	400	106	22	250	4
2	440	69	910	220	1,960	164	7,600	355	85	22	70	12
3	124	34	850	276	1,210	178	6,720	478	80	100	33	6
4	81	58	425	2,950	814	192	3,580	446	80	61	24	6
5	58	54	380	4,250	410	276	2,120	415	80	61	17	6
6	58	69	380	3,690	320	395	2,080	340	61	24	12	3
7	51	26	335	1,330	248	440	3,800	310	53	17	5	2
8	112	22	290	560	206	350	10,900	280	61	14	6	2
9	90	20	248	485	192	276	13,400	250	370	12	5	2
10	69	18	220	425	192	276	10,300	235	205	10	4	2
11	58	26	220	395	206	320	8,320	280	75	8	4	2
12	45	18	192	305	192	638	6,720	415	61	8	3	1.5
13	39	26	178	220	124	485	6,040	462	50	12	3	1.5
14	26	23	164	192	90	9,950	5,030	280	46	12	2	1.5
15	24	26	136	220	81	15,000	6,550	205	39	8	3	2
16	26	26	130	192	90	10,960	6,550	191	33	12	3	2.5
17	26	30	220	220	112	7,420	8,320	191	39	12	3	2
18	26	638	455	192	130	6,380	9,040	177	39	10	2	2.5
19	26	3,200	290	164	118	5,870	7,960	177	33	8	4	2.5
20	23	4,100	276	150	124	3,740	6,550	177	30	6	3	2.5
21	26	4,700	220		130	5,530	1,960	130	27	5	10	2.5
22	22	3,580	164		150	5,530	1,170	123	24	5	6	2.5
23	20	1,210	560		276	2,520	760	117	22	6	4	2
24	22	485	3,150		515	910	606	111	22	5	4	2
25	20	365	4,100		440	724	832	136	20	5	12	2
26	23	335	4,400	85	276	1,660	990	265	17	5	10	2.5
27	26	276	1,400		276	1,290	724	778	20	5	10	2.5
28	22	262	606		220	1,170	415	950	17	5	6	2
29	164	220	575		-------	990	510	355	17	5	4	1
30	90	192	455		-------	2,000	446	205	20	8	3	2
31	58	-------	425		-------	6,040	-------	136	-------	177	3	-------

NOTE.—Stage-discharge relation affected by ice Jan. 21–31; discharge estimated by use of several gage heights, observer's notes, and weather records.

Monthly discharge of Macoupin Creek near Kane, Ill., for the year ending Sept. 30, 1922

[Drainage area, 865 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	440	20	74.8	0.086	0.10
November	4,700	18	672	.777	.87
December	4,400	130	729	.843	.97
January	4,250	-------	569	.658	.76
February	1,960	81	360	.416	.43
March	15,000	130	2,960	3.42	3.94
April	13,400	415	4,920	5.69	6.35
May	950	111	302	.349	.40
June	370	17	61.1	.071	.08
July	177	5	21.6	.025	.03
August	250	2	17	.020	.02
September	12	1	2.88	.0033	.004
The year	15,000	1	889	1.03	13.95

KASKASKIA RIVER AT VANDALIA, ILL.

LOCATION.—In sec. 16, T. 6 N., R. 1 E. third principal meridian, at highway bridge at east end of Main Street, Vandalia, Fayette County, 3½ miles above Hickory Creek.

DRAINAGE AREA.—1,980 square miles.

RECORDS AVAILABLE.—February 26, 1908, to December 31, 1912; August 11, 1914, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by Wilson Haley.

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

CHANNEL AND CONTROL.—Measuring section is at a pool; control likely to shift.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during year, 18,800 second-feet, April 18; minimum stage 0.68 foot September 26 (discharge, 19 second-feet).

1908–1912; 1914–1922: Maximum discharge recorded, that of April 18, 1922; minimum discharge, 3.5 second-feet August 22, 1911.

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

ACCURACY.—Stage-discharge relation not permanent; changed slightly in December; affected by ice for a few days in February. From March 15 to April 30 overflow occurred from a break in the levee above the gage, changing the stage-discharge relation materially. Rating curve used October 1 to December 31 well defined above and fairly well defined below 400 second-feet; curve used January 1 to March 15 and May 1 to September 30 well defined between 30 and 11,000 second-feet; curve used March 16 to April 30 fairly well defined between 14,000 and 16,500 second-feet and extended beyond these limits. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good except for high stages, for which they are fair.

Discharge measurements of Kaskaskia River at Vandalia, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Oct. 4	4.15	621	Mar. 18	[a] 18.48	15,000
Mar. 2	4.33	604	Aug. 28	1.08	40.8

[a] Stage discharge relation affected by break in levee above gage, diverting part of flow around station.

Daily discharge, in second-feet, of Kaskaskia River at Vandalia, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,020	195	2,480	1,400	840	660	14,500	2,360	1,440	455	160	46
2	870	188	1,820	1,300	1,300	575	13,800	2,040	1,470	415	130	42
3	730	360	1,680	1,120		575	13,100	1,890	1,680	375	109	35
4	630	340	1,540	1,120		660	13,100	1,780	1,300	295	138	34
5	605	320	1,400	2,640		960	12,600	1,610	1,120	275	84	33
6	530	260	1,330	2,720	1,400	1,330	11,700	1,330	870	190	78	32
7	440	240	1,230	2,360		1,050	11,500	1,300	575	182	62	30
8	400	225	1,230	1,960		750	11,300	1,120	525	182	53	29
9	380	210	1,360	1,780	870	690	17,000	1,080	475	168	62	28
10	730	195	1,140	1,750	780	720	16,000	1,050	435	160	57	26
11	705	188	1,050	1,680	690	810	16,000	1,580	415	1,610	49	26
12	655	188	960	1,500	630	930	14,800	3,000	395	2,600	46	26
13	570	180	930	1,330	575	840	14,500	2,040	660	1,120	42	24
14	480	172	870	1,080	500	5,560	15,500	1,080	750	550	46	24
15	440	172	580	990	435	13,900	18,200	960	525	395	39	24
16	400	165	680	870	395	16,500	16,000	990	415	295	46	23
17	360	172	705	870	395	15,800	17,500	960	335	237	46	20
18	340	300	780	810	780	14,500	18,800	900	295	198	96	20
19	320	3,000	755	780	690	13,800	16,500	870	275	190	72	20
20	300	4,710	755	750	455	13,500	15,000	810	255	175	53	20
21	280	4,950	705	630	415	13,500	13,800	750	255	152	84	20
22	260	4,590	705	630	395	12,400	13,300	690	237	138	62	22
23	240	4,350	755	500	500	11,300	12,600	660	190	116	62	20
24	240	3,990	5,070	500	1,220	10,200	11,300	630	182	123	62	20
25	225	3,690	5,930	525	600	9,150	10,800	630	182	116	62	20
26	225	3,490	6,460	550	630	6,580	9,550	1,300	190	102	57	19
27	210	3,390	5,280	575	660	5,740	6,880	1,260	182	102	46	20
28	210	3,290	3,120	525	690	5,870	5,240	1,190	182	138	39	20
29	210	3,040	2,600	500	-------	3,990	3,220	1,120	220	84	39	20
30	195	2,600	2,000	455	-------	7,840	2,700	1,260	375	315	42	20
31	195	-------	1,780	455	-------	12,200	-------	1,260	-------	275	39	-------

NOTE.—Stage-discharge relation affected by ice Feb. 3-8; discharge estimated from gage heights, observer's notes, and weather records.

Monthly discharge of Kaskaskia River at Vandalia, Ill., for the year ending Sept. 30, 1922

[Drainage area, 1,980 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,020	195	432	0.218	0.25
November	4,950	165	1,640	.828	.92
December	6,460	580	1,860	.939	1.08
January	2,720	455	1,120	.566	.65
February	-------	395	816	.412	.43
March	16,500	575	6,540	3.30	3.80
April	18,800	2,700	12,900	6.52	7.27
May	3,000	630	1,270	.641	.74
June	1,680	182	547	.276	.31
July	2,600	84	378	.191	.22
August	160	39	66.5	.034	.04
September	46	19	25.4	.013	.01
The year	18,800	19	2,300	1.16	15.72

BIG MUDDY RIVER AT PLUMFIELD, ILL.

LOCATION.—In W. ½ sec. 20, T. 7 S., R. 2 E., at highway bridge in Plumfield, Franklin County, 6 miles west of West Frankfort, 1½ miles below mouth of Middle Fork, and 2 miles below station formerly maintained at Chicago, Burlington & Quincy Railroad bridge.

DRAINAGE AREA.—753 square miles.

RECORDS AVAILABLE.—August 18, 1914, to September 30, 1922; June 16, 1908, to December 31, 1912, records were obtained at Chicago, Burlington & Quincy Railroad bridge.

GAGE.—Chain gage attached to bridge; read by Louis Robertson.

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

CHANNEL AND CONTROL.—Bed somewhat shifting; control is a quarter of a mile below gage. Zero flow is at a stage of about 0.6 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 25.1 feet, April 2 (discharge, 10,200 second-feet); minimum stage, 0.69 foot September 27 (discharge, 0.4 second-foot).

1914–1922: Maximum stage recorded, 30.2 feet February 1, 1916 (discharge, 16,300 second-feet); minimum discharge, no flow, August 18–26, 1914.

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

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

Discharge measurements of Big Muddy River at Plumfield, Ill., during the year ending Sept. 30, 1922

[Made by H. E. Grosbach]

Date	Gage height	Discharge
	Feet	*Sec.-ft.*
Mar. 3	3.64	183
Aug. 29	1.16	9.6

Daily discharge, in second-feet, of Big Muddy River at Plumfield, Ill., for the year ending Sept. 30, 1922

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,100	3.0	1,230	1,580	510	258	9,230	1,080	42	11	15	5.5
2	997	3.2	963	895	1,330	213	10,200	525	27	10	12	4.6
3	762	3.6	980	392	1,720	181	9,770	406	20	36	10	4.0
4	378	4.4	963	258	2,000	322	8,830	666	15	48	18	3.2
5	141	4.0	938	650	2,150	525	7,730	610	12	29	25	3.0
6	94	3.6	912	980	2,060	555	6,560	555	10	23	22	48
7	48	3.6	730	929	1,650	698	5,360	510	9	19	18	27
8	34	3.6	570	586	1,030	762	4,110	480	9	15	17	16
9	27	6.0	420	810	510	778	3,120	350	23	12	14	11
10	20	6.0	282	1,050	258	794	2,440	202	618	98	10	8.5
11	16	6.2	202	963	213	1,050	2,240	350	794	69	7.2	5.2
12	12	6.7	161	730	202	1,210	2,210	224	586	39	5.5	4.2
13	10	7.2	126	420	202	1,050	2,280	116	191	31	4.0	3.0
14	9.0	7.0	98	224	171	1,490	2,400	73	73	25	3.2	2.2
15	7.2	6.5	85	171	131	2,480	2,440	52	45	18	7.0	2.2
16	5.8	6.8	73	141	94	4,040	2,480	39	31	14	3.2	1.6
17	5.2	9.0	378	121	69	5,930	2,870	36	25	11	2.7	1.4
18	4.4	141	946	108	55	6,380	3,430	31	25	8.8	2.6	1.3
19	3.8	2,210	1,230	141	55	5,930	3,670	27	19	6.8	2.2	1.1
20	3.6	2,970	1,370	161	151	5,280	3,370	25	15	6.0	48	1.3
21	3.6	4,960	1,490	141	188	4,670	2,870	23	14	4.8	34	1.3
22	3.2	5,520	878	141	224	4,250	2,360	22	510	3.8	27	1.0
23	3.2	5,200	1,510	112	465	3,790	1,750	21	730	3.8	19	.9
24	2.6	4,880	2,360	94	682	3,120	997	25	406	3.2	27	.7
25	2.4	4,390	3,910	58	698	2,360	698	22	112	4.6	25	.5
26	1.6	3,910	5,440	39	495	1,620	980	21	52	336	17	.5
27	2.2	3,490	5,520	34	350	1,550	1,350	18	31	258	12	.4
28	2.2	2,920	5,040	36	282	1,720	1,680	42	23	108	9.8	.5
29	2.2	2,360	4,250	31	-------	2,000	1,720	85	17	52	8.8	.5
30	2.2	1,800	3,320	29	-------	3,270	1,650	112	14	29	7.5	.5
31	2.6	-------	2,480	31	-------	6,560	-------	73	-------	21	6.5	-------

NOTE.—Gage not read and discharge interpolated Oct. 6, Nov. 12, 30, Dec. 4, Feb. 21, Mar. 9, May 5, and Aug. 4.

Monthly discharge of Big Muddy River at Plumfield, Ill., for the year ending Sept. 30, 1922

[Drainage area, 753 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	1,100	1.6	120	0.159	0.18
November	5,520	3.0	1,490	1.98	2.21
December	5,520	73	1,580	2.10	2.42
January	1,580	29	389	.517	.60
February	2,150	55	641	.851	.89
March	6,560	181	2,410	3.20	3.69
April	10,200	698	3,690	4.90	5.47
May	1,080	18	220	.292	.34
June	794	9.0	150	.199	.22
July	336	3.2	43.7	.058	.07
August	48	2.2	14.2	.019	.02
September	48	.4	5.37	.0071	.008
The year	10,200	.4	894	1.19	16.12

BIG MUDDY RIVER AT MURPHYSBORO, ILL.

LOCATION.—In SW. ¼ sec. 8, T. 9 S., R. 2 W., at lower highway bridge on South Twentieth Street, Murphysboro, Jackson County, a quarter of a mile below mouth of Louis Creek.

DRAINAGE AREA.—2,170 square miles.

RECORDS AVAILABLE.—December 6, 1916, to September 30, 1922.

GAGE.—Chain gage attached to bridge; read by Clarence Jacobs.

CHANNEL AND CONTROL.—Bed composed of heavy clay; likely to shift.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 35.2 feet at 2 p. m. April 4 (discharge, not determined because of backwater from Mississippi River); minimum stage, 1.64 feet September 29 and 30 (discharge, 2.8 second-feet).

1917–1922: Maximum discharge recorded, 15,600 second-feet, January 10, 1917; minimum discharge, that of September 29 and 30, 1922.

About February 2, 1916, the river reached a height of 39.6 feet—the highest known stage—on the present gage (discharge, from extension of rating curve, 28,000 second-feet).

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

ACCURACY.—Stage-discharge relation permanent except as affected by backwater from Mississippi River whenever height on gage of United States Weather Bureau at Chester, Ill., is above about 10 feet. Rating curve well defined between 10 and 600 second-feet; fairly well defined beyond these limits. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table; not determined for period of backwater, March 2 to August 8. Records good, except for extremely low stages, which are fair.

The following discharge measurement was made by H. E. Grosbach:

August 29, 1922: Gage-height, 2.84 feet; discharge, 47.1 second-feet.

Daily discharge, in second-feet, of Big Muddy River at Murphysboro, Ill., for the year ending Sept. 30, 1922

Day	Feb.	Mar.	Aug.	Sept.	Day	Feb.	Mar.	Aug.	Sept.
1		1,180		1,090	16			15	12
2				1,000	17			13	8.0
3				640	18			13	8.6
4				270	19			16	8.0
5				240	20			36	8.0
6				89	21			52	6.8
7				42	22			82	6.0
8				52	23			270	7.6
9			20	65	24			250	5.6
10			22	52	25			210	4.4
11			18	36	26	1,720		220	4.0
12			19	30	27	1,450		70	4.8
13			17	19	28	1,300		56	3.2
14			16	19	29			52	2.8
15			16	12	30			60	2.8
					31			76	

NOTE.—No record Oct. 1 to Feb. 25.

Monthly discharge of Big Muddy River at Murphysboro, Ill., for the year ending Sept. 30, 1922

[Drainage area, 2,170 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
August 9–31	270	13	70.4	0.032	0.03
September	1,090	2.8	125	.058	.06

MISCELLANEOUS MEASUREMENTS

Miscellaneous discharge measurements in Upper Mississippi River drainage basin during the year ending Sept. 30, 1922

Date	Stream	Tributary to—	Locality	Gage height	Discharge.
				Feet.	*Sec.-ft.*
Jan. 14	Kinnikinnic River	St. Croix River	Old gaging station, near River Falls, Wis.	[a] 5.48	60.5
Feb. 8	do	do	do	[b] 5.60	59.4
June 20	do	do	do	3.55	112
Apr. 26	Elk Creek	Turkey River	Garber, Iowa		48
Nov. 10	Illinois River	Mississippi River	Utica, Ill	[c] 446.09	14,000
25	do	do	do	450.80	26,600
30	do	do	do	449.33	20,400
Apr. 14	do	do	do	457.97	56,200

[a] Nearly complete ice cover.
[b] Nearly complete ice cover at control; open at measuring section.
[c] Elevation referred to mean sea level.

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