1964

Surface Water Records of Minnesota

UNITED STATES DEPARTMENT OF THE INTERIOR-GEOLOGICAL SURVEY

Prepared in cooperation with the Minnesota Department of Conservation, Division of Waters; the Minnesota Department of Highways; the Minnesota Department of Iron Range Resources and Rehabilitation; and with other State, county, municipal, and Federal agencies

United States Department of the Interior
Geological Survey - Water Resources Division

SURFACE WATER RECORDS OF MINNESOTA

1964

Prepared in cooperation with

Minnesota Department of Conservation, Division of Waters
Minnesota Department of Highways
City of Austin, through the Minnesota Division of Waters
City of Rochester, through the Minnesota Division of Waters
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U. S. Department of State

Copies of this report may be obtained from
District Engineer, Surface Water Branch
U. S. Geological Survey
1610 Post Office Building
St. Paul, Minnesota 55101

CALENDAR FOR WATER YEAR 1964

OCTOBER 1963

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

NOVEMBER 1963

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

DECEMBER 1963

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

JANUARY 1964

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

FEBRUARY 1964

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

MARCH 1964

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

APRIL 1964

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

MAY 1964

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

JUNE 1964

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

JULY 1964

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

AUGUST 1964

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

SEPTEMBER 1964

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

CONTENTS

SURFACE WATER RECORDS OF MINNESOTA, 1964

INTRODUCTION

The surface-water records for the 1964 water year for gaging stations, partial-record stations, and miscellaneous sites within the State of Minnesota are given in this report. For convenience there are also included records for a few pertinent gaging stations in bordering states. The records were collected and computed by the Water Resources Division of the U. S. Geological Survey under the direction of D. B. Anderson, district engineer, Surface Water Branch.

Through September 30, 1960, the records of discharge and stage of streams and contents and stage of lakes or reservoirs were published in an annual series of U. S. Geological Survey water-supply papers entitled "Surface Water Supply of the United States." Since 1951 there have been 20 volumes in the series; each volume covered an area whose boundaries coincided with those of certain natural drainage areas. The records in Minnesota were contained in Parts 4, 5 and 6 of that series.

Beginning with the 1961 water year, streamflow records and related data will be released by the Geological Survey in annual reports on a State-boundary basis. Distribution of these basic-data reports will be limited and primarily for local needs. The records later will be published in Geological Survey water-supply papers at 5-year intervals.

COOPERATION

Cooperative agreements between the U. S. Geological Survey and organizations of the State of Minnesota for the systematic collection of streamflow records began in 1909. Organizations that supplied data are acknowledged in station descriptions. Organizations that assisted in collecting data through cooperative agreements with the Survey are:

Minnesota Department of Conservation, Division of Waters, Sidney A. Frellsen, director.

Minnesota Department of Highways, James C. Marshall, Commissioner.

Assistance in the form of funds or services was given by Corps of Engineers, U. S. Army, in collecting records for 30 gaging stations published in this report.

Several gaging stations in the Hudson Bay and St. Lawrence River basins were maintained by funds appropriated to the United States Department of State.

On waters adjacent to the international boundary, certain gaging stations are maintained by the United States (or Canada) under agreement with Canada (or the United States), and the records are obtained and compiled in a manner equally acceptable in both countries. These stations are designated herein as "International gaging stations."

DEFINITION OF TERMS AND ABBREVIATIONS

The terms of streamflow and other hydrologic data, as used in this report, are defined as follows:

Gaging station is a particular site on a stream, canal, lake or reservoir where systematic observations of gage height or discharge are obtained. When used in connection with a discharge record, the term is applied only to those gaging stations where a continuous record of discharge is obtained.

Partial-record station is a particular site where limited streamflow data are collected systematically over a period of years for use in hydrologic analyses.

Cubic foot per second (cfs) is the rate of discharge of a stream whose channel is 1 square foot in cross-sectional area and whose average velocity is 1 foot per second.

Cubic feet per second per square mile (cfsm) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Runoff in inches (in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Acre-foot (ac-ft) is the quantity of water required to cover an acre to the depth of 1 foot and is equivalent to 43,560 cubic feet.

Cfs-day is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, 1.983471 acre-feet, or 646,317 gallons, and represents a runoff of 0.0372 inch from 1 square mile.

Stage-discharge relation is the relation between gage height and the amount of water flowing in a channel, expressed as volume per unit of time.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, a long reach of the channel, or an artificial structure.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is so enclosed by a topographic divide that direct surface runoff from precipitation normally would drain by gravity into the river above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

WSP is used as an abbreviation for "Water-Supply Paper" in references to previously published reports.

DOWNSTREAM ORDER AND STATION NUMBERS

Stations are listed in the same downstream order used in the water-supply papers. Records are listed in a downstream direction along the main stem with all stations on a tributary entering above a main-stem station listed before that station. If a tributary enters between two main-stem stations, it is listed between them. A similar order is followed listing stations on first rank, second rank, and other ranks of tributaries. To indicate the rank of any tributary on which a gaging station is situated and the stream to which it is immediately tributary, each indention in the listing of gaging stations in the table of contents of this report represents one rank. This downstream order and system of indention shows which gaging stations are on tributaries between any two stations on a main stem and the rank of the tributary on which each gaging station is situated.

As an added means of identification, each gaging station and partial-record station has been assigned a station number. The numbers have been assigned in the same downstream order used in the annual series of water-supply papers. In assigning station numbers, no distinction is made between partial-record stations and continuous-record gaging stations, so that the station number for a prtial-record station indicates downstream order position in a list made up of both types of stations. Gaps are left in the numbers to allow for new stations that may be established; hence the numbers are not consecutive.

The complete number for each station, such as 5-3310.00, includes the part number "5" and a six digit station number. In this report, the part number and only the essential digits of the station number are shown. For example, the complete number 5-3310.00 would appear as 5-3310, just to the left of the station name. In this report, the records are listed in downstream order by parts. All records for a drainage basin encompassing more than one State could be arranged in downstream order by assembling pages from the various State reports by station number to include all records in the basin.

The base data collected at gaging stations consist of records of stage and measurements of discharge. In addition, observations of factors affecting the stage-discharge relation, weather records, and other information are used to supplement base data in determining the daily flow. The records of stage are obtained from a water-stage recorder that gives a continuous record of fluctuations or from direct readings on a nonrecording gage. Measurements of discharge are made with a current meter by the general methods adopted by the Geological Survey on the basis of experience in stream gaging since 1888. These methods are described in Water-Supply Paper 888 and are also outlined in standard textbooks on the measurement of stream discharge.

Rating tables giving the discharge for any stage are prepared from stage-discharge relation curves defined by discharge measurements. If extensions to the rating curves are necessary to define the extremes of discharge, they are made on the basis of indirect measurements of peak discharge (such as slope-area or contracted-opening measurements, or computation of flow over dams or weirs), velocity-area studies, and logarithmic plotting. The application of the daily mean gage height to those rating tables gives the daily mean discharge, from which the monthly and the yearly mean discharge are computed. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on individual discharge measurements and notes by engineers and observers are used in applying the gage heights to the rating tables. If the stage-discharge relation for a station is temporarily changed by the presence of aquatic growth or debris on the control, the daily mean discharge is computed by what is in effect the shifting-control method.

At some gaging stations the stage-discharge relation is affected by backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in determining discharge. Information required for determining the slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage. For such stations, the rate of change in stage is used as a factor in determining discharge.

At some gaging stations the stage-discharge relation is affected by ice during the winter, and it becomes impossible to compute the discharge in the usual manner. Discharge for periods of ice effect is computed on the basis of the gage-height record and occasional winter discharge measurements, consideration being given to the available information on temperature and precipitation, notes by gage observers and engineers, and comparable records of discharge for other stations in the same or nearby basins.

For some gaging stations there are periods when no gage-height record is obtained or the recorded gage height is so faulty that it cannot be used to compute the daily discharge. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, float is frozen in the well, or for various other reasons. For such periods the daily discharges are estimated on the basis of recorded range in stage, adjoining good record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins.

The data in this report generally comprise a description of the station, a skeleton rating table, and a table showing the daily discharge and monthly and yearly discharge of the stream. Tables of mean daily gage height are included for some stations. Records are published for the water year which begins on October 1 and ends on September 30. A calendar for the 1964 water year is shown on page II to facilitate finding the day of the week for any date.

The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The location of the gaging station and the drainage area are obtained from the most accurate maps available. River mileage given under "Location" for some stations, is that determined and used by the Corps of Engineers unless otherwise noted. Under "Records available" are given periods for which there are published records for the present station or for stations generally equivalent to the present one. Under "Gage" are given the type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records avail-

able. The references to "datum of 1929" and adjustments of other years are to the datum and adjustments of the U. S. Coast and Geodetic Survey. Under "Average discharge" is given the average discharge for the number of years indicated. It is not given for stations having fewer than five complete years of record or for stations where changes in water development during the period of record cause the figure to have little significance. Under "Extremes" are given the maximum discharge and gage height; the minimum discharge if there is little or no regulation; the minimum daily discharge if there is extensive regulation (also the minimum discharge if useful); and the minimum gage height if it is significant. In the first paragraph, the data given are for the complete current water year unless otherwise specified. In the second paragraph, the data given are for the periods of record within the calendar year dates in the heading (not necessarily those for the complete years indicated by the heading dates). Reliable information concerning major floods that have occurred outside the period of record are given in the third or last paragraph under "Extremes." Unless otherwise qualified, the maximum discharge corresponds to the crest stage obtained by use of a water-stage recorder, a crest-stage indicator, or a nonrecording gage read at the time of the crest. If the maximum gage height did not occur at the same time as the maximum discharge, it is given separately. Information pertaining to the accuracy of the records and to conditions which affect the natural flow at the gaging station is given under "Remarks."

Skeleton rating tables are published for all stations except those for which the daily discharge for the greater part of the open-water period was determined by the shifting-control method, the slope method, or other special methods involving an equivalent adjustment to the gage height of more than one-tenth foot. Skeleton rating tables generally are not published for canals, ditches, or springs.

The daily table gives the discharge corresponding to the daily mean gage height unless there are large or rapid changes in discharge during a day. For days having large or rapid changes, discharge for the day is computed by averaging the mean discharges for several parts of a day. For digital recorders, the daily mean discharge is always the average of the discharges at each punched reading. For stations equipped with nonrecording gages, the

daily discharge corresponds to once-daily readings of the gage or to the mean of twice-daily readings; but for periods of rapidly changing stage the discharge is determined from a gage-height graph based on gage readings.

In the table of daily discharge, the figures for the maximum day and the minimum day for each month are underlined only on the first day of its occurrence.

In the monthly summary below the daily table, the line headed "Total" gives the sum of the daily figures; it is the total cfs-days for the month. The line headed "Mean" gives the average flow in cubic feet per second during the month. Discharge for the month may be expressed in cubic feet per second per square mile (line headed "Cfsm), or in inches (line headed "In.), or in acre-feet (line headed "Ac-ft"). Figures for cubic feet per second per square mile and runoff in inches are omitted if the drainage area includes large noncontributing areas, or if the average annual rainfall on the drainage basin is usually less than 20 inches.

In the yearly summary below the monthly summary, the figures of maximum are the maximum daily discharges, not the momentary discharges when the water was at crest stage. Likewise, the minimums in this summary are the minimum daily discharges.

Peak discharges and the times of their occurrence and corresponding gage heights for most stations are listed below the table of daily and monthly discharge. All independent peaks above the selected base are given. The base discharge, which is given in parentheses, is selected so that an average of about three peaks a year can be presented. Peak discharges are not published for any stream for which the peaks are subject to substantial control by man. Time of day is expressed in 24-hour time, for example, 12:30 a.m. is 0030, 1:30 p.m. is 1330.

Footnotes to the table of daily discharge indicate periods for which discharge was computed or estimated by unusual or special methods because of no gage-height record, ice effect, or other conditions that reduce the degree of accuracy of the records. The footnotes are either reference footnotes, with corresponding symbols used in the table of daily discharge to indicate the days included, or general footnotes, introduced by the word "Note", in which the days included are stated. The

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methods used in computing data for such footnoted periods have been explained in preceding paragraphs.

For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. For some reservoirs a table showing daily contents or stage is given. A skeleton table of capacity at given stages is published each year for all reservoirs for which records are published on a daily basis, but it is not published for reservoirs for which only monthly data are given.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

The accuracy of streamflow data depends primarily on (1) the stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements, and (2) the accuracy of observations of stage, measurements of discharge, and interpretation of records.

The station description states the degree of accuracy of the records. "Excellent" indicates that, in general, the error in the daily records is believed to be less than 5 percent; "good," less than 10 percent; "fair," less than 15 percent; and "poor," probably more than 15 percent. The records of monthly and yearly mean discharge and runoff are, in general, more nearly accurate than the daily records.

Discharge at some stations, as indicated by the monthly mean, may vary widely from natural runoff, owing to diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff in inches are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur when relatively large negative adjustments are made or when evaporation is large in comparison with the observed discharge.

SUPPLEMENTAL DATA

Data collected at partial-record stations and at miscellaneous sites are given at the end of this report. Data for partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. Discharge measurements at miscellaneous sites are given in a third table.

Information of a more detailed nature than that published for most of the gaging stations is on file in the district office, such as discharge measurements and recorder charts or nonrecording-gage readings. At many gaging stations water samples are collected from the streams for the purpose of making chemical analyses; computing dissolved solids, suspended sediment loads, and particle-size distribution; or measuring water temperatures. Prior to September 30, 1963, for most of these samples the results are published in an annual series of U. S. Geological Survey water-supply papers entitled "Quality of Surface Waters of the United States." Beginning with the 1964 water year, "Quality of Surface Waters" and related data will be released by the Geological Survey in annual reports on a State-boundary basis. The 1964 annual report is a combined Minnesota-Iowa report. Information on the availability of unpublished data, or quality of water records may generally be obtained from the district office.

4-105. Pigeon River at Middle Falls, below International Bridge, Minn.

(International gaging station)

Location.--Lat 48°00'44", long 89°36'58", in NE¼ sec.24, T.64 N., R.6 E., on right bank 400 ft upstream from Middle Falls, 3½ miles upstream from mouth, and 5¾ miles downstream from International Bridge.

Drainage area.--600 sq mi.

Records available.--June to October 1921, April to November 1922, March 1923 to September 1964. Published as "at International Bridge" April 1924 to September 1940. Monthly discharge only for some periods, published in WSP 1307.

Gage.--Water-stage recorder. Datum of gage is 789.58 ft above mean sea level, datum of 1929. Prior to Sept. 2, 1936, staff gage and Sept. 2, 1936, to Sept. 30, 1940, wire-weight gage at International Bridge, 5¾ miles upstream at datum 100.24 ft higher.

Average discharge.--41 years (1923-64), 480 cfs.

Extremes.--Maximum discharge during year, 8,270 cfs May 6 (gage height, 9.65 ft); minimum daily, 92 cfs Mar. 26-31; minimum gage height, 0.74 ft Dec. 2.
1923-64: Maximum discharge, 11,000 cfs May 5, 1934 (gage height, 7.6 ft, site and datum then in use), from rating curve extended above 7,000 cfs; minimum, 27 cfs Nov. 4, 1945 (gage height, -0.08 ft).

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair.

Cooperation.--This station is one of the international gaging stations maintained by the United States under agreement with Canada.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.7	112	3.0	817	7.0	3,920
1.0	172	4.0	1,320	9.0	6,880
1.5	302	5.0	2,010		
2.0	452	6.0	2,920		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	224	134	127	113	102	95	93	*3,000	924	792	296	266
2	216	132	124	114	101	96	95	2,600	869	768	308	255
3	211	130	119	115	100	97	96	2,290	826	724	308	244
4	204	128	*118	116	100	97	97	2,200	788	689	305	237
5	198	128	116	117	101	96	100	4,000	752	652	294	226
6	186	130	117	116	99	96	104	6,770	768	626	280	221
7	182	130	118	114	96	96	108	5,630	986	615	274	224
8	179	130	118	*112	96	96	112	4,440	1,020	615	269	224
9	174	134	119	111	96	95	116	3,350	1,590	*618	260	221
10	170	142	119	109	97	95	126	2,480	1,510	597	255	216
11	163	152	118	108	98	95	185	2,150	1,250	568	294	208
12	161	157	118	107	98	96	390	2,180	1,040	544	285	208
13	159	159	117	106	99	97	790	2,330	869	517	308	204
14	157	152	116	106	99	98	1,120	2,600	826	500	282	194
15	154	150	114	106	99	98	1,300	2,870	856	484	266	184
16	150	146	113	106	100	96	1,220	3,070	834	468	255	177
17	150	144	112	106	100	94	1,240	3,240	801	452	255	172
18	150	144	112	107	101	94	1,450	3,320	792	415	250	170
19	150	144	111	108	101	94	1,800	3,310	*784	396	242	170
20	148	142	111	109	102	94	2,200	3,410	764	415	234	182
21	148	144	110	109	100	95	1,580	3,570	744	415	237	196
22	154	177	109	108	99	96	1,390	3,670	713	390	242	204
23	159	171	108	107	97	96	1,740	3,040	914	366	250	211
24	161	160	107	104	95	95	1,770	1,540	1,710	354	250	250
25	159	150	107	102	94	*94	1,510	1,260	1,610	340	242	294
26	152	145	106	101	*94	92	1,400	1,620	1,270	328	*237	354
27	148	140	107	100	94	92	1,640	1,760	1,060	322	231	409
28	146	138	108	99	94	92	4,470	*1,450	943	322	234	372
29	142	134	108	99	95	92	4,030	1,250	856	*322	234	331
30	*138	132	110	100	---------	92	3,580	1,110	809	314	247	*294
31	136	----------	112	102	---------	92	----------	1,010	----------	305	266	----------
Total	5,129	4,299	3,529	3,337	2,847	2,943	35,852	86,520	29,478	15,233	8,190	7,118
Mean	165	143	114	108	98.2	94.9	1,195	2,791	983	491	264	237
Cfsm	0.275	0.238	0.190	0.180	0.164	0.158	1.99	4.65	1.64	0.818	0.440	0.395
In.	0.32	0.27	0.22	0.21	0.18	0.18	2.22	5.36	1.83	0.94	0.51	0.44

Calendar year 1963: Max 2,650 Min 79 Mean 333 Cfsm 0.555 In. 7.55
Water year 1963-64: Max 6,770 Min 92 Mean 559 Cfsm 0.932 In. 12.68

Peak discharge (base, 3,000 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-28	1230	7.68	4,710	5-22	1630	6.79	3,710
5- 6	0230	9.65	8,270				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23 to Apr. 21 (no gage-height record Jan. 12 to Feb. 25, Apr. 1-13).

4-145. Baptism River near Beaver Bay, Minn.

Location.--Lat 47°20'15", long 91°12'00", in SE¼NE¼ sec.15, T.56 N., R.7 W., on right bank 260 ft upstream from bridge on U. S. Highway 61, 0.2 mile upstream from mouth, 4 miles northeast of Silver Bay, and 7 miles northeast of village of Beaver Bay.

Drainage area.--140 sq mi.

Records available.--October 1927 to September 1964. Monthly discharge only for some periods, published in WSP 1307.

Gage.--Water-stage recorder. Datum of gage is 609.97 ft above mean sea level (Corps of Engineers bench mark). Prior to Oct. 5, 1934, staff gage at same site and datum.

Average discharge.--37 years, 157 cfs.

Extremes.--Maximum discharge during year, 3,220 cfs Apr. 28 (gage height, 5.38 ft); minimum, 10 cfs Aug. 21 (gage height, 1.90 ft).
1927-64: Maximum discharge recorded, 9,350 cfs Aug. 9, 1939 (gage height, 8.11 ft), from rating curve extended above 4,000 cfs; minimum daily, 0.4 cfs Jan. 5, 6, 1940.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to May 30				May 31 to Sept. 30					
1.8	8.5	2.7	83	1.9	10	3.0	138	4.5	1,500
2.0	16	3.0	146	2.1	18	3.3	270	5.0	2,460
2.2	28	3.3	270	2.4	39	3.6	525	5.4	3,260
2.4	44	Note.--Same as following table above 3.3 ft.		2.7	78	4.0	905		

Discharge, in cubic feet per second, water year October1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	52	27	49	24	17	16	15	1,220	190	207	17	212
2	48	25	47	25	18	16	15	1,140	172	169	17	194
3	43	25	50	25	18	16	16	952	155	131	23	181
4	38	24	*53	25	18	16	17	886	138	110	18	131
5	34	24	56	24	18	15	17	1,140	121	91	15	106
6	30	23	56	23	18	15	18	1,250	112	79	13	98
7	28	22	54	22	17	15	19	1,210	162	75	13	334
8	25	22	50	*22	17	15	20	952	172	88	12	394
9	22	24	47	24	17	16	22	724	319	95	12	284
10	20	26	46	22	17	16	24	582	298	86	14	478
11	19	25	44	20	18	16	28	496	238	73	28	305
12	19	28	42	18	18	16	110	620	190	*66	24	207
13	18	28	40	17	18	16	520	563	169	56	21	158
14	16	24	38	16	18	16	582	449	152	48	19	124
15	16	28	36	16	18	16	525	376	203	40	16	98
16	15	29	35	16	18	15	*572	305	194	36	16	84
17	15	29	34	16	17	15	762	265	169	33	14	78
18	15	28	33	16	17	15	791	319	404	30	13	69
19	16	28	31	17	18	16	724	412	782	27	12	104
20	18	28	30	17	17	16	696	333	658	25	11	190
21	28	29	30	17	17	17	1,070	277	478	24	150	194
22	72	210	30	18	17	17	1,420	238	349	21	358	172
23	68	200	30	18	16	17	1,080	1,080	1,260	19	232	232
24	63	180	32	17	16	17	876	1,900	2,000	24	162	270
25	58	140	31	17	*16	*16	734	1,280	1,240	23	124	243
26	48	130	30	17	16	16	658	848	782	21	*90	409
27	42	121	29	17	16	16	1,190	*592	516	24	72	525
28	38	106	28	17	15	16	2,800	449	340	*25	131	394
29	34	88	26	17	16	15	2,020	340	243	21	169	305
30	*31	65	25	17	- - - - - -	15	*1,610	270	248	18	270	*248
31	30	- - - - - -	24	17	- - - - - -	15	- - - - - -	227	- - - - - -	17	254	- - - - - -
Total	1,019	1,786	1,186	594	497	490	18,951	21,695	12,454	1,802	2,340	6,821
Mean	32.9	59.5	38.3	19.2	17.1	15.8	632	700	415	58.1	75.5	227
Cfsm	0.235	0.425	0.274	0.137	0.122	0.113	4.51	5.00	2.96	0.415	0.539	1.62
In.	0.27	0.47	0.32	0.16	0.13	0.13	5.03	5.76	3.31	0.48	0.62	1.81

Calendar year1963: Max 880 Min 1.7 Mean 83.6 Cfsm 0.597 In. 8.10
Water year1963-64: Max 2,800 Min 11 Mean 190 Cfsm 1.36 In. 18.49

Peak discharge (base, 1,300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-13	0800	4.89	2,240	5-6	2315	4.40	1,340
4-22	0200	4.53	1,550	6-24	0700	4.86	2,180
4-28	0345	5.38	3,220				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23-26, Nov. 30 to Dec. 20, Dec. 24, 25, 27-29, Jan. 17 to Feb. 11, Mar. 4-11, Mar. 13 to Apr. 13.

4-155. Second Creek near Aurora, Minn.

Location.--Lat 47°31'25", long 92°11'35", in SW¼ sec.12, T.58 N., R.15 W., on left bank 0.1 mile downstream from First Creek, 0.4 mile upstream from mouth, and 2.1 miles east of Aurora.

Drainage area.--26.3 sq mi.

Records available.--March 1955 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,410.36 ft above mean sea level, datum of 1929 (levels by Erie Mining Company).

Average discharge.--9 years, 16.7 cfs.

Extremes.--Maximum discharge during year, 101 cfs June 24 (gage height, 4.67 ft); minimum, 4.4 cfs Feb. 12 (gage height, 3.26 ft).
1955-64: Maximum discharge, 213 cfs Apr. 22, 1961; maximum gage height, 5.75 ft Mar. 28, 1957 (backwater from ice); minimum daily discharge, 1.5 cfs Jan. 26 to Feb. 4, 1963; minimum gage height, 3.10 ft Feb. 2, 3, 4, 1963.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 19				Apr. 20 to Sept. 30			
3.2	3.2	3.8	25	3.3	5.4	4.0	42
3.3	5.4	4.0	39	3.4	8.4	4.5	85
3.4	8.0	4.5	82	3.6	17	5.0	136
3.6	15			3.8	27		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	8.9	*7.5	8.0	7.6	5.8	7.2	*8.2	50	18	44	8.8	30
2	8.3	8.3	7.7	7.6	5.6	7.3	9.5	46	17	36	8.4	26
3	*7.5	8.3	7.8	7.6	5.4	7.4	11	*42	17	30	8.8	26
4	7.5	8.3	8.0	7.8	5.2	7.4	10	44	17	28	*9.1	*27
5	6.4	7.7	*8.2	8.0	5.1	7.4	9.8	49	17	26	8.1	25
6	6.2	6.7	8.9	8.2	5.0	7.4	9.5	68	19	23	7.8	25
7	7.2	6.2	9.2	8.4	4.9	7.5	9.4	90	27	22	7.5	47
8	8.0	6.4	10	8.5	4.8	7.6	11	87	37	25	7.2	56
9	7.5	6.7	11	*8.6	4.7	7.8	13	79	45	25	7.5	59
10	6.2	7.2	11	8.6	4.6	8.0	16	68	44	28	8.8	55
11	7.0	7.5	10	8.5	4.6	8.1	20	56	38	*25	12	47
12	10	8.3	9.6	8.4	4.6	8.3	28	49	32	22	13	38
13	9.2	9.9	9.0	8.3	4.6	8.4	41	42	26	19	14	31
14	8.6	9.2	8.5	8.2	4.6	8.6	39	36	25	18	14	27
15	9.6	9.6	8.2	8.1	4.6	8.6	36	30	23	17	13	29
16	15	9.9	8.1	8.0	4.6	8.6	34	28	22	15	13	23
17	17	9.6	8.0	7.9	4.7	8.5	32	24	21	14	11	23
18	19	9.2	8.0	7.8	4.8	8.4	31	26	32	13	9.1	22
19	10	8.6	7.9	7.8	4.9	8.3	29	29	39	13	7.5	22
20	8.0	7.5	7.8	7.7	5.0	8.2	28	27	36	13	7.5	22
21	7.5	7.2	7.7	7.5	5.1	8.3	38	24	32	13	9.9	21
22	17	12	7.7	7.4	5.3	8.4	60	24	28	14	14	20
23	17	13	7.7	7.3	5.5	8.5	*56	32	62	12	16	42
24	16	12	7.6	7.1	5.8	8.5	50	50	95	11	14	50
25	15	11	7.6	7.0	6.1	8.5	41	42	93	11	14	50
26	13	10	7.6	6.8	6.4	8.3	36	34	84	11	13	53
27	12	10	7.5	6.6	*6.8	8.1	34	28	66	11	12	49
28	12	9.5	7.4	6.5	7.0	8.0	44	24	50	11	19	44
29	9.9	9.2	7.4	6.3	7.1	7.8	51	22	38	10	23	39
30	8.0	8.5	7.5	6.1	------	7.7	52	20	50	9.1	28	33
31	7.2	------	7.5	5.9	------	7.9	------	*19	------	8.8	28	------
Total	321.7	265.0	258.1	236.1	153.2	249.0	887.4	1,289	1,150	577.9	387.0	1,061
Mean	10.4	8.83	8.33	7.62	5.28	8.03	29.6	41.6	38.3	18.6	12.5	35.4
Cfsm	0.395	0.336	0.317	0.290	0.201	0.305	1.13	1.58	1.46	0.707	0.475	1.35
In.	0.45	0.37	0.36	0.33	0.22	0.35	1.25	1.82	1.63	0.82	0.55	1.50

Calendar year 1963: Max 138 Min 1.5 Mean 13.6 Cfsm 0.517 In. 7.01
Water year 1963-64: Max 95 Min 4.6 Mean 18.7 Cfsm 0.711 In. 9.65

Peak discharge (base, 60 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-22	0400	4.22	61	6-24	0300	4.67	101
5- 7	0300	4.58	93	9- 9	0700	4.21	60

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Dec. 5, Dec. 13 to Feb. 11, Feb. 14-20, Feb. 22 to Apr. 19.

4-160. Partridge River near Aurora, Minn.

Location.--Lat 47°31'02", long 92°11'24", in SE¼SW¼ sec.12, T.58 N., R.15 W., on right bank at upstream side of highway bridge, 1,000 ft downstream from Second Creek, 2½ miles east of Aurora, and 2¾ miles upstream from mouth.

Drainage area.--156 sq mi.

Records available.--August 1942 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,402.30 ft above mean sea level, datum of 1929. Aug. 5, 1942, to Aug. 25, 1944, staff gage and Aug. 26, 1944, to July 1, 1956, water-stage recorder at site 45 ft downstream at same datum.

Average discharge.--22 years, 120 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 1,420 cfs June 27 (gage height, 5.65 ft); minimum, 7.7 cfs Feb. 23, (gage height, 1.22 ft).
1942-64: Maximum discharge, 3,230 cfs May 10, 1950 (gage height, 7.86 ft); minimum, 2.2 cfs Jan. 30, 31, 1961; minimum gage height, 0.88 ft Mar. 2, 1963.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Flow regulated at times by storage in off-channel Partridge Reservoir, formerly known as Whitewater Lake. Reservoir formed from lake by levees around marsh areas and natural outlet. Available capacity, 20,000 acre-ft between elevations 1,410 ft (natural lake level) and 1,440 ft. Storage began Apr. 9, 1955. Storage in reservoir obtained from Colby Lake during periods of high flow; release from storage returned to Colby Lake to maintain lake elevation during diversion for iron-ore processing. Diversion began Feb. 7, 1956. Some seepage losses from reservoir bypass station.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 28)

1.2	7.4	2.7	85
1.4	11	3.0	128
1.6	16	3.5	230
1.8	22	4.0	382
2.1	33	5.0	930
2.4	52	6.0	1,700

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	25	*24	14	10	9.6	9.6	*14	57	137	490	21	55
2	24	25	13	11	9.4	9.8	18	54	117	363	21	60
3	*22	25	12	11	9.3	10	20	*51	99	302	21	64
4	22	24	12	11	9.2	11	18	55	85	247	*20	*55
5	19	23	*12	12	9.1	11	17	63	73	201	18	62
6	19	22	15	13	9.0	11	18	106	69	164	18	69
7	19	22	15	13	9.0	12	18	190	79	142	16	84
8	20	22	19	14	9.0	12	16	289	98	133	14	99
9	18	22	22	*15	9.0	12	18	392	118	120	14	117
10	17	22	22	15	9.0	12	22	382	139	111	18	102
11	17	22	20	14	9.0	12	33	460	150	*98	22	82
12	20	22	17	13	9.0	12	46	445	148	84	22	70
13	18	23	16	13	9.0	12	58	366	135	73	22	63
14	17	23	13	13	9.0	13	50	280	123	63	22	56
15	17	24	11	12	9.0	13	43	233	105	54	22	51
16	22	24	10	12	8.8	13	45	187	99	48	20	57
17	25	23	10	12	8.6	13	45	168	102	41	19	52
18	26	23	9.7	12	8.5	13	39	157	126	38	17	48
19	20	22	9.5	12	8.3	13	34	146	159	38	16	44
20	17	22	9.3	12	8.1	14	33	142	172	41	16	49
21	17	20	9.2	12	8.5	14	41	133	187	41	20	51
22	30	32	9.1	12	8.3	14	*65	126	190	41	24	53
23	29	28	9.0	11	7.9	15	59	135	286	41	25	82
24	29	23	9.0	11	8.8	15	52	194	560	35	24	83
25	27	26	9.0	11	9.8	14	43	252	848	31	24	96
26	26	20	9.0	11	10	13	41	261	1,270	28	22	102
27	26	23	9.2	11	*10	13	39	289	1,370	28	22	102
28	27	22	9.2	10	10	12	54	264	1,130	25	32	115
29	27	17	9.6	10	9.6	12	63	233	836	23	36	125
30	26	16	9.8	10	----------	13	61	201	655	21	44	133
31	24	----------	10	10	----------	12	----------	*166	----------	21	46	----------
Total	692	686	383.6	369	261.8	385.4	1,123	6,477	9,665	3,186	698	2,281
Mean	22.3	22.9	12.4	11.9	9.03	12.4	37.4	209	322	103	22.5	76.0
(↗)	-0.2	+10.3	+9.4	-0.03	-0.1	-0.06	+82.8	+94.2	+29.1	+7.8	-0.2	+61.4
Mean≠	22.1	33.2	21.8	11.9	8.93	12.3	120	303	351	111	22.3	137
Cfsm≠	0.142	0.213	0.140	0.076	0.057	0.079	0.769	1.94	2.25	0.712	0.143	0.878
In.≠	0.16	0.24	0.16	0.09	0.06	0.09	0.86	2.24	2.51	0.82	0.16	0.98

Calendar year 1963: Max 203 Min 3.1 Mean 45.7 Mean≠ 61.6 Cfsm≠ 0.395 In.≠ 5.35
Water year 1963-64: Max 1,370 Min 7.9 Mean 71.6 Mean≠ 96.0 Cfsm≠ 0.615 In.≠ 8.37

* Discharge measurement made on this day.
↗ Change in contents in Partridge Reservoir and diversion to iron-ore processing plant, equivalent in cubic feet per second; furnished by Erie Mining Co.
≠ Adjusted for change in contents and diversion.
Note.--Stage-discharge relation affected by ice Dec. 16-25, Jan. 15 to Feb. 11, Feb. 14-17, Mar. 6-8, 13-18, 26-28. No gage-height record Nov. 30 to Dec. 5, Dec. 30 to Jan. 2.

4-165. St. Louis River near Aurora, Minn.

Location.--Lat 47°29'30", long 92°14'20", in SW¼ sec.22, T.58 N., R.15 W., on left bank at upstream side of highway bridge, three-quarters of a mile downstream from Partridge River and 1½ miles south of Aurora.

Drainage area.--312 sq mi.

Records available.--August 1942 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,371.24 ft above mean sea level, datum of 1929. Prior to Aug. 26, 1944, chain gage at same site and datum.

Average discharge.--22 years, 231 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 2,080 cfs June 27 (gage height, 5.10 ft); minimum daily, 21 cfs Mar. 28 to Apr. 1; minimum gage height, 0.86 ft Oct. 21.
1942-64: Maximum discharge, 5,380 cfs May 14, 1950 (gage height, 8.37 ft); minimum, 4.0 cfs Oct. 2, 3, 1948 (gage height, 0.30 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated at times by storage in off-channel Partridge Reservoir, formerly known as Whitewater Lake. Reservoir formed from lake by levees around marsh areas and natural outlet. Available capacity 20,000 acre-ft between elevations 1,410 ft (natural lake level) and 1,440 ft. Storage began Apr. 9, 1955. Storage in reservoir obtained from Colby Lake during periods of high flow; release from storage returned to Colby Lake to maintain lake elevation during diversion for iron-ore processing. Diversion began Feb. 7, 1956. Some seepage losses from reservoir enter above station.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 28		Apr. 29 to Sept. 30			
0.7	26	0.9	42	3.0	661
1.0	52	1.3	91	4.0	1,240
1.3	89	1.6	143	5.0	2,000
1.6	140	2.0	248	6.0	2,880
2.0	237	2.5	432		
2.5	394				

Discharge, in cubic feet per second, water year October 1963 to September, 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	60	*50	50	38	27	24	*21	448	366	1,180	72	105
2	56	51	49	38	27	24	23	448	325	980	74	122
3	52	52	48	39	26	24	25	*436	293	848	74	130
4	*50	49	49	39	26	24	26	444	262	738	*72	*124
5	48	48	50	39	26	24	27	461	235	637	70	132
6	44	47	*52	40	26	24	27	565	219	551	62	149
7	44	45	56	40	25	24	27	763	242	486	54	186
8	42	45	60	40	25	24	26	826	275	461	50	210
9	41	47	63	40	25	24	25	898	304	409	49	248
10	40	46	64	*40	24	24	26	838	318	366	57	255
11	38	45	63	40	24	24	31	865	318	*325	66	232
12	38	46	59	39	25	24	47	843	307	286	62	210
13	39	47	56	38	25	25	85	768	282	248	59	202
14	37	48	53	37	25	25	140	666	265	222	58	188
15	36	47	51	36	25	24	175	599	235	196	57	176
16	38	48	48	36	25	24	180	523	216	178	57	183
17	43	48	46	35	26	24	175	473	219	162	52	178
18	44	47	44	35	26	24	161	457	286	149	49	166
19	42	46	43	34	26	23	154	436	382	139	46	160
20	37	44	42	34	*26	23	144	412	416	139	46	164
21	38	44	40	33	25	23	162	385	416	135	56	164
22	70	72	39	33	25	23	*243	363	428	128	60	169
23	66	73	39	33	24	23	249	393	632	122	59	238
24	64	62	38	32	24	22	246	599	1,280	116	60	238
25	62	59	38	31	24	22	226	695	1,770	104	62	262
26	59	62	38	31	23	22	220	671	1,960	99	59	293
27	59	60	38	30	23	22	220	632	2,020	94	57	311
28	58	58	37	29	24	21	301	579	1,840	88	82	304
29	58	54	37	29	24	21	409	518	1,580	80	82	311
30	56	52	37	28	----------	21	452	*469	1,370	75	97	314
31	53	----------	38	28	----------	21	----------	416	----------	72	96	----------
Total	1,512	1,542	1,465	1,094	726	721	4,273	17,889	19,061	9,813	1,956	6,124
Mean	48.8	51.4	47.3	35.3	25.0	23.3	142	577	635	316	63.1	204
(≠)	-0.2	+10.3	+9.4	-0.03	-0.1	-0.1	+83	+94	+29	+7.8	-0.2	+61
Mean ≠	48.6	61.7	56.7	35.3	24.9	23.2	225	671	664	324	62.9	265
Cfsm	≠ 0.156	0.198	0.182	0.113	0.080	0.074	0.721	2.15	2.13	1.04	0.202	0.849
In.	≠ 0.18	0.22	0.21	0.13	0.09	0.08	0.80	2.48	2.38	1.20	0.23	0.95

Calendar year 1963: Max 641 Min 14 Mean 115 Mean≠ 131 Cfsm≠ 0.420 In.≠ 5.69
Water year 1963-64: Max 2,020 Min 21 Mean 181 Mean≠ 205 Cfsm≠ 0.657 In.≠ 8.95

* Discharge measurement made on this day.
≠ Change in contents in Partridge Reservoir and diversion to iron-ore processing plant, equivalent in cubic feet per second, furnished by Erie Mining Company.
≠ Adjusted for change in contents and diversion.
Note.--Stage-discharge relation affected by ice Nov. 23 to Apr. 17.

4-170. Embarrass River at Embarrass, Minn.

Location.--Lat 47°39'24", long 92°11'51", in NW¼ sec.25, T.60 N., R.15 W., on left bank at Embarrass, 30 ft upstream from highway bridge and 100 ft upstream from railroad bridge.

Drainage area.--93.8 sq mi.

Records available.--August 1942 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,410.36 ft above mean sea level, datum of 1929. Prior to Aug. 28, 1944, chain gage at same site and datum.

Average discharge.--22 years, 64.4 cfs.

Extremes.--Maximum discharge during year, 470 cfs June 26 (gage height, 7.33 ft); minimum daily, 2.5 cfs Mar. 25-30; minimum gage height, 0.75 ft Feb. 29.
1942-64: Maximum discharge, 1,740 cfs May 8, 9, 1950; maximum gage height, 10.92 ft May 9, 1950; minimum daily discharge, 0.9 cfs Jan. 28 to Feb. 5, 1963; minimum gage height, 0.63 ft Mar. 7, 1963.

Remarks.--Records good except those for periods of ice effect or shifting control, which are fair.

Rating table, water year 1963-64, except periods of ice effect or shifting control (gage height, in feet, and discharge, in cubic feet per second)

0.8	3.0	1.4	32	4.0	201
.9	5.2	1.6	49	5.0	266
1.0	8.3	2.0	82	7.0	428
1.2	18	3.0	142	8.0	550

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16	13	13	5.0	3.5	3.0	*2.6	229	73	187	6.6	24
2	14	11	14	5.0	3.5	3.0	3.0	*233	63	163	6.3	24
3	*12	11	15	5.0	3.5	2.8	3.5	226	56	138	6.3	37
4	11	10	15	5.0	3.5	2.8	4.0	221	50	110	*6.0	41
5	11	10	*15	5.0	3.5	2.8	4.5	223	46	87	5.2	36
6	10	10	15	5.0	3.5	2.8	5.0	253	44	71	5.2	32
7	9.6	10	15	4.8	3.5	2.8	6.0	307	83	61	5.2	70
8	9.2	11	15	4.8	3.3	2.9	7.0	355	114	59	4.7	114
9	8.7	11	13	*4.8	3.3	3.0	8.0	392	150	58	3.4	117
10	8.3	12	12	4.5	3.3	3.0	15	365	170	51	4.0	133
11	8.3	13	11	4.5	3.1	3.2	27	318	176	*46	5.8	127
12	8.3	14	11	4.5	3.0	3.3	67	263	159	40	6.6	110
13	8.7	14	11	4.5	3.0	3.5	87	215	152	33	6.6	85
14	10	14	11	4.3	3.0	3.5	90	180	135	29	6.6	63
15	9.2	14	11	4.3	3.0	3.3	99	154	114	26	6.0	48
16	8.7	15	10	4.3	3.0	3.3	98	130	92	23	6.0	41
17	8.7	15	9.0	4.3	3.0	3.3	99	110	78	19	5.8	40
18	8.7	15	8.5	4.0	3.0	3.1	88	103	116	17	5.8	36
19	8.3	15	8.0	4.0	3.0	3.0	83	112	143	14	5.5	33
20	8.3	14	7.0	4.0	3.0	2.8	83	107	140	14	5.5	33
21	8.7	14	6.5	3.8	3.0	2.8	95	99	131	13	6.3	38
22	14	13	6.0	3.8	3.0	2.6	105	91	116	12	7.6	36
23	22	12	5.5	3.8	2.8	2.6	187	97	176	11	8.0	90
24	20	12	5.3	4.0	2.8	2.6	*185	128	281	9.6	8.3	142
25	17	13	5.1	4.0	2.8	2.5	172	142	375	8.7	10	148
26	17	14	5.0	4.0	2.8	2.5	159	147	462	8.3	13	148
27	15	15	4.8	3.5	*2.8	2.5	150	145	430	8.3	9.6	155
28	14	15	4.8	3.5	2.8	2.5	166	137	360	8.3	*9.6	150
29	14	15	4.5	3.5	3	2.5	199	122	279	8.0	15	138
30	14	14	4.5	3.5	---	2.5	219	*104	218	7.6	18	120
31	*13	---	4.5	3.5	---	2.6	---	87	---	7.3	24	---
Total	365.7	389	296.0	132.5	90.3	89.4	2,516.6	5,795	4,982	1,348.1	242.5	2,409
Mean	11.8	13.0	9.55	4.27	3.11	2.88	83.9	187	166	43.5	7.82	80.3
Cfsm	0.126	0.139	0.102	0.045	0.033	0.031	0.894	1.99	1.77	0.464	0.083	0.856
In.	0.14	0.15	0.12	0.05	0.04	0.04	1.00	2.30	1.98	0.53	0.10	0.96

Calendar year 1963: Max 179 Min 0.9 Mean 30.8 Cfsm 0.328 In. 4.44
Water year 1963-64: Max 462 Min 2.5 Mean 51.0 Cfsm 0.544 In. 7.41

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Dec. 4, Dec. 9 to Apr. 9. Shifting-control method used Oct. 1-25, Apr. 11 to July 9, July 13 to Sept. 30.

4-193. West Swan River near Silica, Minn.

Location.--Lat 47°17'36", long 93°02'30", in SW¼NW¼ sec.32, T.56 N., R.21 W., on right bank 10 ft upstream from pilings of dismantled bridge and railroad bed of Great Northern Railroad, 2 miles northwest of Silica, 9 miles southwest of Hibbing and 20 miles above confluence of East Swan and West Swan.

Records available.--April 1963 to September 1964.

Gage.--Water-stage recorder. Altitude of gage is 1,360 ft (from topographic map). Prior to Aug. 2, 1963 reference point at same site and datum.

Extremes.--Maximum discharge during year, 166 cfs June 24 (gage height, 3.63 ft); maximum gage height, 3.66 ft Apr. 6 (backwater from ice); minimum discharge, 0.7 cfs Aug. 9 (gage height, 0.96 ft).
1963-64: Maximum discharge, that of June 24, 1964; maximum gage height, that of Apr. 6, 1963; minimum discharge, 0.3 cfs Aug. 8, 1963.

Remarks.--Records good except for periods of ice effect or no gage-height record, which are fair. One hundred and eleven discharge measurements, including ninety-eight by Hanna Mining, were made during the year.

Cooperation.--Additional discharge measurements and gage readings furnished by M. A. Hanna Mining Co.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Nov. 19, 21, Apr. 13-18, 21-24)

Oct. 1 to Apr. 12

1.3	1.0				
1.4	2.5				
1.6	6.0				
2.0	17				

Apr. 13 to Sept. 30

1.0	0.8		2.0	22	
1.1	1.1		2.5	52	
1.3	2.4		3.0	94	
1.5	4.8		3.7	174	
1.7	10				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.2	3.7	9.1	5.4	5.7	a7.7	10	28	2.8	5.3	1.5	6.4
2	6.7	3.3	9.1	5.3	5.6	7.4	11	24	2.7	4.4	2.2	7.0
3	6.0	3.5	9.4	5.3	5.6	7.2	13	21	2.6	3.5	2.4	5.5
4	5.6	3.3	9.1	5.3	5.6	6.6	a16	30	2.5	2.9	1.8	4.7
5	5.8	3.5	9.2	5.2	5.5	6.2	a22	50	2.3	2.6	1.2	4.0
6	6.0	3.1	9.4	5.2	5.5	6.0	15	101	2.6	2.5	1.3	4.3
7	6.0	3.1	9.1	5.2	5.5	a6.0	13	136	8.0	2.6	1.3	9.0
8	6.0	4.5	8.9	5.2	a5.5	a6.0	11	87	11	3.6	1.1	12
9	6.0	4.9	8.6	5.2	a5.5	5.9	10	53	12	3.6	.9	8.0
10	5.8	4.5	8.5	5.2	5.5	5.9	12	32	7.0	3.5	1.8	6.4
11	8.6	3.8	8.0	5.4	5.6	5.8	a90	22	4.8	3.1	3.2	4.8
12	13	3.1	7.6	5.8	6.2	5.7	a102	17	4.6	2.9	2.7	4.2
13	8.1	3.3	7.6	6.4	6.5	5.7	162	13	4.0	2.8	2.1	3.8
14	6.9	3.3	7.4	6.8	6.6	a5.7	155	10	3.5	2.5	1.9	3.6
15	6.7	3.0	7.3	7.2	a6.6	a5.8	120	8.0	3.2	2.3	1.9	2.7
16	6.9	2.5	7.2	7.4	a6.6	6.0	86	7.0	2.7	2.0	1.9	2.9
17	7.9	2.0	7.0	7.5	6.5	6.4	61	6.0	3.4	2.0	1.8	3.4
18	11	1.9	6.5	7.5	6.2	7.1	34	12	12	1.5	1.7	3.2
19	7.4	1.7	6.2	7.5	5.8	7.5	22	17	19	1.5	1.5	2.8
20	7.4	1.7	6.1	7.6	5.7	7.2	16	12	16	2.6	3.6	3.2
21	8.6	1.7	a6.0	7.6	5.7	a6.7	41	8.3	12	2.3	5.7	3.1
22	10	4.2	a6.0	7.6	a6.4	a6.5	114	6.4	8.3	1.9	6.4	3.1
23	9.9	3.7	5.9	7.6	a7.6	6.2	82	7.6	57	1.8	4.7	6.4
24	8.9	4.5	5.9	7.5	8.0	6.1	43	13	152	2.1	4.6	7.6
25	8.4	5.3	a5.8	7.5	8.1	6.2	26	9.4	100	1.8	4.6	6.2
26	7.6	6.5	5.8	7.4	8.0	6.7	19	6.7	49	1.5	3.8	6.4
27	6.5	6.9	5.7	6.8	8.0	a8.0	16	5.3	21	2.1	3.4	11
28	5.8	8.9	5.7	6.4	7.9	a8.6	25	5.3	12	2.0	8.0	8.0
29	5.1	9.1	5.6	6.1	a7.8	a9.0	31	5.3	7.6	1.5	9.7	6.2
30	4.2	9.2	5.5	5.9	----------	9.2	33	4.0	7.3	1.2	10	5.0
31	3.7	----------	5.4	5.8	----------	9.2	----------	3.2	----------	1.2	7.6	----------
Total	223.7	123.7	224.6	197.8	185.3	210.2	1,411	760.5	552.9	77.1	106.3	164.9
Mean	7.22	4.12	7.25	6.38	6.39	6.78	47.0	24.5	18.4	2.49	3.43	5.50
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year : Max - Min - Mean - Ac-ft -
Water year 1963-64: Max 162 Min 0.9 Mean 11.6 Ac-ft -

a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 20, 23, 24, Nov. 30 to Dec. 2, Dec. 5, Dec. 10 to Apr. 12.

4-240. St. Louis River at Scanlon, Minn.

Location.--Lat 46°42'12", long 92°25'07", in NW¼ sec.30, T.49 N., R.16 W., on right bank 25 ft downstream from lower bridge on U. S. Highway 61 at Scanlon, 0.6 mile downstream from Minnesota Power & Light Co. powerplant, 3 miles upstream from Thomson Reservoir, and 3.2 miles upstream from Midway River.

Drainage area.--3,430 sq mi, approximately.

Records available.--January 1908 to September 1964. Monthly discharge only for some periods, published in WSP 1307. Published as "near Thomson" 1908-50.

Gage.--Water-stage recorder. Datum of gage is 1,101.23 ft above mean sea level, datum of 1929. Oct. 5, 1909, to Sept. 5, 1914, chain gage 3 miles downstream and 50 ft below powerplant at datum about 420 ft lower. Sept. 6, 1914, to Aug. 4, 1953, powerplant record at Thomson hydroelectric plant.

Average discharge.--56 years, 2,165 cfs (unadjusted).

Extremes.--Maximum discharge during year, 18,000 cfs June 25 (gage height, 9.83 ft); minimum, 324 cfs Oct. 11 (gage height, 2.27 ft).
1908-64: Maximum daily discharge, 37,900 cfs May 9, 1950; maximum gage height, 15.8 ft, May 9, 1950, from Minnesota Highway Department (discharge uncertain); minimum discharge, 80 cfs Aug. 29, 1963; minimum daily, 109 cfs Feb. 7, 1924.

Remarks.--Records good. Diurnal fluctuation caused by powerplant upstream. Flow regulated by Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes (combined capacity, 332,160 acre-ft).

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 13 to Nov. 13)

Oct. 1 to June 25				June 26 to Sept. 30			
2.2	330	5.0	3,940	2.9	850	5.0	3,940
2.3	390	6.0	5,960	3.2	1,180	6.0	5,960
2.5	515	7.0	8,740	3.6	1,670	8.0	11,800
3.0	915	8.0	11,800	4.0	2,200	10.0	18,600
3.5	1,440	10.0	18,600				
4.0	2,100						

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	744	522	897	720	710	750	640	5,640	2,310	7,960	1,120	1,440
2	695	482	852	720	700	770	650	5,680	2,080	6,520	983	1,380
3	641	463	816	730	710	780	687	5,600	1,820	4,560	1,050	1,130
4	631	496	924	740	720	830	798	5,540	1,730	3,480	1,020	950
5	592	420	1,130	750	710	880	1,000	6,640	1,470	2,900	961	860
6	599	408	*1,190	740	730	920	890	8,410	1,440	2,590	1,060	920
7	496	476	1,210	740	710	920	895	14,800	1,320	2,300	994	2,900
8	463	438	1,210	740	700	925	746	16,100	1,630	*2,000	950	4,140
9	573	482	1,080	740	690	925	861	14,600	2,090	1,930	890	3,980
10	456	508	843	750	690	925	1,390	12,600	2,580	1,830	961	4,340
11	426	613	879	745	680	925	1,630	10,600	2,520	1,800	1,120	3,940
12	366	613	962	745	650	910	2,640	10,000	2,060	1,770	940	3,370
13	408	557	972	740	660	915	3,600	9,280	1,820	1,880	983	2,800
14	402	536	934	*725	660	960	5,220	7,690	1,650	2,060	1,070	2,300
15	378	571	870	725	640	1,030	5,130	6,340	1,500	2,010	900	2,050
16	378	655	870	725	630	1,150	5,190	5,560	1,340	1,930	1,000	1,890
17	384	663	834	730	*615	1,100	5,060	4,860	1,230	1,890	994	1,670
18	402	719	852	725	620	920	4,720	4,640	1,150	1,800	920	1,440
19	402	834	816	725	630	990	4,020	6,100	1,620	1,720	910	1,500
20	378	915	780	735	650	1,020	3,140	6,170	3,420	1,670	961	1,460
21	390	944	798	730	660	870	3,040	5,280	3,130	1,660	1,110	1,270
22	476	1,150	771	725	640	930	5,000	4,540	2,600	1,710	1,110	1,320
23	606	1,330	730	735	660	960	6,100	4,020	6,470	1,610	880	1,480
24	861	1,430	700	730	690	930	5,810	5,120	15,200	1,580	1,020	1,600
25	870	1,180	700	715	680	830	5,180	7,300	17,600	1,570	*1,260	1,830
26	789	1,140	745	715	715	710	4,780	*6,460	15,400	1,540	1,220	2,170
27	703	1,340	765	700	760	650	4,260	5,220	13,300	1,500	1,190	2,400
28	641	1,310	765	700	780	640	3,940	4,400	12,100	*1,560	1,420	*2,920
29	*585	1,000	730	705	755	600	*4,220	3,640	10,400	1,540	1,250	2,740
30	536	1,050	740	710	----------	*620	5,100	3,050	8,920	1,330	1,240	2,430
31	496	----------	720	725	----------	635	----------	2,700	----------	1,250	1,320	----------
Total	16,767	23,245	27,085	22,580	19,845	26,920	96,337	218,580	141,900	71,450	32,807	64,620
Mean	541	775	874	728	684	868	3,211	7,051	4,730	2,305	1,058	2,154
(≠)	-29	-167	-416	-450	-478	-650	+1,166	+1,927	+1,114	-657	-476	+828
Mean ≠	512	608	458	278	206	218	4,377	8,978	5,844	1,648	582	2,982
Cfsm ≠	0.149	0.177	0.134	0.081	0.060	0.064	1.28	2.62	1.70	0.480	0.170	0.869
In. ≠	0.17	0.20	0.15	0.09	0.06	0.07	1.43	3.02	1.90	0.55	0.20	0.97

Calendar year 1963: Max 7,450 Min 366 Mean 1,263 Mean≠ 1,262 Cfsm≠ 0.368 In.≠ 4.99
Water year 1962-63: Max 17,600 Min 366 Mean 2,082 Mean≠ 2,225 Cfsm≠ 0.649 In.≠ 8.81

* Discharge measurement made on this day.
≠ Change in contents, equivalent in cubic feet per second, in Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes; records furnished by Minnesota Power and Light Co.
≠ Adjusted for change in contents.
Note.--Stage-discharge relation affected by ice Dec. 23 to Apr. 2. No gage-height record Apr. 5-16.

5-300. Otter Tail River near Detroit Lakes, Minn.

Location.--Lat 46°50', long 95°42', in sec.23, T.139 N., R.40 W., on right bank 10 ft upstream from highway bridge, 5 miles downstream from Height of Land Lake, and 7½ miles east of city of Detroit Lakes.

Drainage area.--270 sq mi.

Records available.--March 1937 to September 1964.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,409.49 ft above mean sea level, datum of 1929.

Average discharge.--27 years, 51.8 cfs (37,500 acre-ft per year).

Extremes.--Maximum discharge during year, 164 cfs May 19 (gage height, 4.10 ft); minimum, 5.8 cfs Nov. 18 (gage height, 2.85 ft).
1937-64: Maximum discharge, 371 cfs June 26, 1943 (gage height, 4.78 ft, from graph based on partial record); maximum gage height, 6.96 ft Jan. 27, 1950 (backwater from ice); minimum daily discharge, 0.1 cfs Mar. 23, 1940.

Remarks.--Records good except those for periods of ice effect, which are fair. Flow partly regulated by dams of Minnesota Department of Conservation on several lakes above station.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.86	6.1	3.5	50
2.9	7.5	3.7	78
3.0	12	3.9	117
3.1	17	4.1	164
3.3	30		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	29	10	8.3	15	16	15	30	113	124	89	47	25
2	28	10	7.9	15	15	15	33	115	117	87	45	24
3	28	9.6	8.3	15	15	15	*34	124	115	85	43	21
4	27	9.2	8.3	14	15	15	33	133	111	85	41	17
5	25	9.2	8.3	13	15	15	35	142	104	87	37	17
6	24	8.8	8.3	13	15	15	40	150	102	92	35	19
7	24	8.3	8.2	13	15	15	42	152	104	98	32	24
8	23	8.3	8.5	13	14	15	42	152	115	*100	29	23
9	23	8.3	8.5	13	14	16	43	152	115	104	28	24
10	24	8.3	8.5	14	14	16	45	154	111	104	20	27
11	23	7.9	8.6	14	14	16	47	152	104	104	13	23
12	22	7.2	8.8	14	15	16	49	152	98	109	14	20
13	20	7.2	9.0	14	14	17	70	147	94	104	15	19
14	19	6.8	9.2	14	14	16	90	142	92	98	15	19
15	18	6.8	9.5	14	14	16	94	142	90	90	15	18
16	17	7.2	10	14	14	15	*100	142	85	87	15	20
17	17	6.8	10	15	14	15	109	142	87	83	15	19
18	16	6.1	*11	15	14	15	113	145	94	79	14	18
19	16	6.1	12	15	14	16	122	162	96	74	13	18
20	15	6.1	12	15	14	17	131	152	96	72	14	18
21	16	6.1	13	15	14	18	147	145	94	68	20	18
22	16	6.2	15	15	14	18	135	140	94	64	21	19
23	16	7.0	15	13	14	18	126	140	100	60	20	29
24	15	7.5	15	15	14	19	115	138	100	60	19	31
25	15	8.0	15	16	14	20	109	140	100	57	18	29
26	13	8.8	15	16	14	21	106	140	98	55	*16	30
27	13	*8.8	14	16	*15	25	113	*142	96	52	16	28
28	*12	8.3	13	16	15	26	*119	142	94	51	16	26
29	11	8.3	13	16	15	27	111	138	90	50	18	*25
30	11	7.9	13	*16	----------	28	111	133	90	*46	23	25
31	10	----------	14	16	----------	*29	----------	128	----------	44	23	----------
Total	586	235.1	338.2	452	418	560	2,494	4,391	3,010	2,438	710	673
Mean	18.9	7.84	10.9	14.6	14.4	18.1	83.1	142	100	78.6	22.9	22.4
Ac-ft	1,160	466	671	897	829	1,110	4,950	8,710	5,970	4,840	1,410	1,330

Calendar year 1963: Max 154 Min 6.1 Mean 35.1 Ac-ft 25,430
Water year 1963-64: Max 162 Min 6.1 Mean 44.6 Ac-ft 32,340

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22-25, Dec. 7 to Apr. 2.

5-405. Pelican River near Fergus Falls, Minn.

Location.--Lat 46°20'10", long 96°07'00", in NE¼ sec.17, T.133 N., R.43 W., on left bank 990 ft downstream from bridge on U. S. Highway 52, 3 miles northwest of Fergus Falls and 7½ miles upstream from mouth.

Drainage area.--482 sq mi.

Records available.--June 1909 to December 1912, July 1942 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,176.98 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department). June 19, 1909, to Dec. 31, 1912, staff gage at site 1 mile downstream at different datum. July 1, 1942, to Nov. 6, 1955, staff gage and Nov. 7, 1955 to Sept. 30, 1963, water-stage recorder at site 900 ft upstream at datum 3.00 ft higher.

Average discharge.--24 years (1910-12, 1942-64), 70.4 cfs (50,970 acre-ft per year).

Extremes.--Maximum discharge during year, 274 cfs May 8 (gage height, 4.47 ft); maximum gage height, 5.54 ft Apr. 11 (backwater from ice); minimum daily discharge, 12 cfs Dec. 21, 22.
1909-12, 1942-64: Maximum discharge, 756 cfs Mar. 29, 1943 (gage height, 5.53 ft); maximum gage height observed, 5.60 ft Mar. 28, 1950 (backwater from ice); no flow on many days in 1946, 1949-50.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Flow affected by storage in lakes above station.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.0	18	3.7	86
3.2	27	4.0	151
3.4	43	4.5	282

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	44	27	23	15	23	30	70	227	182	86	37	33
2	43	26	22	15	24	30	*85	224	180	82	37	32
3	*41	26	23	15	24	30	90	219	175	78	37	31
4	40	25	22	15	24	30	100	227	168	73	36	30
5	39	24	22	15	24	30	110	232	163	72	34	29
6	39	24	22	16	24	30	130	240	156	73	34	30
7	39	24	22	16	24	32	140	251	153	70	33	33
8	39	24	20	16	24	32	150	265	146	*68	33	30
9	38	24	18	15	25	32	160	265	146	65	35	30
10	37	24	18	15	25	32	170	254	144	65	35	30
11	36	24	17	16	25	32	180	249	142	64	32	30
12	35	24	16	16	25	32	170	240	137	61	31	30
13	34	20	16	16	25	34	185	230	130	61	33	30
14	33	26	15	16	25	34	156	230	126	61	33	*30
15	33	25	14	16	26	34	*227	227	119	60	33	31
16	32	23	14	16	26	34	235	227	113	57	33	31
17	31	23	14	17	26	34	235	227	113	53	33	32
18	31	22	13	17	26	34	222	227	149	50	31	31
19	31	22	*13	18	26	34	205	227	149	46	31	33
20	31	22	13	19	26	36	*192	224	153	44	31	32
21	32	22	12	19	26	36	208	222	153	41	34	32
22	33	25	12	19	27	37	214	222	153	40	34	33
23	33	22	13	19	27	38	222	219	149	39	34	35
24	33	24	13	19	27	40	219	216	137	39	34	37
25	32	25	13	21	28	40	211	214	133	38	33	37
26	31	25	14	20	28	40	222	205	124	37	*32	39
27	30	*25	14	21	*28	45	227	*195	115	36	33	39
28	29	24	14	22	28	50	*230	192	104	37	33	37
29	*29	24	14	22	28	55	227	188	96	*36	33	*37
30	28	23	14	*23	----------	60	230	185	90	35	33	36
31	27	----------	14	23	----------	*60	----------	180	----------	34	33	----------
Total	1,063	718	504	548	744	1,147	5,422	6,950	4,198	1,701	1,038	980
Mean	34.3	23.9	16.3	17.7	25.7	37.0	181	224	140	54.9	33.5	32.7
Ac-ft	2,110	1,420	1,000	1,090	1,480	2,280	10,750	13,790	8,330	3,370	2,060	1,940

Calendar year 1963: Max 200 Min 12 Mean 68.3 Ac-ft 49,490
Water year 1963-64: Max 265 Min 12 Mean 68.3 Ac-ft 49,620

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 11 (no gage-height record Jan. 29, Feb. 29 to Mar. 6).

5-459.5 Orwell Reservoir near Fergus Falls, Minn.

Location.--Lat 46°12'55", long 96°10'40", in SW¼ sec.26, T.132 N., R.44 W., at dam on Otter Tail River at outlet of Orwell Reservoir, 7 miles southwest of Fergus Falls, Minn.

Drainage area.--1,830 sq mi, approximately.

Records available.--March 1953 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,000.00 ft above mean sea level, adjustment of 1912. Gage readings reduced to elevations above mean sea level.

Extremes.--Maximum contents during year, 15,690 acre-ft Sept. 30 (elevation, 1,071.37 ft); minimum, 1,000 acre-ft July 6 (elevation, 1,048.00 ft).
1953-64: Maximum contents, 16,920 acre-ft June 17, 1962 (elevation, 1,072.38 ft); minimum (after initial filling), 844 acre-ft Aug. 26, 27, 1953 (elevation, 1,046.96 ft).

Remarks.--Reservoir is formed by earth dam with concrete spillway with one taintor gate; storage began in March 1953. Capacity to elevation, 1,070 ft (maximum operating stage) is 14,100 acre-ft of which 13,100 acre-ft is controlled storage above elevation 1,048 ft (minimum operating stage). Dead storage, 210 acre-ft. Figures given herein represent total contents. Reservoir is used for flood control and to increase low flow for water supply and pollution abatement.

Cooperation.--Records furnished by Corps of Engineers.

Month-end elevation and contents, water year October 1963 to September 1964

Date	Elevation (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	1,069.71	13,780	-
Oct. 31	1,070.65	14,850	+1,070
Nov. 30	1,068.48	12,480	-2,370
Dec. 31	1,061.86	7,000	-5,480
Calendar year 1963	-	-	-2,740
Jan. 31	1,058.04	4,620	-2,380
Feb. 29	1,058.71	4,990	+370
Mar. 31	1,060.88	6,320	+1,330
Apr. 30	1,061.19	6,530	+210
May 31	1,057.53	4,360	-2,170
June 30	1,048.44	1,090	-3,270
July 31	1,049.03	1,210	+120
Aug. 31	1,065.60	9,880	+8,670
Sept.30	1,071.30	15,610	+5,730
Water year 1963-64	-	-	+1,830

/ Elevation at 2400.

5-460. Otter Tail River below Orwell Dam, near Fergus Falls, Minn.

Location.--Lat 46°12'35", long 96°11'05", in NE¼ sec.34, T.132 N., R.44 W., on left bank 0.7 mile downstream from Orwell Dam, 6.1 miles downstream from Dayton Hollow Dam, 8 miles southwest of Fergus Falls, and 11.1 miles downstream from Pelican River.

Drainage area.--1,830 sq mi, approximately.

Records available.--October 1930 to September 1964. Prior to October 1952, published as Otter Tail River below Pelican River, near Fergus Falls. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,029.65 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Oct. 11, 1930, to Nov. 17, 1933, at same site at datum 2.00 ft higher; Nov. 18, 1933, to Mar. 21, 1953, at site 6.1 miles upstream at datum 40.30 ft higher.

Average discharge.--34 years, 258 cfs (186,800 acre-ft per year).

Extremes.--Maximum discharge during year, 861 cfs May 11 (gage height, 3.73 ft); minimum, 10 cfs Aug. 26 (gage height, 1.82 ft).
1930-64: Maximum discharge, 1,710 cfs June 17, 1953 (gage height, 5.60 ft, backwater from aquatic vegetation); minimum, 1.0 cfs May 2, 1934, Sept. 30, 1935; minimum daily, 1.6 cfs Feb. 7, 1937.

Remarks.--Records good except those for periods of no gage-height record, which are fair. Flow regulated by Orwell Reservoir beginning Mar. 21, 1953 (see preceding page) and powerplants upstream.

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

2.1	51	3.0	440
2.3	100	3.8	903
2.6	219		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	187	205	173	160	178	64	191	790	749	334	210	64
2	191	201	173	160	178	64	219	784	743	322	214	64
3	*210	201	173	160	178	69	278	726	743	356	182	64
4	219	201	173	160	178	69	278	703	726	372	*100	64
5	219	201	173	160	178	69	278	709	714	367	92	64
6	214	201	169	165	178	71	294	709	691	328	66	64
7	230	205	165	170	182	73	311	761	668	322	51	64
8	235	205	169	170	191	71	317	796	651	*372	53	67
9	230	205	165	170	191	73	355	796	633	378	58	71
10	235	205	161	170	182	73	380	790	633	350	*55	110
11	235	210	169	170	182	76	380	819	680	367	64	153
12	235	191	191	170	182	76	380	855	680	356	73	153
13	235	165	191	170	182	97	380	849	622	367	66	153
14	235	165	191	170	182	116	435	855	570	339	66	*153
15	235	165	191	170	182	120	530	849	519	256	66	153
16	235	165	191	172	178	123	*576	849	412	230	66	153
17	235	165	191	175	178	157	576	849	272	283	66	157
18	235	165	191	175	173	182	576	849	372	294	*66	161
19	235	165	*187	175	153	201	576	843	616	278	66	161
20	235	165	187	175	130	240	564	837	772	251	66	161
21	235	165	186	175	126	300	559	825	651	246	66	161
22	224	169	186	175	126	300	564	825	490	251	66	161
23	210	169	170	175	126	267	564	825	418	278	64	161
24	187	165	160	178	126	251	564	819	513	278	62	161
25	187	157	160	180	126	246	570	814	524	272	*62	161
26	187	157	160	180	126	246	576	814	446	251	55	161
27	196	*173	160	180	*92	210	674	*802	378	240	66	161
28	205	173	160	180	62	187	*732	796	362	240	62	161
29	*201	173	160	180	62	191	767	785	350	*210	60	*161
30	201	173	160	*178	----------	191	790	770	334	205	62	165
31	201	----------	160	178	----------	*187	----------	755	----------	210	64	----------
Total	6,754	5,425	5,396	5,326	4,508	4,660	14,234	24,848	16,932	9,203	2,435	3,868
Mean	218	181	174	172	155	150	474	802	564	297	78.5	129
Ac-ft	13,400	10,760	10,700	10,560	8,940	9,240	28,230	48,290	33,580	18,250	4,830	7,670

Calendar year 1963: Max 740 Min 75 Mean 287 Ac-ft 208,100
Water year 1963-64: Max 855 Min 51 Mean 283 Ac-ft 205,400

* Discharge measurement made on this day.
Note.--No gage-height record Dec. 20 to Jan. 29, Apr. 9-15, May 29-31, Aug. 13-17, Sept. 5-13.

5-500. Bois de Sioux River near White Rock, S. Dak.

Location.--Lat 45°51'45", long 96°34'25", in SW¼SW¼ sec.27, T.128 N., R.47 W., on left bank just downstream from Big Slough Outlet, 300 ft downstream from White Rock Dam, 4 miles south of White Rock, and 5 miles northwest of Wheaton, Minn.

Drainage area.--1,160 sq mi, approximately.

Records available.--October 1941 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 960.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Jan. 14, 1943, staff gage at same site at datum 0.11 ft lower. Jan. 15, 1943, to Sept. 30, 1963, water stage recorder at same site at datum 0.11 ft lower.

Average discharge.--23 years, 79.2 cfs (57,340 acre-ft per year).

Extremes.--Maximum discharge during year, 209 cfs Apr. 22 (gage height, 5.44 ft); minimum, no flow for many days.

1941-64: Maximum discharge, 1,620 cfs Aug. 6, 1962 (gage height, 11.41, present datum); no flow at times in most years.

Remarks.--Records good except those for periods of ice effect or shifting control, which are fair. Flow regulated by Lake Traverse-Bois de Sioux Flood Control and Water Conservation project (available capacity for flood control, 137,000 acre-ft).

Rating table, water year 1963-64, except periods of ice effect or shifting control
(gage height, in feet, and discharge, in cubic feet per second)

2.7	0	3.4	13
2.8	.2	3.6	22
2.9	.7	4.0	46
3.0	1.7	4.5	82
3.1	3.7	5.0	138
3.2	6.2	5.5	220

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.6	1.1	1.3	0.5	0.3	0.2	0.4	167	39	8.9	0.3	1.2
2	1.7	2.4	1.2	.5	.3	.2	.5	156	40	6.2	.2	1.3
3	1.9	1.0	1.2	.5	.3	.2	.6	152	36	5.0	.1	1.3
4	2.2	1.0	1.2	.5	.3	.2	.7	155	36	8.0	.1	1.3
5	1.7	1.0	1.1	.5	.3	.2	1.0	147	41	12	.5	1.3
6	1.2	1.0	1.1	.5	.2	.2	3.5	156	36	11	.2	1.2
7	1.2	1.1	1.1	.5	.2	.2	*13	140	27	8.9	*.1	1.6
8	1.2	1.0	1.0	.5	.2	.2	41	127	36	*5.0	0	1.2
9	1.0	1.0	.9	.5	.2	.2	68	122	15	5.7	0	3.0
10	1.0	1.0	.8	.5	.2	.2	71	116	21	6.2	0	1.7
11	.9	1.0	.8	.5	.2	.2	56	100	*33	13	0	1.4
12	1.1	1.0	.7	.5	.2	.2	48	97	24	16	0	*1.3
13	1.3	1.0	.7	.5	.2	.2	89	101	13	12	0	1.1
14	1.1	.8	.7	.5	.2	.2	122	94	11	9.2	0	1.3
15	1.1	1.1	.6	*.5	.2	.2	148	89	11	12	0	1.1
16	1.1	.9	.6	.5	.2	.2	127	87	11	8.9	0	1.1
17	1.1	.9	.6	.5	.2	.3	113	85	18	5.0	0	1.1
18	1.1	.9	.6	.5	*.2	.3	125	80	33	.7	0	1.0
19	1.1	1.0	*.6	.5	.2	.3	135	*75	22	6.5	0	1.0
20	1.0	*1.0	.6	.5	.2	.3	*159	79	7.7	2.2	0	1.0
21	1.7	1.1	.6	.4	.2	.3	167	78	8.6	.2	0	1.0
22	1.7	1.4	.6	.4	.2	.3	206	71	5.7	.7	0	1.2
23	3.2	1.4	.6	.4	.2	.3	204	65	11	2.6	0	1.3
24	*2.2	1.3	.6	.4	.2	*.3	204	64	18	.6	0	1.2
25	1.6	1.3	.6	.4	.2	.3	199	65	18	.5	0	1.1
26	1.4	1.2	.6	.4	.2	.3	197	52	9.6	1.0	4.4	1.4
27	1.3	1.3	.6	.4	.2	.3	195	49	16	8.8	1.3	1.1
28	1.3	1.4	.5	.4	.2	.3	190	50	17	.3	1.3	1.0
29	2.8	1.4	.5	.3	.2	.3	180	47	12	.1	1.3	.9
30	1.2	1.4	.5	.3	----------	.3	174	40	1.6	.2	1.3	2.2
31	1.2	----------	.5	.3	----------	.4	----------	43	----------	.1	1.2	----------
Total	45.2	34.4	23.6	14.1	6.3	7.8	3,237.7	2,949	628.2	177.5	12.3	38.9
Mean	1.46	1.15	0.76	0.45	0.22	0.25	108	95.1	20.9	5.73	0.40	1.30
Ac-ft	90	68	47	28	12	15	6,422	5,849	1,246	352	24	77

Calendar year 1963: Max 936 Min 0.5 Mean 68.2 Ac-ft 49,370
Water year 1963-64: Max 206 Min 0 Mean 19.6 Ac-ft 14,230

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 13. Shifting-control method used June 10 to Sept. 15.

5-515. Red River of the North at Wahpeton, N. Dak.

Location.--Lat 46°15'55", long 96°35'40", in NE¼ sec.8, T.132 N., R.47 W., on left bank in Wahpeton, 800 ft downstream from confluence of Bois de Sioux and Otter Tail Rivers and at mile 548.6.

Drainage area.--4,010 sq mi, approximately.

Records available.--April 1942 to September 1964. Gage-height records collected in this vicinity since 1917 are contained in reports of U. S. Weather Bureau.

Gage.--Water-stage recorder and concrete and wooden dam. Datum of gage is 943 ft above mean sea level, datum of 1929. Prior to Aug. 6, 1943, U. S. Weather Bureau staff gage 800 ft upstream, converted to present datum. Aug. 6, 1943, to Oct. 27, 1950, chain gage at present site and datum.

Average discharge.--21 years (1943-64), 504 cfs (364,900 acre-ft per year).

Extremes.--Maximum discharge during year, 1,700 cfs May 6 (gage height, 7.39 ft); minimum, 25 cfs Nov. 23 (gage height, 2.29 ft).
1942-64: Maximum discharge, 7,130 cfs Apr. 12, 1952 (gage height, 14.99 ft); minimum, 8 cfs Aug. 25, 1961 (gage height, 2.26 ft).
Maximum stage known, 17.0 ft in spring of 1897.

Remarks.--Records good, except those for period of ice effect, which are fair. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft M.S.L., 1912 Adj.); Lake Traverse (capacity, 137,000 acre-ft, available for flood control); numerous other controlled lakes and ponds, and several powerplants.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	180	212	118	141	192	104	*210	*1,020	798	418	210	80
2	*178	210	106	150	176	108	280	1,010	780	394	205	69
3	182	205	119	148	168	103	490	1,010	770	343	205	64
4	196	205	139	147	172	94	740	980	763	334	186	58
5	216	216	160	139	174	*107	770	964	742	343	106	60
6	216	220	154	136	172	98	630	1,560	724	352	94	70
7	221	218	158	138	143	98	542	1,520	714	319	74	107
8	234	216	81	150	160	101	*463	1,210	696	300	37	101
9	236	216	40	145	196	110	475	1,080	648	337	41	97
10	238	214	101	113	192	113	463	1,020	644	376	47	81
11	238	212	162	150	176	126	460	980	634	355	40	94
12	238	210	160	150	*182	139	445	*960	640	349	39	145
13	236	205	150	150	190	178	487	988	672	343	72	147
14	236	176	164	148	182	*221	535	1,000	637	340	58	145
15	236	172	184	*148	184	234	884	972	570	322	46	*148
16	*238	172	210	143	176	243	*1,350	964	522	250	45	152
17	238	172	192	148	178	246	1,560	960	457	214	45	147
18	238	170	*192	150	192	221	1,270	940	439	253	*50	145
19	238	170	178	152	178	234	1,000	908	430	265	51	147
20	243	168	168	158	147	221	892	924	556	253	54	150
21	250	*160	168	166	132	238	900	904	724	241	91	148
22	246	177	164	154	145	250	1,000	896	679	*229	80	148
23	236	74	180	138	130	262	*1,030	880	542	229	65	152
24	216	125	176	119	110	262	972	860	*454	262	67	162
25	199	150	154	147	143	223	904	850	472	262	64	158
26	194	148	148	154	134	*243	868	850	532	260	65	150
27	192	139	139	184	134	255	848	*844	504	241	60	158
28	203	158	118	172	125	229	896	844	433	232	62	158
29	212	145	131	184	101	205	948	826	415	232	70	154
30	210	130	132	174	----------	184	984	816	418	210	68	158
31	*210	----------	138	184	----------	203	----------	805	----------	201	67	----------
Total	6,844	5,365	4,584	4,680	4,684	5,653	23,296	30,345	18,009	9,059	2,464	3,753
Mean	221	179	148	151	162	182	777	979	600	292	79.5	125
Ac-ft	13,580	10,640	9,090	9,280	9,290	11,210	46,210	60,190	35,720	17,970	4,890	7,440

Calendar year 1963: Max 3,560 Min 40 Mean 415 Ac-ft 300,800
Water year 1963-64: Max 1,560 Min 37 Mean 324 Ac-ft 235,500

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Apr. 1-14. Gage height from once-daily readings of recorder tape Nov. 5, Dec. 14 to Jan. 15, May 8-23.

GPO 819-718-3

5-540. Red River of the North at Fargo, N. Dak.

Location.--Lat 46°51'40", long 96°47'00", in NW¼NE¼ sec.18, T.139 N., R.48 W., at city water plant on 4th St. S. in Fargo, 25 miles upstream from mouth of Sheyenne River and at mile 453.

Drainage area.--6,800 sq mi, approximately.

Records available.--May 1901 to September 1964. Published as "at Moorhead, Minn." 1901. Monthly discharge for some periods, published in WSP 1308.

Gage.--Water-stage recorder and concrete control. Datum of gage is 861.8 ft above mean sea level, datum of 1929. Prior to Sept. 1, 1914, staff gage at site 1½ miles downstream at datum 1.0 ft lower. Sept. 1, 1914, to July 31, 1928, staff gage at site 1 mile downstream at datum 9.3 ft higher. Aug. 1, 1928, to Apr. 12, 1959, staff gage at site 1 mile downstream at datum 5.6 ft higher. Aug. 13, 1959, to June 21, 1960, water-stage recorder at site 2 miles upstream at datum 5.6 ft higher. June 22, 1960, to Sept. 30, 1962, water-stage recorder at present site at datum 5.6 ft higher. Since June 22, 1960, auxiliary water-stage recorder 2 miles upstream.

Average discharge.--63 years, 503 cfs (364,200 acre-ft per year, unadjusted); median of yearly mean discharges, 408 cfs (295,000 acre-ft per year, unadjusted).

Extremes.--Maximum discharge during year, 2,400 cfs Apr. 18 (gage height, 16.22 ft); minimum, 28 cfs Aug. 18 (gage height, 13.23 ft) result of regulation.
1901-64: Maximum discharge, 16,300 cfs Apr. 15, 16, 1952; maximum gage height, 28.79 ft Apr. 16, 1952, datum then in use; no flow for many days in each year for period 1932-41.
Maximum stage known, 40.1 ft Apr. 7, 1897, site and datum in use prior to 1914.

Remarks.--Records good. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft M.S.L., 1912 adj.), Lake Traverse (capacity, 137,000 acre-ft, available for flood control), other controlled lakes and ponds and several powerplants. Some small diversions for municipal supply. Figures of daily discharge do not include diversion by City of Fargo.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	198	*188	142	122	170	151	286	1,100	796	538	263	52
2	*170	193	134	126	170	134	*298	1,130	788	507	252	58
3	165	183	126	134	170	115	352	1,190	772	507	230	58
4	160	183	119	138	174	107	414	1,190	748	507	204	58
5	156	183	119	142	174	*107	582	1,180	740	482	188	58
6	160	198	142	147	179	100	*829	1,170	748	476	188	58
7	188	209	156	138	174	96	1,050	1,310	756	432	142	64
8	214	204	179	138	174	93	1,030	1,900	764	432	122	58
9	224	204	151	142	174	90	901	2,030	756	414	103	55
10	224	209	111	138	165	90	856	1,730	726	395	83	58
11	240	204	80	138	165	*96	919	1,460	698	482	64	70
12	246	204	73	138	183	103	1,060	1,310	677	513	64	70
13	240	209	119	138	*188	115	1,210	*1,200	664	494	52	67
14	240	209	165	*138	183	*134	1,010	1,130	651	482	42	*67
15	246	204	170	138	188	151	*1,370	1,130	651	445	35	119
16	246	193	160	142	188	188	1,530	1,120	657	408	35	*142
17	*240	174	165	130	183	219	1,880	1,100	638	383	*31	138
18	224	170	174	130	188	252	2,330	1,070	780	340	31	151
19	224	160	*193	130	188	292	2,280	1,060	698	292	*35	165
20	230	156	198	130	188	275	1,860	1,020	780	275	39	156
21	240	*151	198	134	179	263	1,690	982	919	298	93	156
22	235	156	188	138	170	252	*1,680	973	937	*304	64	170
23	235	138	179	151	170	252	1,490	964	937	286	55	193
24	240	111	165	147	151	269	1,450	946	*892	281	58	193
25	240	96	165	147	147	275	1,390	901	748	275	64	188
26	224	103	165	138	130	286	1,280	*892	657	275	67	183
27	193	134	165	130	126	*310	1,190	865	626	292	64	183
28	179	156	156	142	138	292	1,100	856	626	298	*64	183
29	165	156	151	142	147	304	1,070	838	626	292	61	179
30	165	160	126	156	----------	304	*1,070	829	588	275	61	193
31	179	----------	119	160	----------	292	----------	820	----------	257	58	----------
Total	6,530	5,198	4,653	4,302	4,924	6,007	35,457	35,396	22,044	11,937	2,912	3,543
Mean	211	173	150	139	170	194	1,182	1,142	735	385	93.9	118
Ac-ft	12,950	10,310	9,230	8,530	9,770	11,910	70,330	70,210	43,720	23,680	5,780	7,030
(≠)	595	501	519	519	460	484	479	679	658	930	755	536
Mean ≠	221	182	158	147	178	202	1,190	1,153	746	400	106	127
Ac-ft ≠	13,550	10,810	9,750	9,050	10,230	12,400	70,810	70,890	44,380	24,610	6,530	7,560

Calendar year 1963: Max 4,820 Min 52 Mean 507 Ac-ft 367,400 Mean 517 Ac-ft 374,100
Water year 1963-64: Max 2,330 Min 31 Mean 390 Ac-ft 283,400 Mean 400 Ac-ft 290,600

* Discharge measurement made on this day.
a No gage-height record.
≠ Diversion in acre-ft, by City of Fargo.
≠ Adjusted for diversion.

5-610. Buffalo River near Hawley, Minn.

Location.--Lat 46°51'00", long 96°19'45", near center of SE¼ sec.14, T.139 N., R.45 W., near left downstream end of bridge on farm lane, 2 miles southwest of Hawley.

Drainage area.--322 sq mi.

Records available.--March 1945 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,111.91 ft above mean sea level, datum of 1929. Prior to Jan.29, 1953, chain gage at bridge 1,800 ft upstream at datum 3.17 ft lower.

Average discharge.--19 years, 70.8 cfs (51,260 acre-ft per year).

Extremes.--Maximum discharge during year, 1,000 cfs Apr. 19 (gage height, 8.46 ft); minimum daily, 13 cfs Aug. 19,20.
1945-64: Maximum discharge, 1,590 cfs Aug. 5, 1955 (gage height, 9.31 ft); minimum observed, 6.8 cfs July 28, 1945; minimum gage height, 2.55 ft Sept. 5, 1961.
Maximum stage known, about 11.3 ft, present datum, in spring of 1921, from information by local resident.

Remarks.--Records good except those for period of ice effect, which are poor.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.7	12	5.0	206
2.8	14	6.0	348
3.1	26	7.0	522
3.5	50	8.0	810
4.0	93	9.0	1,340

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	31	22	20	15	16	22	30	315	74	48	19	22
2	30	22	19	15	16	22	50	294	70	45	19	22
3	29	22	19	15	16	23	55	277	65	43	18	21
4	28	22	18	15	16	23	80	281	61	39	17	18
5	28	22	17	15	16	22	110	274	58	37	16	17
6	28	22	16	15	16	22	120	264	58	*41	16	18
7	27	22	16	15	16	22	160	288	63	45	15	18
8	26	22	16	15	17	23	*220	301	65	43	15	20
9	26	22	16	15	17	23	270	303	78	41	16	20
10	26	22	15	16	17	24	350	313	87	38	16	19
11	26	23	14	16	17	25	380	310	76	37	16	19
12	26	22	14	16	17	35	360	292	68	37	16	20
13	26	22	14	16	17	*45	360	273	62	36	15	20
14	25	21	14	16	17	25	395	252	56	33	15	18
15	25	21	14	16	17	22	*290	231	53	31	15	18
16	25	20	14	16	18	20	506	213	50	29	15	19
17	25	20	14	16	18	25	833	199	49	27	14	20
18	24	20	*14	16	18	24	848	183	58	26	14	20
19	25	19	14	16	18	24	958	181	78	24	13	20
20	25	19	14	16	19	23	882	176	101	26	13	21
21	26	19	15	16	19	22	803	166	106	27	17	22
22	28	18	15	16	19	20	788	156	107	26	18	23
23	29	19	15	16	19	20	*740	145	103	24	20	30
24	28	18	15	16	19	20	663	134	99	22	21	45
25	27	17	15	16	19	22	602	123	95	22	21	47
26	28	*16	15	16	*19	23	543	111	88	21	20	48
27	26	16	15	16	19	22	477	100	76	19	*19	45
28	*24	16	15	16	20	22	*428	*92	65	*19	18	39
29	24	17	15	*16	21	26	382	86	58	19	18	*36
30	23	18	15	16	----------	*25	342	82	53	20	19	34
31	23	----------	15	16	----------	25	----------	78	----------	19	19	----------
Total	817	601	477	487	513	741	13,025	6,493	2,180	964	523	759
Mean	26.4	20.0	15.4	15.7	17.7	23.9	434	209	72.7	31.1	16.9	25.3
Ac-ft	1,620	1,190	946	966	1,020	1,470	25,830	12,880	4,320	1,910	1,040	1,510

Calendar year 1963: Max 195 Min 9.0 Mean 42.9 Ac-ft 31,010
Water year 1963-64: Max 958 Min 13 Mean 75.4 Ac-ft 54,700

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 16 to Apr. 15.

5-615. South Branch Buffalo River at Sabin, Minn.

Location.--Lat 46°46'20", long 96°37'40", in SW¼SW¼ sec.9, T.138 N., R.47 W., near center of span on downstream side of highway bridge, a quarter of a mile downstream from Whiskey Creek and 1 mile east of Sabin.

Drainage area.--522 sq mi.

Records available.--March 1945 to September 1964.

Gage.--Chain gage read once or twice daily. Datum of gage is 902.39 ft above mean sea level, datum of 1929 (levels by Soil Conservation Service). Prior to Aug. 17, 1948, at site 1 mile downstream at different datum.

Average discharge.--19 years, 53.9 cfs (39,020 acre-ft per year).

Extremes.--Maximum discharge during year, 796 cfs Apr. 17 (gage height, 11.72 ft); no flow Dec. 22 to Mar. 8.
1945-64: Maximum discharge, 6,340 cfs June 9, 1962 (gage height, 17.04 ft); no flow for many days in most years.

Remarks.--Records fair except those for periods of ice effect or no gage-height record, which are poor.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*4.3	5.2	a7.2			0	8.0	159	6.9	15	3.6	7.2
2	4.1	6.2	a7.0			0	10	140	5.2	11	a5.0	5.8
3	3.2	4.9	a6.5			0	**20	130	5.2	8.2	6.2	5.2
4	3.6	6.0	a6.5			0	100	121	4.7	7.2	6.2	5.2
5	3.7	6.4	a6.5			0	350	123	4.7	6.9	4.3	5.0
6	2.4	6.9	a6.2			0	500	131	3.8	5.2	3.5	a4.5
7	2.4	8.1	a6.0			0	*480	155	3.8	4.6	1.8	4.1
8	5.5	7.0	a5.5			0	440	199	3.6	4.3	2.0	6.7
9	3.0	7.6	a5.0			.1	*410	233	4.4	5.8	2.6	10
10	2.7	8.4	a4.5			.5	360	186	5.2	6.2	3.7	14
11	4.4	8.1	a4.0			1.0	300	153	7.2	6.5	2.4	13
12	a5.5	7.2	a3.5			4.0	241	*110	13	a9.5	4.6	11
13	6.5	7.5	a3.0			**8.0	a230	90	12	12	4.3	7.0
14	5.5	7.4	a2.5			8.0	226	73	9.8	8.9	3.5	4.9
15	4.9	7.5	a2.0			10	*401	62	9.3	7.9	2.8	3.7
16	7.6	7.2	a1.5			12	658	50	7.2	5.2	a2.2	4.3
17	6.5	7.0	a1.0			6.0	780	48	8.6	4.3	1.6	2.9
18	7.4	8.1	a.5			5.0	714	46	8.9	2.7	1.8	3.4
19	6.9	8.0	*.1			5.0	a540	38	16	2.9	1.7	3.0
20	a7.5	8.0	a.1			4.0	*401	33	53	3.6	2.0	3.6
21	8.2	9.0	a.1			4.0	353	30	a100	2.5	3.7	3.0
22	7.6	a8.5	a0			4.0	415	24	132	2.2	4.1	3.1
23	8.9	a8.5	a0			4.0	478	21	132	2.0	9.3	4.4
24	8.9	a8.0	a0			4.0	468	19	100	1.7	13	5.3
25	11	a8.0	a0			5.0	383	*16	76	1.7	*12	7.4
26	9.5	*8.2	a0			5.0	292	14	*55	1.3	a11	8.4
27	8.4	8.5	a0			5.5	*241	12	42	1.5	a10	16
28	7.4	8.0	a0		(*)	6.0	220	11	29	*1.9	a9.0	*17
29	*8.1	7.8	a0	(*)		6.5	204	8.6	24	2.3	a8.0	14
30	13	7.6	a0		----------	*6.9	191	8.2	19	1.7	a6.5	10
31	6.5	----------	a0		----------	7.5	----------	6.5	----------	2.3	5.3	----------
Total	195.1	224.8	79.2	0	0	122.0	10,414.0	2,450.3	901.5	159.0	157.7	213.1
Mean	6.29	7.49	2.55	0	0	3.94	347	79.0	30.0	5.13	5.09	7.10
Ac-ft	387	446	157	0	0	242	20,660	4,860	1,790	315	313	423

Calendar year 1963: Max 1,330 Min 0 Mean 47.8 Ac-ft 34,620
Water year 1963-64: Max 780 Min 0 Mean 40.8 Ac-ft 29,590

* Discharge measurement or observation of no flow made this day.
** Field estimate made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 13-15, 17, Nov. 19 to Apr. 11.

5-620. Buffalo River near Dilworth, Minn.

Location.--Lat 46°57'40", long 96°39'40", in SW¼SE¼ sec.6, T.140 N., R.47 W., on left bank 4½ miles southeast of Kragnes, 6½ miles northeast of Dilworth, and 9 miles downstream from South Branch.

Drainage area.--1,040 sq mi, approximately.

Records available.--March 1931 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Altitude of gage is 870 ft (from topographic map). Prior to Apr. 5, 1937, chain gage at same site and datum.

Average discharge.--33 years, 117 cfs (84,700 acre-ft per year).

Extremes.--Maximum discharge during year, 1,740 cfs Apr. 22 (gage height, 16.40 ft); minimum, 10 cfs Aug. 20 (gage height, 1.98 ft).
1931-64: Maximum discharge, 6,140 cfs June 11, 1962 (gage height, 23.56 ft); no flow at times in 1936.

Remarks.--Records good except those for period of ice effect, which are poor.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*44	34	40	16	17	20	45	684	96	97	20	29
2	44	35	37	16	17	21	48	613	89	83	19	27
3	43	36	35	16	17	21	55	553	80	68	19	29
4	42	36	38	16	17	22	75	513	73	57	19	28
5	41	34	37	16	18	24	150	481	67	54	17	24
6	40	33	35	16	18	26	300	457	64	53	15	22
7	38	32	33	17	18	26	*455	446	64	53	14	21
8	38	32	31	17	18	26	580	445	65	51	14	21
9	36	32	28	17	18	26	*680	457	73	53	15	23
10	36	32	24	17	18	27	750	489	80	62	14	23
11	36	33	22	17	18	28	900	498	89	57	15	22
12	35	32	20	17	18	28	890	*485	98	52	15	23
13	35	33	18	17	18	30	874	454	93	47	15	25
14	35	33	17	17	18	34	768	415	84	46	15	27
15	36	33	15	17	18	45	*934	378	75	45	14	*27
16	38	32	14	17	18	55	1,020	347	66	43	13	27
17	38	32	14	17	18	65	1,040	324	64	41	13	26
18	36	32	13	17	18	70	1,110	305	86	38	13	24
19	36	32	*12	17	18	80	1,220	285	161	35	11	24
20	36	32	12	17	18	90	*1,300	267	171	34	11	23
21	36	36	12	17	18	95	1,380	254	154	31	14	23
22	37	34	11	17	18	85	1,670	239	202	31	15	24
23	40	32	11	17	19	70	*1,670	222	230	31	18	25
24	40	34	11	17	19	60	1,500	206	244	28	*21	28
25	40	32	12	17	19	50	1,360	191	231	26	23	31
26	40	*37	13	17	*19	48	1,220	174	*197	24	25	38
27	39	40	14	17	19	45	*1,070	157	177	23	31	47
28	39	38	14	17	19	42	955	*140	154	*22	31	*52
29	38	40	15	*17	19	38	846	127	133	21	30	54
30	*37	40	16	17	----------	*39	758	113	116	22	31	53
31	36	----------	16	17	----------	42	----------	104	----------	20	30	----------
Total	1,185	1,023	640	521	525	1,378	25,623	10,823	3,576	1,348	570	870
Mean	38.2	34.1	20.6	16.8	18.1	44.5	854	349	119	43.5	18.4	29.0
Ac-ft	2,350	2,030	1,270	1,030	1,040	2,730	50,820	21,470	7,090	2,670	1,130	1,730

Calendar year 1963: Max 1,280 Min 5.8 Mean 107 Ac-ft 77,500
Water year 1963-64: Max 1,670 Min 11 Mean 131 Ac-ft 95,360

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 14 to Apr. 12.

5-625. Wild Rice River at Twin Valley, Minn.

Location.--Lat 47°16'00", long 96°14'40", in NE¼ sec.27, T.144 N., R.44 W., on left bank 100 ft upstream from highway bridge, three-quarters of a mile northeast of village of Twin Valley, and 2 miles upstream from a small tributary.

Drainage area.--888 sq mi.

Records available.--June 1909 to September 1917, July 1930 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,008.16 ft above mean sea level, datum of 1929 (Corps of Engineers bench mark). June 1909 to September 1917 staff gage at site a quarter of a mile downstream at different datum. July 23, 1930, to Nov. 24, 1934, chain gage at highway bridge 100 ft downstream from present site at present datum. Nov. 25, 1934, to Aug. 2, 1950, water-stage recorder 80 ft upstream from present site at present datum.

Average discharge.--42 years, 159 cfs (115,100 acre-ft per year).

Extremes.--Maximum discharge during year, 1,640 cfs Apr. 17 (gage height, 7.68 ft); minimum, 12 cfs Oct. 17 (gage height, 0.81 ft).
1909-17, 1930-64: Maximum discharge, 9,200 cfs July 22, 1909 (gage height, 20.0 ft, site and datum then in use), from rating curve extended above 3,300 cfs; minimum, 0.5 cfs Nov. 4, 1939.

Remarks.--Records good except those for period of ice effect, which are poor. Flow slightly regulated by Rice Lake and many other small lakes above station. Diurnal fluctuation caused by operation of mill at Faith, 17 miles above station.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.9	16	2.5	194
1.2	32	3.0	294
1.5	58	5.0	768
2.0	114	8.0	1,780

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	29	29	29	19	29	31	45	750	206	331	69	37
2	24	28	28	20	29	31	50	721	192	302	63	*34
3	24	24	26	21	29	32	80	706	175	274	66	32
4	25	26	26	22	29	32	100	711	166	250	56	30
5	21	29	26	23	29	34	120	708	153	228	48	30
6	20	26	26	23	29	36	135	703	161	232	50	27
7	23	23	27	23	29	36	145	716	168	222	48	21
8	30	30	27	23	29	38	*170	758	194	216	42	31
9	17	29	26	23	29	38	175	768	367	*200	35	33
10	28	25	25	22	29	38	200	755	519	206	38	33
11	25	28	24	22	29	38	270	739	429	202	39	32
12	24	29	24	22	30	38	350	708	346	200	36	30
13	20	29	23	22	30	*40	550	682	304	183	34	23
14	18	27	22	22	30	40	446	651	300	161	30	25
15	28	28	22	22	30	40	514	617	292	148	28	29
16	25	29	21	23	30	42	*984	589	254	136	26	28
17	17	29	21	24	30	42	1,500	562	246	128	26	28
18	28	31	*20	24	30	41	1,580	543	424	118	29	26
19	26	29	20	25	30	41	1,330	504	927	110	24	26
20	27	31	20	25	30	42	1,120	483	1,140	120	22	23
21	35	29	20	26	30	42	1,170	451	975	118	32	23
22	33	29	19	27	30	41	1,380	420	850	114	32	30
23	31	35	19	28	30	40	1,280	404	760	104	26	38
24	31	25	20	28	30	42	1,170	378	716	104	31	44
25	33	27	20	28	30	41	1,050	348	674	103	32	52
26	33	*35	20	28	*30	41	945	320	628	96	30	72
27	26	30	19	29	30	42	870	296	548	94	38	71
28	*28	32	19	29	30	42	825	*276	469	87	32	69
29	29	31	19	*29	30	42	*794	246	402	85	30	67
30	25	30	18	29	----------	*42	776	232	360	*78	25	*76
31	27	----------	18	29	----------	42	----------	224	----------	74	29	----------
Total	810	862	694	760	859	1,207	20,124	16,969	13,345	5,024	1,146	1,120
Mean	26.1	28.7	22.4	24.5	29.6	38.9	671	547	445	162	37.0	37.3
Ac-ft	1,610	1,710	1,380	1,510	1,700	2,390	39,920	33,660	26,470	9,960	2,270	2,220

Calendar year 1963: Max 1,640 Min 6.4 Mean 144 Ac-ft 104,100
Water year 1963-64: Max 1,580 Min 17 Mean 172 Ac-ft 124,800

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 18 to Apr. 13 (no gage-height record Dec. 21 to Jan. 28).

5-640. Wild Rice River at Hendrum, Minn.

Location.--Lat 47°16'05", long 96°47'50", in SE¼ sec.19, T.144 N., R.48 W., near center of span on downstream side of highway bridge, half a mile east of Hendrum and 4 miles upstream from mouth.

Drainage area.--1,600 sq mi, approximately.

Records available.--March 1944 to September 1964.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 836.75 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Aug. 2, 1949, chain gage at same site and datum.

Average discharge.--20 years, 208 cfs (151,300 acre-ft per year).

Extremes.--Maximum discharge during year, 2,690 cfs Apr. 23 (gage height, 17.55 ft); minimum daily, 12 cfs Dec. 23-25.
1944-64: Maximum discharge, 4,660 cfs Apr. 14, 1956 (gage height, 24.26 ft); maximum gage height observed, 27.70 ft Apr. 15, 1947 (backwater from Red River of the North); no flow for some days in 1948-49.

Remarks.--Records fair except those for periods of ice effect or no gage-height record, which are poor. Large part of high flow diverted into Marsh River basin at overflow section 3½ miles east of Ada. Another diversion into Marsh River basin, formed 1½ miles southeast of Ada, diverted water at all stages 1947-51, after which it was closed except for small regulated flow diverted at same point. Amount of diversion not known.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 13, May 28 to June 16, Sept. 25-30)

Oct. 1 to Apr. 15		Apr. 16 to Sept. 30			
1.6	22	1.6	24	6.0	363
1.8	28	2.0	40	9.0	760
2.0	36	2.5	66	13.0	1,510
2.5	59	3.0	99	18.0	2,830
		4.0	175		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	29	36	a31	16	22	26	*48	a940	236	198	90	26
2	29	38	30	17	22	26	50	a930	229	198	87	29
3	28	45	30	17	22	26	55	a910	*215	198	80	29
4	*27	36	29	18	22	26	65	a900	214	a196	80	29
5	24	33	28	18	22	26	80	884	196	196	76	30
6	24	34	27	18	23	26	170	864	190	194	76	a30
7	24	35	26	18	23	26	270	848	193	195	74	31
8	25	37	25	18	23	26	300	829	191	196	72	31
9	21	34	24	18	23	26	*440	789	169	230	71	32
10	37	33	23	19	23	26	560	747	223	*252	69	33
11	a32	32	22	19	23	26	710	a730	260	257	68	*36
12	a30	30	21	19	24	27	830	717	356	257	62	39
13	29	26	20	19	24	27	900	686	246	245	62	38
14	29	28	19	19	24	27	*950	658	260	247	59	33
15	25	28	17	19	24	28	1,300	631	263	235	58	33
16	22	28	17	20	25	28	1,610	a610	270	227	56	34
17	20	28	16	20	25	28	*1,790	601	318	222	54	34
18	20	30	15	20	25	28	2,070	589	410	173	47	34
19	21	30	15	20	25	29	2,260	584	703	112	38	34
20	26	30	14	20	25	29	2,320	573	1,180	126	31	35
21	26	30	14	20	25	29	2,310	547	1,400	129	24	35
22	29	30	a13	21	26	29	2,280	530	1,540	127	24	37
23	32	30	*12	21	26	29	*2,570	511	1,410	127	a24	38
24	33	30	12	21	26	29	2,480	487	957	127	25	38
25	33	30	12	21	26	29	2,150	454	718	125	25	42
26	31	*32	14	21	26	30	a1,900	427	a600	a120	29	42
27	31	31	14	21	26	30	a1,600	418	a520	111	*25	69
28	31	31	15	21	*26	30	a1,300	394	a440	112	24	94
29	30	31	15	21	26	33	*1,020	394	a340	107	24	97
30	*33	31	15	21	----------	36	a950	a320	a250	*100	24	*90
31	33	----------	16	*22	----------	40	----------	246	----------	97	24	----------
Total	864	957	601	603	702	881	35,338	19,748	14,497	5,436	1,582	1,232
Mean	27.9	31.9	19.4	19.5	24.2	28.4	1,178	637	483	175	51.0	41.1
Ac-ft	1,710	1,900	1,190	1,200	1,390	1,750	70,090	39,170	28,750	10,780	3,140	2,440

Calendar year 1963: Max 1,610 Min 4.7 Mean 175 Ac-ft 126,400
Water year 1963-64: Max 2,570 Min 12 Mean 225 Ac-ft 163,500

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 14 to Apr. 15.

5-645. Red River of the North at Halstad, Minn.

Location.--Lat 47°21'10", long 96°50'50", on line between secs.24 and 25, T.145 N., R.49 W., on left bank on upstream side of highway bridge, half a mile west of Halstad, 2½ miles downstream from Wild Rice River, and at mile 375.2.

Drainage area.--21,800 sq mi, approximately, (includes 3,800 sq mi in closed basins).

Records available.--April 1936 to June 1937 (no winter records), April 1942 to September 1960 (spring and summer months only), May 1961 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 826.65 ft above mean sea level, datum of 1929. Prior to July 17, 1961, wire-weight gage at same site and datum.

Extremes.--Maximum discharge during year, 7,820 cfs Apr. 23 (gage height, 15.27 ft); minimum daily, 164 cfs Aug. 20 (gage height, 2.06 ft).
1936-37, 1942-64: Maximum discharge, 24,500 cfs Apr. 16, 1947; maximum gage height, 34.00 ft Apr. 17,1947; minimum discharge observed, 5.4 cfs Oct. 8, 9, 12-14, 1936.
Flood in 1897 reached a stage of about 38.5 ft.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair. Some regulation by many controlled lakes and reservoirs on tributaries.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Loop curves used Apr. 16-24)

2.1	158	8.0	2,460
2.6	246	14.0	6,450
3.0	344	16.0	7,950
5.0	1,020		

Discharge, in cubic feet per second, water year October 1963to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	396	317	295	225	225	230	*445	3,210	a1,320	1,580	453	253
2	369	312	290	225	225	230	450	3,060	1,260	1,520	a435	250
3	339	312	290	225	225	230	460	2,960	*1,200	1,470	a415	*244
4	*312	322	285	225	225	230	480	2,890	1,170	1,410	396	227
5	287	333	280	225	225	230	500	2,860	1,150	1,360	369	208
6	275	336	275	225	225	230	550	3,250	1,140	1,330	358	196
7	275	344	270	225	225	230	750	2,960	1,130	1,310	336	192
8	268	347	270	225	225	230	1,200	2,780	1,130	1,300	322	196
9	278	339	a265	225	225	230	1,800	2,980	1,160	1,270	300	203
10	292	336	a260	225	225	230	2,200	3,400	1,180	1,260	264	192
11	307	333	255	225	225	230	2,900	3,440	1,300	1,210	240	*189
12	304	336	a255	225	225	230	3,600	3,220	1,300	1,150	225	194
13	312	330	a250	225	225	235	4,650	2,980	1,480	1,130	206	194
14	320	325	a245	225	225	240	*4,700	2,770	1,380	1,090	192	196
15	325	320	a245	225	225	250	5,000	2,600	1,290	1,010	189	198
16	325	333	240	225	225	260	5,430	2,450	1,280	929	183	196
17	325	350	235	225	225	270	*6,560	2,360	a1,400	883	179	210
18	330	333	230	225	225	280	6,820	2,310	1,500	849	175	264
19	330	317	230	225	225	300	6,920	2,190	1,660	838	168	257
20	330	312	230	225	225	330	*6,420	2,200	2,770	841	164	255
21	344	312	225	225	225	360	6,050	2,280	3,040	798	181	253
22	347	310	225	225	225	380	7,050	a2,150	3,110	729	194	253
23	350	305	*225	225	225	390	*7,750	a2,020	a3,050	661	261	257
24	364	300	225	225	230	400	7,250	a1,880	2,930	616	240	261
25	366	300	225	225	230	410	6,390	a1,750	*2,710	567	204	294
26	369	*298	225	225	230	410	5,480	1,620	2,460	537	203	287
27	364	295	225	225	230	420	*4,720	a1,570	2,170	519	229	294
28	358	290	225	225	*230	420	4,180	a1,520	1,920	513	240	302
29	350	290	225	225	230	a420	3,760	a1,470	1,780	504	227	328
30	*328	290	225	225	----------	a430	3,440	a1,420	1,640	498	233	*339
31	317	----------	225	*225	----------	a440	----------	a1,370	----------	*480	236	----------
Total	10,156	9,577	7,670	6,975	6,555	9,405	117,905	75,920	52,010	30,162	8,017	7,182
Mean	328	319	247	225	226	303	3,930	2,449	1,734	973	259	239
Ac-ft	20,140	19,000	15,210	13,830	13,000	18,650	233,900	150,600	103,200	59,830	15,900	14,250

Calendar year1963: Max 5,820 Min 225 Mean 954 Ac-ft 690,400
Water year1963-64: Max 7,750 Min 164 Mean 933 Ac-ft 677,500

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 15. Discharge computed from once-daily wire-weight gage readings Dec. 11, 16-21, May 26, June 2-16, 18-22, June 24 to July 30, Aug.4-9.

5-675. Marsh River near Shelly, Minn.

Location.--Lat 47°24'45", long 96°45'50", in NE¼NW¼ sec.3, T.145 N., R.48 W., near center of span on downstream truss of bridge, 3¾ miles southeast of Shelly and 10 miles upstream from mouth.

Drainage area.--151 sq mi.

Records available.--March 1944 to September 1964. Monthly discharge only for March 1944, published in WSP 1308.

Gage.--Chain gage read once or twice daily. Datum of gage is 844.14 ft above mean sea level, datum of 1929 (levels by Corps of Engineers).

Average discharge.--20 years, 89.2 cfs (64,580 acre-ft per year).

Extremes.--Maximum discharge during year, 450 cfs Apr. 22 (gage height, 5.41 ft); no flow for many days.
1944-64: Maximum discharge, 4,660 cfs May 11, 1950 (gage height, 18.96 ft, from floodmark); no flow for many days most years.

Remarks.--Records fair. Large part of high flow of Wild Rice River diverted into Marsh River basin at overflow section 3½ miles east of Ada. Another diversion from Wild Rice River formed 1 mile southeast of Ada supplemented flow at all stages 1947-51, after which it was closed except for small regulated flow diverted at same point for abatement of pollution from Ada sewage plant effluent.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							0	19	0.3	a13	0	0.4
2							0	16	a.2	11	0	.9
3							**0	16	*.2	9.3	0	.3
4	(*)						.2	17	0	6.7	0	0
5							a1.0	24	0	3.9	0	0
6							3.0	217	.2	4.5	0	0
7							*5.0	146	.5	4.7	0	0
8							5.5	62	.6	3.7	0	0
9							*7.0	41	4.0	*4.3	0	0
10							12	31	1.4	5.3	0	0
11							53	23	a2.5	3.3	0	*0
12							102	18	3.3	7.0	0	0
13						(*)	158	a15	1.4	5.3	0	0
14							*128	a12	2.5	3.7	0	0
15							90	9.8	7.7	a2.5	0	0
16							228	8.4	6.4	1.8	0	0
17							343	8.0	6.0	1.0	0	0
18							228	6.2	9.0	.9	0	0
19							169	4.9	14	.9	0	0
20			(*)				*130	4.0	50	a.9	0	0
21							109	a3.6	a62	a1.0	0	0
22							370	a3.2	86	1.1	0	0
23							*393	3.0	74	a.9	0	0
24							245	2.5	57	.7	0	0
25							120	2.2	44	.5	0	0
26		(*)					72	a1.5	35	.5	0	a.5
27							48	1.2	a30	a.6	a.4	1.6
28	(*)				(*)		34	a1.0	24	.8	1.0	.9
29							*25	a.8	20	a.7	a.4	a.4
30				(*)	----------		a22	.6	16	.7	a.1	**0
31		----------			----------		----------	.3	----------	**0	**0	----------
Total	0	0	0	0	0	0	3,100.7	718.2	558.2	101.2	1.9	5.0
Mean	0	0	0	0	0	0	103	23.2	18.6	3.26	0.06	0.17
Ac-ft	0	0	0	0	0	0	6,150	1,420	1,110	201	3.8	9.9

Calendar year 1963: Max 233 Min 0 Mean 8.24 Ac-ft 5,970
Water year 1963-64: Max 393 Min 0 Mean 12.3 Ac-ft 8,890

* Discharge measurement or observation of no flow made on this day.
** Field estimate made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Mar. 13 to Apr. 10 (no gage-height record Mar. 24, 26, 28, 29, Apr. 5).

5-690. Sandhill River at Climax, Minn.

Location.--Lat 47°36'10", long 96°47'40", in SE¼SE¼ sec.29, T.148 N., R.48 W., near center of span on upstream side of highway bridge, 1 mile southeast of Climax and 4 miles upstream from mouth.

Drainage area.--405 sq mi, approximately.

Records available.--March 1943 to September 1964 (winter records incomplete in some years). Monthly discharge only for some periods, published in WSP 1308.

Gage.--Chain gage read once daily. Datum of gage is 833.69 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Average discharge.--18 years (1946-64), 56.9 cfs (41,190 acre-ft per year).

Extremes.--Maximum discharge during year, 730 cfs Apr. 17 (gage height, 9.40 ft, from floodmark); minimum daily, 3.6 cfs Dec. 9, 10.
1943-64: Maximum discharge, 3,040 cfs Apr. 22, 1950 (gage height, 16.31 ft, from floodmark); minimum not determined.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are poor.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 26 to Nov. 13, Apr. 14-25, Sept. 9-13, 27-30)

0.7	5.3	3.0	94
1.0	11	5.0	258
1.5	25	8.0	570
2.0	43	9.0	765

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9.5	11	6.5	6.0	7.6	11	14	160	26	51	20	107
2	10	11	6.0	6.0	7.8	11	18	141	23	47	18	76
3	9.5	12	6.0	6.0	8.2	11	25	132	23	44	18	46
4	9.1	11	6.0	6.0	8.2	11	30	119	22	39	16	29
5	9.3	12	5.5	6.2	8.4	11	50	133	24	36	16	23
6	9.5	12	5.5	6.2	8.6	11	70	262	24	37	15	24
7	9.8	12	5.0	6.2	8.6	11	80	219	23	41	15	24
8	9.8	11	4.0	6.2	8.8	12	90	168	25	45	15	25
9	10	11	3.6	6.2	9.2	12	100	119	30	47	14	27
10	10	11	*3.6	6.4	9.2	12	140	114	41	430	*14	27
11	10	10	4.0	6.4	*9.5	12	*190	114	38	415	14	*30
12	9.5	*8.9	4.5	6.4	10	12	210	100	49	212	15	29
13	10	8.9	4.5	6.6	10	12	212	102	54	97	15	31
14	10	9.0	4.6	6.6	10	12	213	93	80	75	14	27
15	10	9.0	4.6	6.6	10	12	333	75	49	49	14	26
16	11	8.0	4.6	6.6	10	12	573	64	39	38	14	27
17	*12	8.0	4.6	6.6	10	12	*477	62	38	32	14	21
18	11	8.0	4.6	6.8	10	*12	302	59	46	29	13	20
19	12	7.5	5.0	6.8	10	12	282	*57	*77	28	13	20
20	12	7.5	5.0	6.8	10	12	348	52	80	*37	13	18
21	12	7.0	5.0	6.8	10	12	480	49	69	35	17	19
22	12	6.5	5.2	6.8	10	12	*547	45	63	33	17	22
23	12	7.0	5.2	7.0	10	12	364	43	62	28	16	36
24	12	7.0	5.2	7.0	10	12	*296	39	68	27	17	32
25	12	7.0	5.4	7.0	10	12	273	38	70	24	17	31
26	12	7.0	5.4	7.0	11	12	239	37	66	21	17	46
27	12	6.5	5.6	7.0	11	12	230	34	64	21	17	63
28	12	6.5	5.8	7.0	11	12	224	34	61	23	18	55
29	12	6.5	5.8	7.0	11	12	204	34	59	25	19	40
30	11	6.5	6.0	7.0	----------	12	173	29	56	24	19	35
31	11	----------	6.0	*7.3	----------	12	----------	27	----------	22	73	----------
Total	334.0	266.3	158.3	204.5	278.1	365	6,787	2,754	1,449	2,112	547	1,036
Mean	10.8	8.88	5.11	6.60	9.59	11.8	226	88.8	48.3	68.1	17.6	34.5
Ac-ft	662	528	314	406	552	724	13,460	5,460	2,870	4,190	1,080	2,050

Calendar year 1963: Max 265 Min 3.0 Mean 27.6 Ac-ft 20,010
Water year 1963-64: Max 573 Min 3.6 Mean 44.5 Ac-ft 32,300

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 14 to Apr. 13. No gage-height record July 29 to Aug. 9, Aug. 11, 13, 14.

5-740. Lower Red Lake near Red Lake, Minn.

Location.--Lat 47°57', long 95°17', in NW¼ sec.28, T.152 N., R.36 W., on left bank just upstream from dam at outlet, 13 miles northwest of village of Red Lake.

Drainage area.--1,950 sq mi, approximately.

Records available.--June 1930 to November 1932 (published as Red Lake at Redby), May 1933 to September 1964 (published as Red Lake near Red Lake 1933-40); records on Upper Red Lake published as Red Lake at Waskish, April 1930 to September 1933, all in reports of Geological Survey. October 1921 to September 1929 gage heights at Redby and on Upper Red Lake at Waskish in files of Minnesota Department of Conservation (fragmentary).

Gage.--Water-stage recorder. Datum of gage is 1,169.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). May 1933 to Sept. 6, 1934, staff gage at same site and datum. Staff gages at Waskish and Redby at datum 69.00 ft lower.

Extremes.--Maximum gage height during year, 6.33 ft Sept. 26 (affected by wind action); minimum, 4.00 ft Oct. 25 (affected by wind action).
1930-64: Maximum gage height, 9.53 ft June 25, 1950; minimum recorded, 0.80 ft Nov. 20, 1936.

Remarks.--Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

Month-end gage height, in feet, October 1963 to September 1964

Oct. 31.....4.49	Feb. 29.....4.25	June 30.....5.59
Nov. 30.....4.39	Mar. 31.....4.30	July 31.....5.28
Dec. 31.....4.38	Apr. 30.....4.92	Aug. 31.....5.17
Jan. 31.....4.26	May 31.....5.11	Sept.30.....5.44

Note.--Mean daily gage heights are available.

5-745. Red Lake River near Red Lake, Minn.

Location.--Lat 47°57', long 95°17', in NW¼ sec.28, T.152 N., R.36 W., on left bank 50 ft downstream from dam at outlet of Lower Red Lake and 13 miles northwest of village of Red Lake.

Drainage area.--1,950 sq mi, approximately.

Records available.--May 1933 to September 1964. Monthly discharge only for May 1933, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,167.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 7, 1934, staff gage at site 50 ft upstream at datum 2.00 ft higher. Sept. 7, 1934, to Nov. 26, 1951, water-stage recorder at present site at datum 2.00 ft higher.

Average discharge.--31 years, 400 cfs (289,600 acre-ft per year).

Extremes.--Maximum daily discharge during year, 1,030 cfs Oct. 22-25; maximum gage height, 6.33 ft Oct. 1 (affected by seiches and backwater from aquatic vegetation); minimum daily discharge, 6.5 cfs May 12-14.
1933-64: Maximum discharge, 3,600 cfs June 25, 1950 (gage height, 11.19 ft, affected by seiches and backwater from aquatic vegetation, present datum), from rating curve extended above 1,400 cfs; no flow at times.

Remarks.--Records fair. Flow completely regulated by outlet dam on Lower Red Lake.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,000	540	535	525	515	345	115	10	30	*75	99	50
2	1,000	540	535	525	515	350	115	9.0	28	75	99	50
3	1,000	540	535	525	515	350	115	8.0	26	75	99	*51
4	1,000	535	535	525	515	350	*116	7.0	24	75	99	52
5	1,000	535	*533	520	515	350	116	7.0	*23	75	99	52
6	1,000	*534	530	520	515	350	116	7.0	23	75	*99	52
7	960	530	530	520	515	350	116	*6.8	22	75	99	52
8	940	530	540	520	515	350	116	6.8	22	75	100	52
9	*930	530	545	520	515	355	116	6.8	22	75	100	52
10	930	525	545	520	515	355	116	6.8	22	90	100	52
11	940	525	545	520	515	355	118	6.8	22	100	100	55
12	940	525	545	520	515	305	118	6.5	20	100	*100	55
13	950	520	545	520	515	225	120	6.5	20	100	100	55
14	950	515	545	*516	515	225	120	6.5	20	100	100	55
15	960	515	545	515	515	225	120	33	40	100	100	55
16	960	515	545	515	515	225	115	55	50	100	100	55
17	960	515	*544	515	*515	225	100	55	50	100	100	55
18	960	515	545	515	515	225	100	55	50	100	100	55
19	980	515	545	515	515	225	100	55	45	100	100	55
20	1,000	*512	545	515	455	225	100	55	45	*98	100	60
21	1,020	512	545	515	345	225	*55	55	40	98	100	*60
22	1,030	515	545	515	345	225	20	*55	35	98	100	60
23	*1,030	530	545	515	345	225	20	56	*31	98	100	60
24	1,030	530	540	515	345	225	20	57	30	98	100	60
25	1,030	530	535	515	345	225	18	*58	30	98	100	60
26	1,020	530	530	515	345	165	18	55	55	98	65	60
27	1,020	530	530	515	345	115	16	50	75	98	50	60
28	860	530	530	515	345	115	14	45	75	98	50	60
29	630	530	530	515	345	115	12	40	75	98	50	60
30	580	530	530	515	----------	115	10	35	75	99	50	60
31	540	----------	530	515	----------	115	----------	35	----------	99	50	----------
Total	29,150	15,778	16,702	16,051	13,345	7,830	2,471	950.5	1,125	2,843	2,808	1,670
Mean	940	526	539	518	460	253	82.4	30.7	37.5	91.7	90.6	55.7
Ac-ft	57,820	31,300	33,130	31,840	26,470	15,530	4,900	1,890	2,230	5,640	5,570	3,310

Calendar year 1963: Max 1,090 Min 300 Mean 803 Ac-ft 581,000
Water year 1963-64: Max 1,030 Min 6.5 Mean 303 Ac-ft 219,600

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 26 to Apr. 4 (no gage-height record Jan. 7-13). Stage-discharge relation indefinite Oct. 1 to Nov. 25, Apr. 5 to Sept. 30.

5-750. Red Lake River at High Landing, near Goodridge, Minn.

Location.--Lat 48°03', long 95°48', on line between secs. 28 and 29, T.153 N., R.40 W., on left bank at upstream side of highway bridge at High Landing, 7 miles south of Goodridge and 33 miles upstream from Thief River.

Drainage area.--2,300 sq mi, approximately.

Records available.--September 1929 to September 1964. Prior to October 1930, published as "at Kratka."

Gage.--Water-stage recorder. Datum of gage is 1,141.57 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Oct. 1, 1930, staff gage at site 10 miles downstream at different datum. Oct. 1, 1930, to Sept. 30, 1932, staff gage at datum 5.00 ft higher and Oct. 1, 1932, to Dec. 8, 1938, staff gage at datum 4.00 ft higher at site 50 ft downstream. Dec. 9, 1938, to Sept. 30, 1949, water-stage recorder at present site at datum 4.00 ft higher.

Average discharge.--35 years, 418 cfs (302,600 acre-ft per year).

Extremes.--Maximum discharge during year, 1,170 cfs Oct. 22-24 (gage height, 7.32 ft); maximum gage height, 7.59 ft Apr. 16 (backwater from ice); minimum discharge, 32 cfs June 6 (gage height, 0.72 ft).
1929-64: Maximum discharge, 3,720 cfs May 11, 1950 (gage height, 13.42 ft); no flow during infrequent periods in 1931-34, 1936-37.

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated by outlet dam on Lower Red Lake.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,010	776	500	540	500	370	140	170	47	240	113	89
2	1,010	707	490	540	500	370	150	160	42	224	116	81
3	1,010	661	500	540	500	370	150	156	38	205	110	81
4	1,030	634	500	530	500	370	170	177	36	184	103	80
5	1,030	617	500	530	500	370	*175	212	35	165	100	78
6	1,040	607	510	530	500	370	180	378	34	152	98	85
7	1,040	601	510	520	500	370	180	329	39	142	94	79
8	1,040	601	520	520	500	370	190	267	74	136	94	79
9	1,040	597	520	520	500	370	190	225	438	133	96	76
10	1,040	589	530	510	510	370	200	198	397	159	100	75
11	1,040	574	540	510	510	380	240	177	279	148	105	74
12	1,070	570	540	500	510	380	250	160	271	132	104	74
13	1,070	575	545	490	515	360	300	146	251	126	102	76
14	1,080	579	545	*483	515	320	350	133	230	127	93	64
15	1,090	579	550	480	515	280	500	121	199	128	85	65
16	1,090	574	*554	480	515	270	*710	138	172	130	89	69
17	1,100	572	555	480	*518	250	500	177	200	134	97	70
18	1,110	572	555	480	520	250	391	186	250	137	93	69
19	1,110	568	550	480	520	240	321	166	350	140	*95	69
20	1,120	*572	550	480	520	240	*294	176	494	*140	98	73
21	1,150	566	550	480	470	230	326	*165	400	142	113	*74
22	*1,170	556	550	480	400	230	452	152	*338	142	128	67
23	1,170	397	550	480	380	250	300	150	317	143	116	84
24	1,160	550	550	480	370	250	238	139	338	138	102	111
25	1,140	720	550	480	370	240	205	118	338	127	88	126
26	1,110	600	550	480	370	260	178	100	318	122	89	140
27	1,080	550	550	480	370	230	158	81	303	118	90	181
28	1,060	520	550	480	370	180	148	83	293	115	106	201
29	1,040	510	550	490	370	150	164	74	273	114	104	180
30	975	500	550	490	----------	140	*174	66	256	113	96	163
31	879	----------	550	500	----------	140	----------	55	----------	112	88	----------
Total	33,104	17,594	16,614	15,463	13,638	8,970	7,924	5,035	7,050	4,468	3,105	2,833
Mean	1,068	586	536	499	470	289	264	162	235	144	100	94.4
Ac-ft	65,640	34,900	32,950	30,670	27,050	17,790	15,720	9,990	13,980	8,860	6,160	5,620

Calendar year 1963: Max 1,540 Min 397 Mean 839 Ac-ft 607,200
Water year 1963-64: Max 1,170 Min 34 Mean 371 Ac-ft 269,300

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 24 to Apr. 17.

5-760. Thief River near Thief River Falls, Minn.

Location.--Lat 48°11', long 96°10', in sec.3, T.154 N., R.43 W., on right bank a quarter of a mile upstream from highway bridge, 5 miles north of city of Thief River Falls, 7 miles upstream from mouth, and 9 miles downstream from Mud Lake National Wild Life Refuge.

Drainage area.--959 sq mi.

Records available.--July 1909 to September 1917, April 1920 to September 1921, October 1922 to September 1924, October 1928 to September 1964. Monthly discharge only for some periods, annual maximums for water years 1919, 1922, 1925, 1926, published in WSP 1308.

Gage.--Water-stage recorder and control of grouted boulders. Datum of gage is 1,112.33 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department). Prior to May 4, 1939, staff or chain gage at same site and datum.

Average discharge.--47 years, 125 cfs (90,500 acre-ft per year).

Extremes.--Maximum discharge during year, 2,480 cfs Aug. 2 (gage height, 12.05 ft); no flow for many days.
1909-17, 1919-26, 1928-64: Maximum discharge, 5,610 cfs May 13, 1950 (gage height, 17.38 ft); no flow at times in some years.

Remarks.--Records good except those for period of ice effect, which are poor. Some regulation by Thief and Mud Lakes.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 19-22)

Oct. 1 to Apr. 12		Apr. 13 to Sept. 30			
3.7	0	4.9	38	7.0	558
3.8	.1	5.0	53	9.0	1,180
4.0	.2	5.5	159	12.0	2,460
4.2	.6	6.0	283	12.1	2,510

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.3	0.1					0	212	232	1,210	495	68
2	.4	.1					b0	214	227	1,160	2,480	76
3	.4	.1					*b.1	214	222	1,110	2,260	65
4	.4	.1					b.1	227	217	1,070	1,550	53
5	.3	0					*b0	242	210	1,020	1,090	47
6	.3	0					b0	339	210	1,010	740	44
7	.3	0					.5	423	214	963	585	41
8	.2	0					2.0	371	237	929	518	38
9	.2	0					10	331	1,150	901	484	38
10	.2	.1					50	312	1,860	786	467	47
11	.1	.1					*b180	296	1,650	740	445	78
12	.1	.1					b250	291	1,930	746	434	82
13	.1	.1					293	286	1,880	721	423	80
14	.1	.1		(*)			220	273	1,650	672	412	76
15	.1	.1					379	265	1,430	594	409	74
16	.1	.1	(*)				*600	262	*1,240	576	401	72
17	.1	.1			(*)		573	260	1,140	558	393	72
18	.1	.1					420	476	1,200	538	382	70
19	.1	.1					306	573	1,780	532	*377	67
20	.1	*0					257	439	2,090	*546	363	65
21	.1	0					*280	*479	1,870	544	275	*63
22	*.1	0					299	459	*1,660	532	267	65
23	.1	0					288	431	1,650	529	260	108
24	.1	0					267	409	1,630	518	244	130
25	.1	0					252	390	1,590	504	108	110
26	.1	0					234	368	1,520	498	63	583
27	.1	0					220	355	1,470	490	60	1,080
28	.2	0					210	344	1,420	484	60	814
29	.1	0					212	333	1,350	479	62	663
30	.1	0			----------		*212	325	1,270	470	62	518
31	.1	----------			----------		----------	252	----------	462	60	----------
Total	5.2	1.4	0	0	0	0	6,014.7	10,451	36,199	21,892	16,229	5,387
Mean	0.17	0.05	0	0	0	0	200	337	1,207	706	524	180
Ac-ft	10	2.8	0	0	0	0	11,930	20,730	71,800	43,420	32,190	10,680

Calendar year 1963: Max 2,080 Min 0 Mean 180 Ac-ft 130,000
Water year 1963-64: Max 2,480 Min 0 Mean 263 Ac-ft 190,800

* Discharge measurement or observation of no flow made on this day.
b Stage-discharge relation affected by ice.

5-777. Ruffy Brook near Gonvick, Minn.

Location.--Lat 47°44'50", long 95°24'45", on line between secs.5 and 8, T.149 N., R.37 W., on downstream side of bridge on County Highway 17, 4 miles upstream from mouth, and 4¾ miles east of Gonvick.

Drainage area.--45.2 sq mi.

Records available.--July 1960 to September 1964.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,227.93 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 9, 1960, reference point at same site and datum.

Extremes.--Maximum discharge during year, 134 cfs Apr. 16 (gage height, 4.45 ft); maximum gage height, 5.37 ft Apr. 13 (backwater from ice); minimum daily discharge, 0.9 cfs Aug. 20 (gage-height, 1.09 ft).
1960-64: Maximum discharge, 364 cfs July 7, 1962 (gage height, 6.70 ft); minimum discharge, 0.6 cfs Sept. 5, 1961; minimum gage height, that of Aug. 20, 1964.

Remarks.--Records good except those for period of ice effect, which are poor.

Rating table, water year 1963-64, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 15, 16, 19-27)

1.0	0.4	1.7	14
1.1	1.1	2.0	23
1.2	1.9	3.0	64
1.3	3.6	4.0	112
1.4	6.0	5.0	182

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.0	2.0	1.8	1.2	1.3	1.4	3.0	35	6.3	10	1.6	5.3
2	2.0	2.1	1.8	1.2	1.3	1.4	3.0	32	5.6	14	1.6	5.8
3	2.0	2.0	1.8	1.2	1.3	1.4	6.0	33	5.1	10	2.0	3.6
4	2.0	2.0	1.6	1.2	1.3	1.4	*14	44	4.3	8.4	1.4	2.6
5	2.1	2.1	1.6	1.2	1.3	1.4	16	40	4.1	7.1	1.5	2.1
6	2.0	2.0	1.6	1.2	1.3	1.6	16	39	4.3	9.2	1.2	2.1
7	2.0	2.0	1.6	1.2	1.3	1.6	14	42	6.3	7.9	1.2	2.6
8	2.2	2.4	1.6	1.2	1.3	1.6	12	36	9.2	6.6	1.1	2.2
9	2.1	2.4	1.4	1.2	1.3	1.6	13	35	13	4.6	1.1	2.0
10	2.1	2.4	1.4	1.2	1.3	1.6	*16	32	11	5.1	1.3	1.9
11	2.1	2.2	1.4	1.2	1.4	1.6	20	33	10	4.3	1.3	1.8
12	2.1	2.2	1.4	1.2	1.4	1.8	30	35	12	4.1	1.2	1.7
13	2.1	2.2	1.4	1.2	1.4	1.8	90	23	14	3.8	*1.2	1.6
14	2.1	2.2	1.2	1.2	1.4	2.0	100	22	14	3.1	1.1	1.6
15	1.9	2.2	1.2	*1.2	1.4	2.0	*114	18	13	3.1	1.2	1.6
16	1.9	2.2	*1.2	1.2	1.4	1.8	131	17	13	2.9	1.1	1.6
17	1.8	2.2	1.2	1.2	1.4	2.5	108	17	14	2.4	1.1	1.4
18	1.9	2.2	1.2	1.2	*1.4	2.5	91	14	16	2.0	1.1	1.3
19	1.9	2.2	1.2	1.2	1.4	4.0	101	13	21	1.8	1.0	1.3
20	2.0	*2.2	1.2	1.2	1.4	4.0	64	13	20	*4.8	.9	1.8
21	2.0	2.1	1.2	1.2	1.4	3.0	*65	14	18	2.9	2.0	1.9
22	1.9	2.1	1.2	1.2	1.4	3.0	76	*14	17	2.2	1.9	*2.2
23	*1.8	2.1	1.2	1.2	1.4	3.0	70	14	*20	2.0	1.6	12
24	1.8	2.1	1.2	1.2	1.4	3.0	62	14	21	2.0	1.7	17
25	1.8	2.1	1.2	1.2	1.4	3.0	55	14	18	1.9	1.5	14
26	1.9	2.0	1.2	1.2	1.4	3.0	49	9.2	16	1.9	1.5	14
27	1.8	2.0	1.2	1.3	1.4	3.0	42	8.4	16	2.1	3.1	16
28	1.8	2.0	1.2	1.3	1.4	3.0	40	7.9	15	2.0	2.4	16
29	1.8	2.0	1.2	1.3	1.4	3.0	43	8.9	14	1.9	2.2	16
30	2.0	1.8	1.2	1.3	-------	3.0	*39	8.7	10	1.9	3.1	15
31	2.2	------	1.2	1.3	------	3.0	------	8.7	------	1.9	2.9	------
Total	61.1	63.7	42.0	37.7	39.6	72.0	1,503.0	694.8	381.2	137.9	49.1	170.0
Mean	1.97	2.12	1.35	1.22	1.37	2.32	50.1	22.4	12.7	4.45	1.58	5.67
Ac-ft	121	126	83	75	79	143	2,980	1,380	756	274	97	337

Calendar year 1963: Max 214 Min 0.7 Mean 13.3 Ac-ft 9,620
Water year 1963-64: Max 131 Min 0.9 Mean 8.89 Ac-ft 6,450

Peak discharge (base, 65 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-16	1400	4.45	134				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 21 to Apr. 14.

5-780. Clearwater River at Plummer, Minn.

Location.--Lat 47°55', long 96°03', in SE¼SW¼ sec.4, T.151 N., R.42 W., on right bank 200 ft downstream from Soo Line Railroad bridge, 300 ft downstream from bridge on U. S. Highway 59, 0.9 mile northwest of railroad depot in Plummer, and 8 miles upstream from Hill River.

Drainage area.--512 sq mi.

Records available.--April 1939 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,099.12 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Nov. 10, 1939, staff gage at site 100 ft upstream at same datum.

Average discharge.--25 years, 166 cfs (120,200 acre-ft per year).

Extremes.--Maximum discharge during year, 1,640 cfs Apr. 17 (gage height, 8.57 ft); maximum gage height, 8.78 ft Apr. 16 (backwater from ice); minimum daily discharge, 22 cfs Aug. 19; minimum gage height, 2.08 ft Nov. 21.
1939-64: Maximum discharge, 3,640 cfs June 9, 1962 (gage height, 11.90 ft); minimum, 7.9 cfs July 8, 1940.

Remarks.--Records good except those for period of ice effect, which are poor. Slight regulation by Clearwater Lake.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 16		Apr. 17 to Sept. 30			
2.3	20	2.3	18	4.0	257
2.6	42	2.6	42	5.0	472
3.0	86	3.0	89	7.0	1,030
3.5	160	3.5	166	9.0	1,840

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	48	43	44	34	30	32	42	*472	81	164	52	90
2	47	43	42	34	30	32	44	442	77	158	48	93
3	46	43	40	34	32	32	*47	412	72	144	32	89
4	46	43	42	32	32	32	50	421	69	129	26	70
5	45	43	42	32	32	32	55	484	68	116	36	70
6	45	43	42	32	32	32	65	735	66	100	45	70
7	44	44	40	32	32	32	75	769	70	96	27	68
8	43	45	40	32	32	32	75	614	173	95	29	65
9	43	45	40	32	32	32	80	503	*743	151	37	62
10	43	46	38	32	32	34	*120	449	824	297	33	49
11	42	48	40	30	32	35	180	410	477	160	32	49
12	41	49	40	30	32	35	220	383	403	115	31	50
13	42	38	40	30	32	35	280	348	351	96	30	48
14	42	44	40	*30	32	35	390	317	271	85	28	45
15	42	49	40	30	32	36	*500	289	208	82	28	44
16	41	55	*39	30	32	36	1,000	269	168	84	29	46
17	43	48	39	30	*32	35	1,490	255	160	71	27	44
18	44	48	38	30	32	35	1,140	244	183	55	25	42
19	44	46	38	30	32	34	918	232	503	45	*22	41
20	43	*54	38	30	32	35	*835	212	735	65	26	41
21	44	46	38	30	32	36	785	*192	522	*72	28	*41
22	*46	30	38	30	32	36	838	180	*374	89	30	43
23	49	40	36	30	32	36	948	168	328	85	34	56
24	46	45	36	30	32	38	894	158	361	70	38	74
25	46	50	36	30	32	38	780	147	370	72	38	121
26	46	50	36	30	32	38	679	131	351	64	38	196
27	46	50	36	30	32	38	596	123	301	64	43	255
28	46	48	36	30	32	38	540	110	249	58	45	230
29	44	46	34	30	32	38	515	102	188	44	79	199
30	44	44	34	30	------	38	513	93	174	55	79	178
31	43	------	34	30	------	40	------	86	------	53	76	------
Total	1,374	1,366	1,196	956	924	1,087	14,694	9,750	8,920	3,034	1,171	2,569
Mean	44.3	45.5	38.6	30.8	31.9	35.1	490	315	297	97.9	37.8	85.6
Ac-ft	2,730	2,710	2,370	1,900	1,830	2,160	29,150	19,340	17,690	6,020	2,320	5,100

Calendar year 1963 : Max 750 Min 22 Mean 124 Ac-ft 89,770
Water year 1963-64 : Max 1,490 Min 22 Mean 129 Ac-ft 93,320

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-17	1130	8.57	1,640	6-10	0515	6.62	912
5- 7	0215	6.30	818	6-20	0715	6.14	772

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23 to Apr. 16 (no gage-height record Dec. 27 to Jan. 13, Jan. 19 to Feb. 16).

5-782.3 Lost River at Oklee, Minn.

Location.--Lat 47°50'35", long 95°51'30", on west edge of sec.1, T.150 N., R.41 W., on upstream side of bridge on State Highway 222 at northwest edge of Oklee, 12 miles upstream from mouth.

Drainage area.--266 sq mi.

Records available.--July 1960 to September 1964.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,134.94 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 9, 1960, reference points at same site and datum.

Extremes.--Maximum discharge during year, 472 cfs Apr. 16 (gage height, 6.07 ft from floodmark); no flow Feb. 15 to Mar. 2.
1960-64: Maximum discharge, 1,490 cfs May 24, 1962 (gage height, 8.72 ft); no flow Feb. 16 to Mar. 21, 1963, Feb. 15 to Mar. 2, 1964.
Maximum stage known since at least 1897, 10.39 ft Apr. 21, 1950, from floodmarks (discharge, 2,790 cfs).

Remarks.--Records fair except those for period of ice effect or below 10 cfs, which are poor.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	1.5	1.8	0.4	0.1	0	0.8	207	37	36	7.9	25
2	10	1.5	1.8	.4	.1	0	1.0	195	37	35	7.9	32
3	4.0	1.5	1.6	.4	.1	.1	3.0	195	36	29	7.3	33
4	2.2	1.5	1.6	.4	.1	.1	5.0	194	32	27	7.3	36
5	1.8	1.5	1.6	.4	.1	.1	*6.5	207	31	24	6.0	25
6	1.8	1.5	1.6	.3	.1	.1	30	*235	31	23	5.3	32
7	1.6	1.1	1.6	.3	.1	.1	30	254	38	21	4.1	41
8	1.8	1.1	1.6	.3	.1	.1	30	250	64	17	3.6	23
9	2.0	1.1	1.6	.3	.1	.1	35	250	135	16	3.1	13
10	1.8	1.1	1.6	.3	.1	.1	50	230	163	64	2.6	17
11	2.2	1.1	1.4	.3	.1	.1	*100	217	148	92	2.2	22
12	2.4	1.1	1.4	.2	.1	.1	180	185	129	70	1.8	21
13	2.4	1.1	1.4	.2	.1	.1	217	148	103	61	*.9	16
14	2.4	.9	1.4	.2	.1	.1	245	113	78	*36	.6	12
15	2.2	2.2	1.4	*.2	0	.1	295	99	64	23	.4	11
16	2.2	2.2	*1.4	.2	0	.1	*421	98	56	12	.3	8.6
17	2.0	3.6	1.4	.1	0	.1	460	94	51	22	.3	8.6
18	1.8	3.6	1.3	.1	*0	.1	446	91	64	14	.3	2.6
19	2.4	3.1	1.3	.1	0	.1	418	83	97	17	.1	2.6
20	2.2	3.1	1.2	.1	0	.1	*408	78	185	*11	.3	7.9
21	2.0	*2.2	1.2	.1	0	.1	414	*72	212	11	.4	7.9
22	2.0	2.0	1.2	.1	0	.2	436	62	*205	4.1	.3	*8.6
23	*2.6	2.0	1.2	.1	0	.2	436	57	187	5.3	.3	14
24	2.2	1.8	1.0	.1	0	.4	393	53	153	1.5	.9	77
25	1.1	1.8	a1.0	.1	0	.4	347	50	129	1.5	.9	160
26	.6	1.8	.8	.1	0	.4	315	47	107	.9	4.1	70
27	.6	1.8	.6	.1	0	.4	277	42	86	2.2	4.7	11
28	.6	1.8	.4	.1	0	.4	252	39	68	4.1	14	3.1
29	.6	1.8	.4	.1	0	.4	234	37	52	4.1	14	a3.0
30	1.5	1.8	.4	.1	----------	.6	*219	37	48	4.1	18	a3.0
31	.9	----------	.4	.1	----------	.6	----------	37	----------	2.2	19	----------
Total	83.9	54.2	38.6	6.3	1.4	5.9	6,704.3	3,956	2,826	691.0	138.9	746.9
Mean	2.71	1.81	1.25	0.20	0.05	0.19	223	128	94.2	22.3	4.48	24.9
Ac-ft	166	108	77	12	2.8	12	13,300	7,850	5,610	1,370	276	1,480

Calendar year 1963: Max 335 Min 0 Mean 39.1 Ac-ft 28,290
Water year 1963-64: Max 460 Min 0 Mean 41.7 Ac-ft 30,260

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 12 (no gage-height record Dec. 25).

GPO 819-718-4

5-785. Clearwater River at Red Lake Falls, Minn.

Location.--Lat 47°53'15", long 96°16'25", in NW¼NE¼ sec.22, T.151 N., R.44 W., on left bank 40 ft downstream from Great Northern Railroad bridge in Red Lake Falls, 1.4 miles upstream from mouth, and 3 miles downstream from Badger Creek.

Drainage area.--1,370 sq mi, approximately.

Records available.--June 1909 to September 1917, October 1934 to September 1964. Monthly discharge only for October, November 1934, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 949.49 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 12, 1911, staff gage at site half a mile upstream and Sept. 12, 1911, to Sept. 30, 1917, staff gage at site 40 ft upstream at different datum.

Average discharge.--38 years, 283 cfs (204,900 acre-ft per year).

Extremes.--Maximum discharge during year, 3,050 cfs Apr. 17 (gage height, 6.58 ft); maximum gage height, 7.56 ft Apr. 16 (backwater from ice); minimum discharge, 18 cfs Nov. 19 (gage height, 1.59 ft).
1909-17, 1934-64: Maximum discharge, 9,310 cfs May 6, 1950 (gage height, 11.28 ft); maximum gage height observed, 17.5 ft Apr. 5, 1913, site and datum then in use (backwater from ice); no flow Sept. 15, 1936, Sept. 14, 1939, Aug. 19-22, 1940.

Remarks.--Records good except those for periods of ice effect, which are poor. Slight regulation by Clearwater Lake and several smaller lakes.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.6	19	4.0	826
1.7	30	5.0	1,500
2.0	78	6.0	2,440
2.5	188	6.6	3,070
3.0	351		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	46	54	78	44	44	48	72	*1,010	157	305	92	111
2	46	54	62	44	45	48	74	956	150	301	86	139
3	44	52	58	44	45	50	76	890	143	264	84	130
4	44	54	43	44	45	50	80	908	134	239	71	119
5	43	55	40	42	45	50	90	968	119	213	57	108
6	43	54	48	42	45	50	100	1,370	126	202	52	117
7	43	54	48	42	45	50	120	1,720	126	174	57	111
8	41	54	52	42	45	50	140	1,400	478	166	52	111
9	40	57	56	42	45	52	160	1,140	*1,740	191	44	111
10	40	57	*57	42	*45	54	*180	1,020	1,580	890	49	98
11	40	57	55	40	45	56	*660	914	1,110	606	49	84
12	40	*57	54	40	45	58	740	832	896	388	*44	80
13	40	57	52	40	45	60	820	758	763	290	43	80
14	41	47	52	40	46	62	867	660	583	222	40	76
15	43	36	52	*39	46	64	*1,120	597	451	176	38	74
16	43	52	50	40	46	64	1,850	547	335	152	36	74
17	*44	62	50	40	46	64	2,690	516	308	143	36	74
18	44	40	50	40	46	*65	2,330	498	320	123	34	71
19	44	40	50	40	46	65	1,820	*494	*894	104	31	69
20	46	54	50	40	46	65	1,650	463	1,540	*121	29	69
21	46	37	48	42	46	66	*1,710	417	1,260	123	30	67
22	49	38	48	42	46	66	2,030	388	950	130	37	*69
23	49	52	48	42	46	66	1,960	355	798	159	38	90
24	49	38	48	42	46	66	1,840	316	763	137	40	102
25	50	37	48	42	46	66	1,610	283	735	121	43	128
26	54	55	46	44	46	66	1,420	257	676	119	43	308
27	54	67	46	44	46	68	1,270	233	583	113	44	588
28	54	67	46	44	46	68	1,170	219	507	108	50	542
29	55	76	46	44	46	70	1,110	191	392	100	50	463
30	54	76	46	44	----------	70	1,070	178	328	88	84	392
31	54	----------	46	44	----------	72	----------	169	----------	90	94	----------
Total	1,423	1,590	1,573	1,301	1,320	1,869	30,829	20,667	18,945	6,558	1,577	4,655
Mean	45.9	53.0	50.7	42.0	45.5	60.3	1,028	667	632	212	50.9	155
Ac-ft	2,820	3,150	3,120	2,580	2,620	3,710	61,150	40,990	37,580	13,010	3,130	9,230

Calendar year 1963: Max 1,500 Min 29 Mean 215 Ac-ft 155,700
Water year 1963-64: Max 2,690 Min 29 Mean 252 Ac-ft 183,090

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 6 to Apr. 13, 15, 16 (no gage-height record Jan. 11-14, Jan. 16 to Feb. 9, Feb. 11 to Mar. 17, Mar. 19 to Apr. 1, Apr. 4).

5-790. Red Lake River at Crookston, Minn.

Location.--Lat 47°46'32", long 96°36'33", in SW¼SW¼ sec.30, T.150 N., R.46 W., on right bank at downstream side of highway bridge in Crookston, 0.3 mile downstream from Interstate Power Co.'s dam and 0.6 mile downstream from bridge on State Highway 81.

Drainage area.--5,280 sq mi, approximately.

Records available.--May 1901 to September 1964. Monthly discharge only for some periods, published in WSP 1308. Figures of daily discharge for Apr. 3-30, 1904, published in WSP 130, have been found unreliable and should not be used.

Gage.--Water-stage recorder. Datum of gage is 832.72 ft above mean sea level, datum of 1929. May 18, 1901, to June 30, 1909, chain gage at bridge 300 ft upstream at same datum. July 1, 1909, to Sept. 25, 1911, chain gage, Sept. 26, 1911, to Sept. 30, 1919, water-stage recorder, and Oct. 1, 1919, to Sept. 30, 1930, chain gage, at present site and datum.

Average discharge.--63 years, 986 cfs (713,800 acre-ft per year).

Extremes.--Maximum discharge during year, 5,550 cfs June 20 (gage height, 11.74 ft); maximum gage height, 13.38 ft Apr. 16 (backwater from ice); minimum discharge, 26 cfs Sept. 20 (gage height, 2.56 ft).
1901-64: Maximum discharge, 27,400 cfs May 7, 1950 (gage height, 25.70 ft); no flow for part of July 13, 1960 (caused by regulation of powerplant upstream).

Remarks.--Records good except those for periods of ice effect, which are fair. Diurnal fluctuation caused by powerplant upstream.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Aug. 10-15)

2.9	125	7.0	2,160
3.0	156	9.0	3,560
4.0	530	12.0	5,760
5.0	970		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	995	965	578	520	550	400	205	*1,540	546	1,930	713	326
2	1,000	848	514	530	545	400	212	1,510	450	1,860	718	*246
3	1,000	803	500	530	550	390	232	1,420	430	1,730	2,660	288
4	970	726	490	535	550	390	253	1,410	398	1,580	2,730	281
5	1,040	677	480	535	545	390	326	1,480	370	1,490	1,980	253
6	1,010	630	460	535	545	390	362	1,690	370	1,420	1,460	242
7	1,030	630	450	535	540	390	354	2,660	370	1,370	1,040	219
8	1,010	626	440	540	540	390	354	3,050	466	1,270	812	219
9	1,060	626	420	540	535	390	398	2,380	1,600	1,250	736	208
10	1,060	618	*400	540	535	390	514	1,940	5,120	1,620	700	212
11	1,040	626	390	545	*535	390	875	1,680	5,000	2,200	690	*242
12	1,060	*610	380	545	535	380	1,700	1,510	3,900	1,650	*654	193
13	1,060	594	390	550	535	390	1,900	1,350	4,090	1,350	626	131
14	1,070	582	390	545	535	400	2,000	1,220	3,550	1,170	618	200
15	1,090	590	400	*547	535	400	*2,000	1,120	2,900	1,040	610	260
16	1,100	594	390	548	535	410	3,380	1,040	2,410	935	598	178
17	*1,060	610	400	550	535	420	5,050	980	2,030	866	582	196
18	1,130	602	420	550	535	*334	5,020	935	1,880	839	550	197
19	1,120	594	430	550	530	307	3,670	*1,120	*2,640	803	538	195
20	1,120	590	450	550	525	292	2,900	1,390	5,100	*808	526	153
21	1,130	546	460	550	525	281	2,670	1,160	5,240	785	542	195
22	1,160	482	470	550	525	278	*2,910	1,060	4,280	808	518	197
23	1,160	315	480	550	525	330	3,110	1,030	3,480	866	434	242
24	1,170	303	490	550	460	550	2,960	950	3,160	866	434	249
25	1,160	232	490	550	420	378	2,580	884	3,040	834	442	342
26	1,150	225	490	550	415	311	2,250	821	2,820	794	346	462
27	1,130	570	490	550	415	300	1,970	749	2,680	798	274	1,580
28	1,110	762	490	550	415	292	1,790	590	2,480	754	205	2,600
29	1,080	686	490	550	410	319	1,690	642	2,290	736	212	2,010
30	1,070	695	500	550	----------	292	1,610	606	2,070	731	208	1,620
31	1,040	----------	510	550	----------	236	----------	586	----------	700	232	----------
Total	33,385	17,957	14,132	16,870	14,880	11,210	55,245	40,503	75,160	35,853	23,388	13,936
Mean	1,077	599	456	544	513	362	1,842	1,307	2,505	1,157	754	465
Ac-ft	66,220	35,620	28,030	33,460	29,510	22,230	109,600	80,340	149,100	71,110	46,390	27,640

Calendar year 1963: Max 6,640 Min 225 Mean 1,286 Ac-ft 930,800
Water year 1963-64: Max 5,240 Min 131 Mean 963 Ac-ft 699,200

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 3 to Mar. 17, Mar. 24, Apr. 12-17.

5-825. Red River of the North at Grand Forks, N. Dak.

Location.--Lat 47°56'26", long 97°02'47", in SE¼NE¼ sec.33, T.152 N., R.50 W., on left bank 500 ft downstream from dam at Riverside Park in Grand Forks, 2 miles downstream from Red Lake River, and at mile 296.0.

Drainage area.--30,100 sq mi, approximately (includes 3,800 sq mi in closed basins).

Records available.--April 1882 to September 1964. Monthly discharge only prior to May 1901, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 778.35 ft above mean sea level, datum of 1929. 1882-92, gages near site of Northern Pacific Railway bridge, 1½ miles upstream (history not available, datum apparently the same as following gage). 1892 to Oct. 15, 1926, staff and chain gages on Northern Pacific Railway bridge, at datum about 5½ ft higher, but published referred to datum only half a foot higher than present datum. Oct. 16, 1926, to Nov. 2, 1933, staff gages near present site, at datum 5 ft higher than present datum but published at present datum.

Average discharge.--82 years, 2,305 cfs (1,669,000 acre-ft per year).

Extremes.--Maximum discharge during year, 13,200 cfs Apr. 19 (gage height, 22.71 ft); minimum, 371 cfs Sept. 15 (gage height, 2.96 ft).
1882-1964: Maximum discharge, about 80,000 cfs Apr. 10, 1897 (gage height, 50.2 ft, site and datum then in use), from rating curve extended above 54,000 cfs; minimum, 2.4 cfs Feb. 3-5, 12, 14, 16-19, 1937 (caused by unusual regulation during repair of dam at Grand Forks).

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated by many lakes and reservoirs on tributaries.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,320	1,410	1,000	780	770	620	820	5,400	1,970	4,070	1,180	614
2	1,320	1,360	970	780	770	620	800	5,080	1,890	3,760	1,170	874
3	1,310	1,260	920	780	770	620	800	4,860	1,780	3,540	1,150	839
4	1,310	1,180	840	770	770	630	800	4,680	1,680	3,370	1,790	740
5	1,270	1,120	840	770	780	630	830	*4,530	1,600	3,180	2,680	669
6	1,270	1,070	830	770	780	630	980	4,550	1,580	*3,020	2,420	592
7	1,290	1,020	820	770	780	620	1,000	5,400	1,550	2,870	1,960	522
8	1,280	999	810	770	770	610	1,080	6,160	1,700	2,760	1,540	475
9	1,270	995	800	780	760	600	1,350	6,320	1,980	2,680	1,260	450
10	1,260	979	770	780	760	590	1,850	5,800	2,440	2,640	1,080	432
11	1,310	968	760	780	740	590	2,800	*5,550	4,460	3,160	976	*430
12	1,330	964	750	770	730	590	3,700	5,380	*6,200	3,450	929	413
13	1,340	972	740	750	730	610	5,180	5,020	6,150	3,180	870	410
14	1,340	944	750	720	*723	630	*6,230	4,630	5,970	2,740	816	396
15	1,360	913	760	720	725	630	7,430	4,280	*5,890	2,450	755	380
16	1,380	917	750	720	725	670	10,000	4,000	5,440	2,200	732	403
17	1,400	929	740	730	740	720	*12,500	3,740	4,880	2,000	711	442
18	1,400	936	740	750	750	660	13,100	3,550	*4,460	1,800	682	420
19	1,400	952	760	750	750	660	13,200	3,380	4,350	1,690	669	427
20	1,440	933	780	750	750	670	11,800	3,310	5,050	1,680	639	481
21	1,460	878	790	760	740	670	10,700	3,420	7,350	1,620	642	489
22	1,470	725	790	760	750	680	*10,300	3,290	*8,700	1,620	672	462
23	1,470	611	790	760	760	740	10,800	3,100	8,460	1,520	679	494
24	1,490	574	790	775	750	1,000	*11,200	2,960	7,540	1,480	675	527
25	1,500	620	790	775	710	940	11,000	2,800	6,880	1,470	672	545
26	1,520	649	790	775	660	900	10,100	*2,670	*6,300	1,420	675	773
27	1,510	*611	800	775	640	880	*8,700	2,540	5,750	1,380	642	929
28	1,530	630	800	773	*632	870	7,430	2,410	5,250	1,350	*598	*1,420
29	1,510	800	800	*773	630	880	*6,500	2,230	4,840	1,310	536	2,500
30	*1,470	980	*800	770	----------	*860	5,860	2,130	4,410	*1,260	497	2,550
31	*1,440	----------	790	770	----------	850	----------	2,050	----------	1,200	478	----------
Total	42,970	27,899	24,860	23,656	21,345	21,870	188,840	125,220	136,500	71,870	30,775	21,098
Mean	1,386	930	802	788	736	705	6,295	4,039	4,550	2,318	993	703
Ac-ft	85,230	55,340	49,310	46,920	42,340	43,380	374,600	248,400	270,700	142,600	61,040	41,850

Calendar year 1963: Max 10,700 Min 574 Mean 2,297 Ac-ft 1,663,000
Water year 1963-64: Max 13,200 Min 380 Mean 2,013 Ac-ft 1,462,000

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Apr. 12.

5-875. Middle River at Argyle, Minn.

Location.--Lat 48°20'27", long 96°49'02", in SE¼SW¼ sec.10, T.156 N., R.48 W., on left bank 20 ft upstream from bridge on U. S. Highway 75 in Argyle and 14 miles upstream from mouth.

Drainage area.--265 sq mi.

Records available.--March to September 1945, November 1950 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 828.53 ft above mean sea level, datum of 1929. Prior to Nov. 8, 1951, chain or wire-weight gage at bridge 20 ft upstream at datum 1.0 ft higher. Nov. 8, 1951, to Sept. 18, 1952, water-stage recorder at present site at datum 1.0 ft higher.

Average discharge.--14 years (1950-64), 31.6 cfs (22,880 acre-ft per year).

Extremes.--Maximum discharge during year, 900 cfs June 22 (gage height, 12.40 ft); no flow Oct. 1-28, Dec. 11 to Apr. 3.
1945, 1950-64: Maximum discharge, 1,620 cfs June 12, 1962 (gage height, 14.12 ft); no flow at times most years.
Maximum stage known, 15.25 ft in April 1950, present datum, from floodmarks (discharge, 2,790 cfs).

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 13-25, Aug. 24 to Sept. 30)

Oct. 1 to Apr. 18		Apr. 19 to Sept. 30			
0.8	0	1.0	0.7	3.0	50
.9	.1	1.1	1.5	4.0	95
1.0	.4	1.2	2.7	6.0	223
1.1	1.1	1.5	7.2	9.0	488
1.2	2.1	2.0	18	12.0	910

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0	0.1	0.1				0	47	*10	98	16	5.3
2	0	.1	.1				0	49	9.2	79	18	4.7
3	0	.2	.1				0	51	8.2	64	25	5.0
4	0	.2	.1				1	58	7.2	53	48	4.6
5	0	.1	.1				2	65	6.5	46	120	4.3
6	0	.1	.1				2	87	7.2	40	138	3.6
7	0	.2	.1				2	102	6.7	35	110	3.6
8	0	.2	.1				5	96	8.6	31	77	4.4
9	0	.2	.1				15	83	13	*30	54	4.0
10	0	.2	.1				*35	67	24	38	41	3.1
11	0	.2	0				25	57	133	65	32	*2.8
12	0	.2	0				30	48	236	75	26	2.2
13	0	.2	0				55	42	356	72	22	1.8
14	0	.2	0				*68	36	478	60	18	1.7
15	0	.2	0				120	33	*859	45	16	1.7
16	0	.2	0				150	29	738	35	14	2.0
17	0	.2	0				*170	26	516	29	12	2.0
18	0	.2	0				230	25	374	24	10	2.0
19	0	.2	*0				270	23	380	23	8.8	2.0
20	0	.2	0				*199	23	509	19	7.8	2.0
21	0	.2	0				164	45	730	17	7.6	1.3
22	0	.2	0	(*)			117	53	878	18	7.1	1.4
23	0	.2	0				101	52	768	41	6.2	3.6
24	0	.2	0				89	46	576	46	5.8	2.6
25	0	.2	0				80	37	438	37	*5.3	2.3
26	0	*.2	0				72	28	343	31	4.7	6.0
27	0	.2	0		(*)		*65	22	273	27	4.3	10
28	0	.1	0				55	17	209	23	5.5	*19
29	*.2	.1	0				47	14	161	19	4.1	53
30	.1	.1	0		----------	(*)	46	12	127	*16	4.7	91
31	.1	----------	0		----------		----------	11	----------	15	5.5	----------
Total	0.4	5.3	1.0	0	0	0	2,215	1,384	9,182.6	1,251	874.4	253.0
Mean	0.01	0.18	0.03	0	0	0	73.8	44.6	306	40.4	28.2	8.43
Ac-ft	0.8	11	2.0	0	0	0	4,390	2,750	18,210	2,480	1,730	502

Calendar year 1963: Max 764 Min 0 Mean 24.2 Ac-ft 17,520
Water year 1963-64: Max 878 Min 0 Mean 41.4 Ac-ft 30,080

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 18.

5-920. Red River of the North at Drayton, N. Dak.

Location.--Lat 48°34'20", long 97°08'50", on line between secs. 24 and 25, T.159 N., R.51 W., on downstream end of east pier of interstate highway bridge, 1½ miles northeast of Drayton and at mile 207.

Drainage area.--34,800 sq mi, approximately (includes 3,800 sq mi in closed basins).

Records available.--April 1936 to June 1937, April 1941 to September 1964 (fragmentary prior to April 1949).

Gage.--Water-stage recorder. Datum of gage is 755.00 ft above mean sea level, datum of 1929 (Minnesota highway bench mark). Prior to Nov. 30, 1954, wire-weight gage at site 1½ miles upstream at datum 1.59 ft higher.

Average discharge.--15 years (1949-64), 3,176 cfs (2,299,000 acre-ft per year); median of yearly mean discharges, 2,450 cfs (1,770,000 acre-ft per year).

Extremes.--Maximum discharge during year, 15,600 cfs Apr. 20 (gage height, 23.60 ft); minimum, 460 cfs, Sept. 18 (gage height, 3.83 ft).
1936-37, 1941-64: Maximum discharge, 86,500 cfs May 12, 1950 (gage height, 41.58 ft, former site and datum); minimum observed, 7.7 cfs Oct. 16, 1936 (gage height, 1.75 ft, former site and datum).
Maximum discharge known since 1860, that of May 12, 1950. Flood of April 1897 reached a stage of about 41 ft, at site and datum in use prior to Nov. 30, 1954.

Remarks.--Records good except those for period of ice effect, which are fair. Some regulation by reservoirs on tributaries.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,400	1,570	700	800	780	690	910	*7,600	2,300	7,400	1,500	680
2	1,410	1,540	800	800	770	680	920	6,850	2,200	a6,700	1,480	647
3	1,410	1,500	900	790	770	670	940	6,250	2,140	a6,000	1,440	693
4	1,390	1,460	950	790	770	660	950	5,850	2,100	a5,300	1,400	884
5	1,390	1,370	940	780	770	650	960	5,480	1,990	a4,600	1,460	963
6	1,390	1,290	910	780	770	640	980	*5,300	1,920	*4,050	2,270	917
7	1,360	*1,220	890	780	a770	630	1,000	5,150	1,860	3,800	2,870	845
8	1,350	1,180	830	770	a770	620	1,050	5,500	1,840	3,550	2,810	765
9	1,350	1,130	800	770	a770	610	1,150	6,200	2,010	3,400	2,480	706
10	*1,350	1,100	780	770	a770	600	1,400	6,630	2,620	3,300	2,110	647
11	1,340	1,080	*770	780	760	600	1,850	6,600	2,950	3,200	1,770	*594
12	1,330	1,060	770	780	760	590	2,500	6,200	4,850	3,250	1,510	549
13	1,350	1,050	760	780	760	590	3,800	5,800	7,850	3,850	*1,330	523
14	1,370	1,010	760	780	760	600	*5,850	5,500	9,250	3,980	1,220	510
15	1,380	996	750	780	760	620	8,750	5,150	*9,650	3,650	1,140	497
16	1,390	996	740	770	760	630	*12,100	4,760	10,200	3,250	1,060	485
17	1,400	970	740	760	760	640	14,400	4,400	10,300	2,900	983	472
18	1,420	957	740	750	760	650	15,100	4,200	*9,950	2,680	911	460
19	1,420	957	740	750	765	670	15,500	4,050	10,300	2,400	871	491
20	1,440	957	730	750	*765	690	*15,600	3,800	10,500	2,200	831	523
21	1,460	838	730	760	765	700	15,000	a3,700	10,700	2,100	812	510
22	1,500	840	730	760	770	690	14,200	a3,600	*11,400	2,080	805	530
23	1,510	830	740	760	770	700	13,400	a3,500	12,800	2,030	818	620
24	1,520	800	750	770	770	710	*12,900	a3,450	13,900	1,990	831	627
25	1,530	780	760	770	770	730	12,600	*3,400	14,000	1,930	831	594
26	1,530	720	770	770	770	770	12,300	3,200	*13,200	1,880	818	666
27	1,540	640	780	780	760	*880	*11,700	3,020	12,300	1,850	812	739
28	1,550	640	780	780	740	900	10,800	2,850	a11,000	1,800	825	825
29	1,560	630	790	780	710	920	9,800	2,720	a9,800	1,720	798	1,060
30	1,560	630	790	780	----------	910	8,600	2,560	a8,600	1,640	792	1,820
31	1,570	----------	800	780	----------	900	----------	2,420	----------	1,560	732	----------
Total	44,470	30,741	24,420	24,000	22,145	21,540	227,010	145,690	224,480	100,040	40,320	20,842
Mean	1,435	1,025	788	774	764	695	7,567	4,700	7,483	3,227	1,301	695
Ac-ft	88,200	60,970	48,440	47,600	43,920	42,720	450,300	289,000	445,200	198,400	79,970	41,340

Calendar year 1963: Max 12,800 Min 630 Mean 2,423 Ac-ft 1,754,000
Water year 1963-64: Max 15,600 Min 460 Mean 2,529 Ac-ft 1,836,000

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 14.

5-940. South Branch Two Rivers at Lake Bronson, Minn.

Location.--Lat 48°43'50", long 96°39'50", in SW¼SW¼ sec.30, T.161 N., R.46 W., on left bank 100 ft upstream from bridge on U. S. Highway 59 at town of Lake Bronson and 2 miles downstream from dam at outlet of Bronson Lake.

Drainage area.--444 sq mi.

Records available.--September 1928 to November 1936, April to September 1937, April 1941 to October 1943, April to December 1944, April 1945 to September 1947, October 1953 to September 1964. Monthly discharge only for some periods, published in WSP 1308. Published as South Fork Two Rivers at Bronson prior to 1941.

Gage.--Water-stage recorder. Datum of gage is 928.46 ft above mean sea level, adjustment of 1928 (levels by Geodetic Survey of Canada). Prior to Nov. 23, 1953, chain gage at bridge 100 ft downstream at datum 2.00 ft higher. Nov. 23, 1953, to Oct. 5, 1963, water-stage recorder at same site at datum 2.00 ft higher.

Average discharge.--23 years (1928-36, 1941-43, 1945-47, 1953-64), 68.3 cfs (49,450 acre-ft per year).

Extremes.--Maximum discharge during year, 2,210 cfs June 14 (gage height, 10.88 ft); minimum daily, 0.6 cfs Dec. 27 to Mar. 4.
1928-37, 1941-47, 1953-64: Maximum discharge, 2,960 cfs June 13, 1962 (gage height, 12.82 ft present datum); no flow at times in 1937, 1941, 1960.

Remarks.--Records good except those for periods of ice effect, which are fair. Flow partly regulated since 1937 by Bronson Lake (usable capacity, 3,700 acre-ft).

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 13)

3.0	0.4	4.5	167
3.1	1.6	5.0	265
3.2	3.7	6.0	500
3.3	8.2	8.0	1,140
3.6	34	11.0	2,260
4.0	86		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.7	1.2	0.9	0.6	0.6	0.6	5	89	*36	219	10	6.8
2	1.3	1.2	.8	.6	.6	.6	20	92	33	167	10	6.8
3	2.0	1.2	.8	.6	.6	.6	20	96	31	15	9.6	6.2
4	2.4	1.3	.8	.6	.6	.6	25	95	28	32	9.6	6.2
5	3.4	1.2	.8	.6	.6	.7	20	122	24	55	8.2	6.8
6	3.4	1.2	.8	.6	.6	.8	25	249	23	58	7.5	6.8
7	3.4	1.3	.9	.6	.6	.8	25	179	22	*58	6.8	6.8
8	3.4	1.4	.9	.6	.6	.8	35	130	23	57	7.5	6.8
9	3.4	1.4	.9	.6	.6	.8	30	140	41	55	7.5	6.8
10	3.4	1.3	.8	.6	.6	.8	*30	131	638	53	7.5	6.8
11	3.4	1.3	.8	.6	.6	.8	70	100	844	50	7.5	7.5
12	3.2	1.4	.8	.6	.6	.8	260	82	1,130	45	7.5	7.5
13	3.2	1.4	.8	.6	.6	.8	550	76	1,930	40	7.5	6.8
14	3.4	1.3	.8	.6	.6	.7	*195	48	1,960	37	7.5	7.5
15	3.4	1.3	.8	.6	.6	.7	49	34	*1,740	33	7.5	6.8
16	3.4	1.3	.7	.6	.6	.7	18	37	1,510	31	7.5	7.5
17	3.2	1.3	.7	.6	.6	.7	*618	37	1,100	28	7.5	6.8
18	3.2	1.3	.7	.6	.6	.7	871	47	732	23	6.8	7.5
19	3.2	1.3	*.7	.6	.6	.7	722	311	1,040	22	6.8	7.5
20	3.2	1.3	.7	.6	.6	.7	*472	445	1,730	19	6.2	6.8
21	3.2	1.3	.7	.6	.6	.7	392	294	1,610	16	5.7	5.7
22	3.2	1.3	.7	*.6	.6	.7	344	180	1,420	20	5.3	5.7
23	3.2	1.2	.7	.6	.6	.8	259	133	1,410	19	5.3	8.8
24	2.4	1.0	.7	.6	.6	.8	221	128	1,040	15	5.3	6.8
25	1.2	1.0	.7	.6	.6	.8	162	96	706	12	*5.3	6.8
26	1.2	*.9	.7	.6	.6	.8	150	77	577	11	5.7	11
27	1.2	.9	.6	.6	*.6	.8	103	57	420	12	*5.7	4.9
28	1.2	.9	.6	.6	.6	.8	*60	47	275	*12	5.7	*4.3
29	1.3	.9	.6	.6	.6	.8	65	46	160	11	6.2	4.3
30	1.4	.9	.6	.6	----------	*.8	74	43	55	11	6.8	4.3
31	*1.3	----------	.6	.6	----------	1.5	----------	41	----------	11	6.2	----------
Total	80.4	36.2	23.1	18.6	17.4	23.7	5,890	3,682	22,288	1,247	219.7	201.6
Mean	2.59	1.21	0.75	0.60	0.60	0.76	196	119	743	40.2	7.09	6.72
Ac-ft	159	72	46	37	35	47	11,680	7,300	44,210	2,470	436	400

Calendar year 1963: Max 1,440 Min 0.6 Mean 31.3 Ac-ft 22,670
Water year 1963-64: Max 1,960 Min 0.6 Mean 92.2 Ac-ft 66,890

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 14 to Apr. 8, Apr. 11-14 (no gage-height record Dec. 20 to Jan. 21, Jan. 23 to Feb. 26, Mar. 16-29).

5-1025. Red River of the North at Emerson, Manitoba

(International gaging station)

Location.--Lat 49°00'30", long 97°13'00", in sec.2, T.1, R.2 E., on right bank 1,500 ft downstream from Canadian National Railway bridge in Emerson, three-quarters of a mile downstream from International Boundary, 3.6 miles downstream from Pembina River, and at mile 154.3.

Drainage area.--40,200 sq mi, approximately (includes 3,800 sq mi in closed basins).

Records available.--March to November 1902 (gage heights only), May 1912 to September 1929 (monthly discharge only, published in WSP 1308), October 1929 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 700.00 ft above mean sea level, datum of 1929, by Geodetic Survey of Canada. Prior to 1912, staff gage at different datum. May 3, 1912, to Apr. 10, 1953, chain gage and/or staff gage on Canadian National Railway bridge, 1,500 ft upstream. May 3, 1912, to September 30, 1923, at datum 2.55 ft lower than present datum; Oct. 1, 1923, to Sept. 30, 1925, at datum 1.14 ft lower than present datum; Oct. 1, 1925, to Sept. 30, 1947, at datum 0.57 ft higher than present datum; and Oct. 1, 1947, to Sept. 30, 1948, at datum 0.21 ft higher than present datum.

Average discharge.--52 years (1912-64), 2,759 cfs (1,997,000 acre-ft per year); median of yearly mean discharges, 2,350 cfs (1,700,000 acre-ft per year).

Extremes.--Maximum daily discharge during year, 17,500 cfs June 25 (gage height, 66.82 ft); maximum gage height, 67.64 ft Apr. 18 (backwater from ice); minimum daily discharge, 362 cfs Sept. 20 (gage height, 46.23 ft).
1912-64: Maximum discharge, 95,500 cfs May 13, 1950 (gage height, 90.89 ft); minimum observed, 0.9 cfs Feb. 6-8, 1937 (gage height, 44.00 ft).

Remarks.--Records fair except those for period of ice effect, which are poor.

Cooperation.--This station is one of the international gaging stations maintained by Canada under agreement with the United States.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,330	1,510	710	770	720	750	830	8,850	2,720	8,760	1,590	919
2	1,340	1,400	700	780	720	720	830	7,780	2,590	7,440	1,520	854
3	1,360	1,300	700	790	720	690	*830	7,080	2,490	6,460	1,470	755
4	1,370	1,200	690	800	720	650	850	6,540	2,380	5,800	1,430	699
5	1,340	1,060	680	810	730	*610	960	6,140	2,260	5,240	1,410	1,410
6	1,330	1,020	680	810	730	580	995	6,060	2,190	4,790	1,390	866
7	1,340	1,000	680	*820	730	595	1,010	6,610	2,060	4,490	2,090	949
8	1,320	980	680	810	730	585	1,040	*6,190	2,030	4,210	2,680	940
9	1,320	970	680	810	730	585	1,200	6,490	2,080	4,010	2,650	861
10	1,300	970	680	800	740	585	2,000	6,870	2,310	3,920	2,380	*759
11	1,290	960	680	800	740	620	2,940	7,120	*3,010	3,730	2,040	688
12	1,300	960	680	790	750	645	3,720	6,940	5,100	3,610	1,880	630
13	1,290	950	680	790	750	665	4,470	6,600	10,900	3,740	1,560	565
14	1,300	950	680	790	760	640	5,160	6,270	11,800	*4,130	1,370	555
15	1,320	950	680	790	760	625	8,490	5,940	*12,200	4,090	1,260	470
16	*1,340	940	680	780	770	605	13,100	5,550	*12,400	3,870	1,180	475
17	1,360	940	680	770	770	610	16,000	5,230	12,600	3,350	1,120	450
18	1,360	*940	680	760	*770	665	*16,200	5,110	12,600	2,980	1,040	450
19	1,380	930	690	760	770	*683	16,500	5,070	15,700	2,760	970	425
20	1,400	920	*690	750	780	710	16,800	4,830	16,800	2,530	896	362
21	1,440	910	690	750	780	730	17,000	4,400	15,200	3,040	849	439
22	1,450	890	690	740	780	735	*16,600	4,490	14,900	2,070	830	435
23	1,460	870	700	730	780	750	*15,800	4,410	15,500	2,170	805	420
24	1,490	850	700	730	780	750	14,700	4,330	16,900	2,120	805	467
25	1,510	820	710	730	780	750	14,300	4,100	*17,500	2,040	805	550
26	1,510	800	710	720	780	750	14,100	3,860	16,800	2,000	830	580
27	1,510	780	720	720	780	750	13,500	*3,650	15,600	1,920	830	667
28	1,520	760	730	*720	770	775	12,700	3,480	14,100	1,890	*805	742
29	1,570	740	740	720	760	800	11,500	3,220	*12,200	*1,820	805	790
30	1,550	720	750	720	----------	820	10,100	3,030	10,400	1,740	830	982
31	*1,550	----------	760	720	----------	830	----------	2,870	----------	1,640	830	----------
Total	43,250	28,990	21,600	23,780	21,880	21,258	254,225	169,110	285,320	112,360	40,950	20,154
Mean	1,400	966	697	767	754	686	8,470	5,460	9,510	3,620	1,320	672
Ac-ft	85,790	57,500	42,840	47,170	43,400	42,160	504,200	335,400	565,900	222,900	81,220	39,970

Calendar year 1963: Max 13,700 Min 680 Mean 2,620 Ac-ft 1,899,000
Water year 1963-64: Max 17,500 Min 580 Mean 2,850 Ac-ft 2,068,000

* Discharge measurement made on this day.
Note.--Computed from manually read gage (no gage-height record Nov. 1-17, Nov. 19 to Feb. 17, Feb. 19 to Mar. 4). Stage-discharge relation affected by ice Nov. 21 to Apr. 21.

5-1045. Roseau River below South Fork near Malung, Minn.

Location.--Lat 48°47'30", long 95°44'40", in SW¼ sec.6, T.161 N., R.39 W., on left bank a quarter of a mile downstream from South Fork and 1½ miles northwest of Malung.

Drainage area.--573 sq mi.

Records available.--October 1946 to September 1964.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,029.67 ft above mean sea level, adjustment of 1912.

Average discharge.--18 years, 129 cfs (93,390 acre-ft per year).

Extremes.--Maximum discharge during year, 1,890 cfs about June 14 (gage height, 13.96 ft, from floodmarks); minimum, 1.0 cfs Oct. 9 (gage height, 4.38 ft).
1946-64: Maximum discharge, 3,650 cfs Apr. 24, 1950 (gage height, 22.51 ft); no flow for part of Jan. 15, 1952 (caused by construction of concrete control) and July 23 to Sept. 8, 1961.

Remarks.--Records good except those for periods of ice effect or no gage height record, which are fair.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

4.4	1.1	5.2	20	7.0	453
4.5	1.9	5.5	42	8.0	700
4.6	3.1	5.7	69	10.0	1,100
4.7	4.7	6.0	124	14.0	1,900
4.9	9.0	6.5	263		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.1	9.6	4.0	3.0	4.3	2.5	4.2	399	80	274	14	48
2	1.9	8.5	4.0	3.2	4.3	2.5	4.2	407	69	250	25	53
3	1.6	7.8	3.5	3.5	4.3	2.5	4.4	395	61	220	133	76
4	1.5	7.1	3.5	3.5	4.3	2.5	4.5	395	*53	190	166	87
5	1.3	13	3.6	3.6	4.3	2.4	5.0	439	51	160	151	81
6	1.2	13	3.6	3.6	4.2	2.4	5.5	491	49	130	124	83
7	1.2	11	3.8	3.8	4.2	2.4	6.0	527	49	100	113	83
8	1.1	10	3.8	3.8	4.0	2.4	7.0	547	51	*72	94	78
9	1.1	8.8	3.6	3.8	3.8	2.4	*18	549	127	67	74	76
10	2.1	8.8	3.6	4.0	3.8	2.4	120	520	626	56	59	58
11	2.3	7.3	3.4	4.2	3.6	2.4	700	479	1,010	51	52	55
12	2.3	5.8	3.2	3.8	3.6	2.4	1,100	407	1,400	53	46	59
13	1.4	5.8	3.0	3.8	3.4	2.6	1,400	344	1,600	48	41	53
14	1.2	6.0	3.0	4.0	3.4	2.6	1,500	309	1,850	42	38	50
15	1.2	6.0	3.0	4.0	3.4	2.8	1,350	271	1,750	36	36	45
16	1.2	5.6	3.0	4.0	3.4	3.0	*1,230	245	*1,480	30	32	42
17	1.3	5.6	3.0	4.3	3.4	3.8	1,100	227	1,250	76	30	40
18	1.6	5.5	2.8	4.3	3.2	3.6	1,020	221	1,110	87	27	42
19	2.0	5.1	2.8	4.3	3.2	3.5	868	256	1,260	51	25	38
20	2.2	5.3	*2.7	4.3	3.2	3.6	732	320	1,290	50	22	37
21	2.3	4.9	2.6	4.5	3.2	3.6	616	320	1,330	36	20	36
22	3.1	5.3	2.5	*4.3	3.0	3.6	547	297	1,390	32	19	37
23	3.5	4.5	2.4	4.3	3.0	3.8	*552	259	1,370	49	19	39
24	6.8	4.3	2.4	4.3	2.8	3.8	522	224	1,270	45	20	49
25	13	4.0	2.6	4.3	2.8	4.5	491	201	1,110	32	20	120
26	22	*4.0	2.8	4.3	2.6	4.8	418	174	926	26	20	168
27	20	4.0	2.8	4.3	2.5	3.8	356	151	750	24	20	485
28	18	4.0	2.8	4.3	*2.5	3.8	324	131	600	20	*22	644
29	15	4.2	2.8	4.3	2.5	3.8	328	116	456	*18	37	708
30	14	4.2	2.8	4.3	----------	4.0	*380	101	332	16	45	*794
31	*12	----------	2.8	4.3	----------	*4.0	----------	90	----------	15	42	----------
Total	161.5	199.0	96.2	124.3	100.2	98.2	15,712.8	9,812	24,750	2,356	1,586	4,264
Mean	5.21	6.63	3.10	4.01	3.46	3.17	524	317	825	76.0	51.2	142
Ac-ft	320	395	191	247	199	195	31,170	19,460	49,090	4,670	3,150	8,460

Calendar year 1963: Max 1,450 Min 1.1 Mean 106 Ac-ft 76,520
Water year 1963-64: Max 1,850 Min 1.1 Mean 162 Ac-ft 117,500

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 28 to Jan. 10, Feb. 5 to Apr. 17 (no gage-height record Mar. 28-30, Apr. 11-15).

5-1060. Sprague Creek near Sprague, Manitoba

(International gaging station)

Location.--Lat 48°59'33", long 95°39'43", in NE¼ sec.34, T.164 N., R.39 W., on left bank half a mile south of international boundary, 3½ miles south of Sprague, Manitoba, 8 miles upstream from mouth, and 14 miles northeast of Roseau, Minn.

Drainage area.--169 sq mi. Prior to October 1958, 151 sq mi; change due to construction of drainage ditch within basin.

Records available.--September 1928 to September 1964 (winter records incomplete prior to 1941). Prior to September 1951, published as Mud Creek near Sprague.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,038.4 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Prior to Mar. 15, 1929, staff gage at same site and datum.

Average discharge.--25 years (1928-29, 1940-64), 56.3 cfs (40,760 acre-ft per year).

Extremes.--Maximum discharge during year, 465 cfs June 19 (gage height, 9.23 ft); minimum daily, 0.1 cfs Feb.25 to Mar. 6.

1928-64: Maximum discharge, 2,070 cfs Sept. 1, 1942 (gage height, 15.31 ft), from rating curve extended above 960 cfs; no flow at times in some years.

Remarks.--Records good except those for periods of ice effect, which are poor.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.1	.4	3.0	14
2.2	.6	3.2	25
2.3	1.0	3.5	48
2.4	1.5	4.0	84
2.5	2.4	5.0	143
2.6	3.6	7.0	255
2.7	5.2	9.0	435
2.8	7.4	9.3	474

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.0	1.1	1.2	0.4	0.3	0.1	1.5	161	28	60	22	42
2	.9	1.2	1.1	.5	.4	.1	2.0	152	26	49	22	57
3	.8	1.1	1.1	.5	.5	.1	2.5	143	*24	40	19	63
4	.8	1.2	1.1	.5	.6	.1	3.0	179	21	33	15	51
5	.9	1.3	1.0	.4	*.7	.1	4.0	189	24	27	12	39
6	.9	1.6	1.0	.4	.7	.1	5.0	190	19	27	9.1	31
7	1.1	1.4	1.0	.4	.6	.2	6.0	228	18	27	7.4	27
8	1.2	1.3	1.0	.4	.6	.2	7.0	231	20	34	6.1	22
9	1.1	1.3	.9	.4	.4	.2	*8.3	238	45	*43	5.0	19
10	1.8	1.4	.9	.4	.3	.2	10	235	54	68	5.0	17
11	1.2	1.4	.9	.3	.3	.2	20	216	53	68	4.2	14
12	1.6	1.5	.8	.3	.3	.2	60	196	194	47	4.0	13
13	4.0	1.4	.7	.2	.3	.2	120	176	248	33	4.0	14
14	.5	1.4	.7	.2	.3	.2	135	160	220	27	3.4	10
15	.4	1.5	.7	.2	.3	.2	150	141	*187	20	2.8	7.4
16	.7	1.5	.7	.2	.2	.3	*140	124	142	16	2.7	7.9
17	.9	1.5	.7	.2	.2	.4	120	109	115	70	2.4	8.8
18	1.0	1.7	.6	.2	.2	.6	90	130	155	112	2.9	10
19	1.0	1.5	.6	.2	.2	.6	80	159	380	72	2.4	7.7
20	1.0	1.5	*.6	.2	.2	.7	77	148	445	120	1.9	8.5
21	1.1	1.5	.6	.2	.2	.7	78	139	389	133	1.9	8.2
22	.9	1.4	.6	.2	.2	.7	76	115	351	140	2.2	8.2
23	1.2	1.3	.6	.2	.2	.8	*69	95	324	136	4.0	39
24	2.2	1.3	.6	*.2	.2	.9	66	81	294	96	5.8	90
25	1.6	1.3	.6	.2	.1	1.0	65	71	252	72	6.1	83
26	1.4	1.3	.5	.2	.1	1.1	61	61	215	55	*6.2	138
27	1.5	*1.3	.5	.2	*.1	1.2	59	52	178	44	6.6	323
28	1.1	1.3	.5	.2	.1	1.2	83	47	133	38	6.9	364
29	.8	1.3	.5	.2	.1	1.2	161	40	100	36	8.8	335
30	*1.1	1.3	.5	.2	----------	*1.2	*162	36	76	*30	17	*304
31	1.1	----------	.5	.3	----------	1.3	----------	32	----------	25	33	----------
Total	36.8	41.1	23.3	8.8	8.9	16.3	1,921.3	4,274	4,730	1,798	251.8	2,161.7
Mean	1.19	1.37	0.75	0.28	0.31	0.53	64.0	138	158	58.0	8.12	72.1
Ac-ft	73	82	46	17	18	32	3,810	8,480	9,380	3,570	499	4,290

Calendar year 1963: Max 690 Min 0.1 Mean 53.4 Ac-ft 38,680
Water year 1963-64: Max 445 Min 0.1 Mean 41.7 Ac-ft 30,300

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23, 24, Nov. 26 to Apr. 18.

5-1065. Roseau River at Roseau Lake, Minn.

Location.--Lat 48°54'22", long 95°49'55", in SW¼SW¼ sec.28, T.163 N., R.40 W., on upstream bridge piling on left bank at Roseau Lake, 3½ miles upstream from Pine Creek, 3¾ miles downstream from Sprague Creek, and 7 miles northwest of Roseau.

Records available.--November 1939 to September 1964 (incomplete).

Gage.--Staff gage read once daily. Datum of gage is 1,018.59 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,031.78 ft June 24, 25; minimum observed, 1,020.64 ft Oct. 1, 2.
1939-64: Maximum elevation observed, 1,036.86 ft May 13, 1950; minimum observed, 1,019.75 ft Aug. 16, 1941.

Elevation, in feet, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20.64							27.96	22.52	30.32	21.48	21.94
2	20.64							27.87	22.31	29.92	21.52	22.14
3	20.66							27.78	22.14	29.48	21.92	22.26
4	20.68							27.75	22.04	29.02	22.84	22.46
5	20.66						21.74	27.80	21.95	28.42	23.06	22.40
6	20.66						21.74	27.92	21.76	27.76	22.92	22.30
7	20.66						21.76	28.08	21.74	27.08	22.58	22.14
8	20.66						21.85	28.12	21.82	26.48	22.33	22.10
9	20.68						21.98	28.28	22.74	25.92	22.14	22.02
10	20.68						22.60	28.30	24.88	25.48	22.02	21.94
11	20.68						25.64	28.22	27.60	25.02	21.76	21.88
12	20.68						28.42	28.12	28.94	24.62	21.60	21.74
13	20.72						28.72	27.98	29.96	24.02	21.40	21.72
14	20.78						28.92	27.73	30.20	23.68	21.34	21.68
15	20.82						29.12	27.46	30.42	23.26	21.34	21.66
16	20.84						30.30	27.06	30.48	23.00	21.38	21.60
17	20.84						30.00	26.74	30.49	23.52	21.28	21.54
18	20.86						29.71	26.62	30.52	24.43	21.18	21.50
19	20.86						29.68	26.66	30.92	24.33	21.14	21.40
20	20.88						29.60	26.72	31.24	23.96	21.08	21.50
21	20.92						29.44	26.66	31.46	23.72	21.04	21.50
22	21.10						29.28	26.48	31.59	23.68	21.04	21.52
23	21.22						29.18	26.16	31.73	24.06	21.04	21.64
24	21.28						28.99	25.82	31.77	23.82	21.10	22.14
25	21.32						28.82	25.42	31.76	23.22	21.16	22.86
26	21.36						28.59	25.02	31.66	22.62	21.12	23.86
27	21.38						28.30	24.62	31.50	22.19	21.08	26.40
28	21.42						28.03	24.24	31.28	22.04	21.10	28.10
29	21.42						28.04	23.88	30.96	21.88	21.08	28.30
30	21.36				----------		28.02	23.44	30.66	21.74	21.54	28.29
31	21.28	----------			----------		----------	22.92	----------	21.58	21.74	----------

Note.--Add 1,000 ft to obtain elevation above mean sea level.

5-1075. Roseau River at Ross, Minn.

Location.--Lat 48°54'37", long 95°55'18", in SE¼ sec.27, T.163 N., R.41 W., on left bank 300 ft downstream from highway bridge, a quarter of a mile north of Ross, and 2.3 miles downstream from Pine Creek.

Drainage area.--1,220 sq mi, approximately.

Records available.--July 1928 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,018.44 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Prior to Mar. 13, 1929, staff gage at same site and datum.

Average discharge.--36 years, 230 cfs (166,500 acre-ft per year).

Extremes.--Maximum discharge during year, 1,770 cfs June 25 (gage height, 12.37 ft); minimum daily, 2.2 cfs Oct. 17, 18.
1928-64: Maximum discharge, 6,560 cfs May 12, 1950 (gage height, 18.25 ft); no flow Aug. 29, 30, 1961. Maximum stage known, about 19 ft in 1896. Other outstanding floods reached the following stages (from information by local residents); flood of July 1919, 17.5 ft; flood of 1927, about 16 ft.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are poor. High flow regulated by natural storage in Roseau Lake.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1, Oct. 30 to Nov. 21, July 5-13, July 24 to Aug. 18, Aug. 30 to Sept. 9)

0.2	1.4	3.0	111
0.4	4.2	4.0	195
0.7	9.5	6.0	438
1.0	17	9.0	963
1.5	32	13.0	1,930
2.0	53		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.8	17	7.8	5.6	6.4	4.4	5.4	883	*145	1,430	64	96
2	3.5	15	7.8	5.6	6.4	4.4	5.6	871	127	1,330	70	110
3	3.0	13	7.6	5.6	6.2	4.6	5.8	857	112	1,230	103	127
4	2.8	12	7.6	5.8	6.2	4.6	6.0	848	102	1,110	182	139
5	2.7	11	7.4	5.8	6.2	4.6	6.2	854	90	987	202	137
6	2.4	11	7.2	6.0	6.2	4.6	6.5	867	84	846	187	127
7	2.3	13	7.2	6.0	6.2	4.6	7.0	881	84	709	159	119
8	2.4	16	7.0	6.0	6.2	4.6	8.0	917	82	*600	141	110
9	2.4	17	7.0	6.0	6.0	4.6	15	927	141	520	121	104
10	2.6	16	6.8	6.2	6.0	4.6	30	935	390	461	99	96
11	3.2	14	6.6	6.2	5.8	4.8	200	929	776	404	86	90
12	3.5	13	6.4	6.4	5.8	4.8	450	917	1,020	345	78	86
13	4.0	11	6.2	6.4	5.8	4.8	500	883	1,150	290	70	86
14	5.0	10	6.0	6.4	5.6	5.0	510	836	1,190	249	63	86
15	6.0	9.5	6.0	6.4	5.4	5.0	*540	789	1,250	214	56	81
16	4.0	9.3	5.8	6.4	5.2	5.0	750	728	*1,320	182	54	75
17	2.2	9.3	5.8	6.4	5.0	5.0	850	669	1,380	235	49	72
18	2.2	8.9	5.6	6.4	5.0	5.0	900	630	1,440	345	44	69
19	2.4	8.6	*5.6	6.4	4.8	5.0	1,100	645	1,500	321	40	68
20	2.6	8.6	5.6	6.4	4.6	5.0	1,200	655	1,580	257	36	68
21	2.8	8.2	5.6	6.4	4.4	5.0	1,210	647	1,650	258	32	66
22	3.0	8.0	5.4	6.6	4.2	5.0	*1,170	621	1,700	258	31	64
23	3.5	8.0	5.4	6.6	4.2	5.0	1,140	578	1,730	299	32	72
24	4.0	8.0	5.4	*6.6	4.2	5.0	1,100	522	1,760	281	34	111
25	5.0	8.0	5.4	6.6	4.2	5.0	1,060	470	1,760	218	38	158
26	8.0	7.8	5.4	6.6	4.2	5.0	1,010	418	1,750	164	*40	230
27	20	*7.8	5.4	6.6	*4.2	5.0	965	368	1,720	125	39	579
28	26	7.8	5.4	6.6	4.2	5.0	*907	317	1,660	108	40	*861
29	25	7.8	5.4	6.6	4.2	5.1	901	278	1,590	*94	41	899
30	*22	7.8	5.4	6.4	----------	*5.1	897	230	1,520	85	64	913
31	19	----------	5.6	6.4	----------	5.2	----------	179	----------	73	87	----------
Total	201.3	322.4	192.8	194.4	153.0	150.4	17,455.5	21,149	30,803	14,028	2,382	5,899
Mean	6.49	10.7	6.22	6.27	5.28	4.85	582	682	1,027	453	76.8	197
Ac-ft	399	639	382	386	303	298	34,620	41,950	61,100	27,820	4,720	11,700

Calendar year 1963: Max 1,550 Min 2.2 Mean 216 Ac-ft 156,600
Water year 1963-64: Max 1,760 Min 2.2 Mean 254 Ac-ft 184,300

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 20. No gage-height record Oct. 2-29.

5-1080. Roseau River near Badger, Minn.

Location.--Lat 48°54'42", long 96°00'24", in SW¼ sec.30, T.163 N., R.41 W., on right bank 100 ft upstream from highway bridge and 9 miles north of Badger.

Records available.--August 1928 to September 1964 (incomplete).

Gage.--Water-stage recorder. Datum of gage is 1,016.90 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,028.52 ft June 25; minimum recorded, 1,017.57 ft Oct. 4.
1928-64: Maximum elevation, 1,032.65 ft May 13, 1950; minimum recorded, 1,017.42 ft Aug. 30, 1961.

Mean elevation, in feet, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	17.62							25.39		27.53	19.18	19.67
2	17.64							25.74	20.18	27.21	19.16	19.88
3	17.58							25.25	20.04	26.86	19.57	20.13
4	17.57							25.23	19.87	26.50	20.57	20.34
5	17.58							25.22	19.68	26.06	21.00	20.33
6	17.58							25.28	19.53	25.56	20.90	20.22
7	17.59							25.35	19.52	25.06	20.63	20.08
8	17.60							25.50	19.49	24.60	20.37	19.98
9	17.62							25.54	20.22	24.15	20.12	19.88
10	17.62						20.04	25.58	22.35	23.79	19.84	19.78
11	17.61						22.86	25.59	24.62	23.38	19.64	19.68
12	17.59						25.66	25.53	25.88	22.91	19.48	19.56
13	17.58						26.07	25.40	26.42	22.36	19.35	19.54
14	17.61						26.11	25.22	26.56	21.89	19.22	19.50
15	17.68						26.17	25.01	26.74	21.56	19.12	19.45
16	17.69						26.82		26.99	21.07	19.09	19.35
17	17.65						26.64		27.21	21.55	18.98	19.23
18	17.61						26.57		27.42	22.25	18.87	19.18
19	17.61						26.65		27.73	22.25	18.77	19.13
20	17.59						26.69		27.94	21.79	18.66	19.09
21	17.59						26.65		28.13	21.72	18.56	19.08
22	17.62						26.52		28.27	21.69	18.52	19.03
23	17.76						26.39		28.38	21.94	18.53	19.15
24	17.91						26.24		28.46	21.81	18.57	19.66
25	17.86						26.09		28.48	21.37	18.64	20.51
26	17.89						25.92		28.48	20.77	18.69	21.36
27	18.26						25.70		28.43	20.23	18.68	23.51
28	18.44						25.50		28.24	19.91	18.68	25.14
29	18.39						25.44		28.04	19.69	18.68	25.44
30	18.35				----------		25.41		27.80	19.52	18.98	25.52
31		----------			----------		----------		----------	19.33	19.43	----------

Note.--Add 1,000 ft to obtain elevation above mean sea level.

5-1095. Roseau River near Haug, Minn.

Location.--Lat 48°55'28", long 96°12'26", in SE¼ sec.21, T.163 N., R.43 W., on left bank 250 ft downstream from abandoned highway bridge, 5 miles south of international boundary, and 8¼ miles northwest of Haug.

Records available.--April 1932 to September 1964 (incomplete).

Gage.--Water-stage recorder. Datum of gage is 1,014.02 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,023.00 ft June 29; minimum recorded, 1,014.85 ft Oct. 8, 13, 22. 1932-64: Maximum elevation, 1,024.64 ft May 15, 1950; minimum recorded, 1,014.74 ft Aug. 8, 1933.

Mean elevation, in feet water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14.93							21.72	17.39	22.97	16.27	16.50
2	14.95							21.71	17.08	22.92	16.16	16.61
3	14.97							21.66	16.88	22.87	16.35	16.78
4	14.92							21.64	16.74	22.79	16.75	16.95
5	14.90							21.60	16.58	22.71	17.35	16.99
6	14.90							21.61	16.49	22.58	17.46	16.94
7	14.89							21.61	16.40	22.42	17.32	16.84
8	14.89							21.66	16.39	22.24	17.08	16.74
9	14.89							21.70	16.87	22.11	16.88	16.67
10	14.91						16.94	21.73	18.19	21.92	16.70	16.60
11	14.90						17.25	21.75	19.53	21.56	16.55	16.54
12	14.88							21.76	20.83	21.03	16.41	16.44
13	14.87							21.73	21.49	20.32	16.30	16.40
14	14.88							21.66	21.74	19.58	16.21	16.39
15	14.88						21.67	21.55	21.88	18.92	16.14	16.35
16	14.91						21.81	21.35	21.99	18.39	16.08	16.21
17	14.92						21.93	21.10	22.12	18.78	16.04	16.05
18	14.92						22.02	20.83	22.24	19.03	16.00	15.97
19	14.91						22.06	20.63	22.35	19.17	15.94	15.93
20	14.91						22.10	20.54	22.47	18.90	15.86	15.91
21	14.88						22.14	20.47	22.57	18.57	15.83	15.90
22	14.88						22.15	20.42	22.66	18.50	15.79	15.90
23	14.89						22.14	20.26	22.74	18.56	15.79	15.99
24	14.99						22.11	20.05	22.82	18.59	15.80	16.13
25	15.10						22.10	19.76	22.89	18.32	15.84	16.74
26	15.08						22.07	19.47	22.93	17.86	15.88	17.47
27	15.13						22.01	19.18	22.98	17.34	15.90	18.41
28	15.41						21.88	18.85	22.99	16.96	15.89	20.23
29	15.47						21.81	18.52	22.99	16.72	15.90	20.86
30							21.75	18.19	22.99	16.53	16.00	21.04
31								17.79		16.39	16.26	

Note.--Add 1,000 ft to obtain elevation above mean sea level.

5-1120. Roseau River below State ditch 51, near Caribou, Minn.

(International gaging station)

Location.--Lat 48°58'54", long 96°27'46", in SE¼SW¼ sec.34, T.164 N., R.45 W., on left bank 400 ft downstream from State ditch 51 (known locally as Caribou cutoff ditch) and 0.6 mile west of Caribou.

Drainage area.--1,570 sq mi, approximately.

Records available.--April to October 1917, April 1920 to September 1964 (some winter records incomplete). Published as "at Caribou", prior to April 1929; as "below Cutoff ditch, near Caribou" April 1929 to September 1936. Records published for both sites April 1929 to September 1930. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,002.14 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Prior to Apr. 1, 1929, chain gage at site at Caribou 0.6 mile upstream at datum 0.95 ft lower.

Average discharge.--15 years (1920-30, 1932-33, 1936-37, 1940-43), 298 cfs (215,700 acre-ft per year).

Extremes.--Maximum discharge during year, 1,430 cfs July 2 (gage height, 7.21 ft); maximum gage height, 7.61 ft Apr. 17 (backwater from ice); minimum daily discharge recorded, 10 cfs Apr. 1.
1917, 1920-64: Maximum discharge, 4,080 cfs May 19, 1950 (gage height, 11.81 ft); no flow Aug. 13, 1936. Flood of 1916 is reported to have reached a stage of about 15.5 ft at former site.

Remarks.--Records good except those below 20 cfs, which are fair, and those for periods of ice effect or no gage-height record, which are poor. Occasionally, at high stages, there is some natural diversion of flow above station to headwaters of Two Rivers.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1963-64, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-29, Sept. 27-30)

1.6	9.2	3.0	192
1.8	19	4.0	413
2.0	36	6.0	980
2.5	102	7.2	1,430

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	12						10	1,050	*214	1,430	118	89
2	13						12	1,040	177	1,430	105	108
3	13						14	1,040	149	1,430	99	123
4	15						16	1,050	131	1,430	99	129
5	18						18	1,020	116	1,420	140	145
6	16						20	1,060	108	1,410	196	152
7	17						25	1,020	102	*1,390	210	150
8	18						30	1,010	96	1,370	196	141
9	18						35	1,000	104	1,340	173	131
10	18						*45	997	206	1,310	154	122
11	19						80	997	387	1,240	138	113
12	20						120	990	754	1,120	120	108
13	20						320	987	925	941	108	99
14	19						*380	983	990	739	100	94
15	22						550	973	1,000	580	88	92
16	25						860	947	1,050	480	82	91
17	30						1,050	883	1,070	533	78	82
18	32						1,080	827	*1,110	554	72	68
19	32						1,080	760	1,190	567	71	63
20	32						1,090	730	1,200	544	66	62
21	33						1,090	708	1,210	473	62	57
22	32						*1,100	699	1,240	433	61	56
23	29						1,110	672	1,290	436	59	59
24	29						1,110	626	1,310	433	58	64
25	29						1,110	575	1,320	406	*57	76
26	34						1,110	515	1,340	337	57	127
27	34						1,100	484	1,350	264	57	239
28	36						1,100	433	1,380	*208	57	497
29	*45						*1,080	375	1,400	173	58	*705
30	55				----------		1,060	315	1,410	145	62	790
31	70	----------			----------		----------	267	----------	127	68	----------
Total	835						17,805	25,033	24,329	24,693	3,069	4,832
Mean	26.9						594	808	811	797	99.0	161
Ac-ft	1,660						35,320	49,650	48,260	48,980	6,090	9,580

Calendar year 1963: Max Min Mean Ac-ft
Water year 1963-64: Max Min Mean Ac-ft

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Apr. 10-17. No gage-height record Oct. 30, 31, Apr. 1-9.

5-1125. Roseau River at international boundary, near Caribou, Minn.

Location.--Lat 48°59'57", long 96°30'20", near center of sec.29, T.164 N., R.45 W., on left bank 400 ft upstream from international boundary crossing and 3 miles northwest of Caribou.

Drainage area.--1,590 sq mi, approximately.

Records available.--May 1933 to September 1964 (incomplete).

Gage.--Water-stage recorder. Datum of gage is 1,002.59 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,007.22 ft Apr. 17; minimum recorded, 1,002.83 ft Oct. 17.
1933-64: Maximum elevation recorded, 1,007.43 ft Apr. 14, 1960; minimum recorded, 1,001.97 ft Aug. 14, 1933.

Mean elevation, in feet, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.92							5.72	3.80	6.41	3.59	3.59
2	2.90							5.70	3.70	6.44	3.51	3.63
3	2.90							5.72	3.65	6.44	3.49	3.65
4	2.94							5.74	3.64	6.44	3.55	3.70
5	2.95							5.70	3.64	6.42	3.79	3.74
6	2.91							5.78	3.64	6.41	3.89	3.73
7	2.89							5.71	3.64	6.37	3.87	3.71
8	2.89							5.65	3.64	6.35	3.80	3.65
9	2.87							5.64	3.65	6.32	3.72	3.64
10	2.87						3.02	5.62	3.95	6.28	3.68	3.61
11	2.88						3.05	5.62	4.37	6.16	3.63	3.60
12	2.88						3.10	5.62	5.12	5.95	3.54	3.55
13	2.87						3.18	5.61	5.51	5.60	3.53	3.53
14	2.86						3.22	5.60	5.64	5.11	3.49	3.53
15	2.85						3.26	5.58	5.69	4.70	3.46	3.53
16	2.85						4.76	5.51	5.76	4.42	3.44	3.51
17	2.85						6.56	5.37	5.82	4.53	3.43	3.42
18	2.86						5.80	5.23		4.63	3.39	3.40
19	2.86						5.78	5.07	6.08	4.67	3.36	3.38
20	2.85						5.79	5.00		4.62	3.36	3.36
21	2.86						5.81	4.94	6.14	4.41	3.34	3.34
22	2.87						5.83	4.91		4.36	3.35	3.34
23	2.87						5.83	4.85	6.24	4.35	3.32	3.38
24	2.86						5.83	4.74	6.26	4.34	3.32	3.42
25	2.87						5.83	4.63	6.27	4.27	3.32	3.53
26	2.92						5.82	4.47	6.30	4.14	3.34	3.83
27	2.91						5.80	4.39	6.33	4.02	3.37	3.14
28	2.98						5.78	4.26	6.35	3.80	3.35	4.59
29	3.10						5.75	4.14	6.38	3.72	3.36	5.05
30							5.73	4.03	6.40	3.65	3.42	5.29
31								3.92		3.60	3.48	

Note.--Add 1,000 ft to obtain elevation above mean sea level.

5-1255. Stony River near Isabella, Minn.

Location.--Lat 47°41'10", long 91°38'20", in NW¼NW¼ sec.17, T.60 N., R.10 W., on left bank 275 ft downstream from Slate Lake and bridge on State Highway 1, 11 miles upstream from Birch Lake, and 12¾ miles northwest of Isabella.

Drainage area.--180 sq mi.

Records available.--October 1952 to September 1964. Prior to October 1958, published as Stoney River near Isabella.

Gage.--Water-stage recorder. Datum of gage is 1,632.45 ft above mean sea level, datum of 1929.

Average discharge.--12 years, 127 cfs.

Extremes.--Maximum discharge during year, 1,150 cfs June 28 (gage height, 9.61 ft); minimum, 12 cfs Apr. 1,2,3 (gage height, 7.43 ft).
1952-64: Maximum discharge, 2,040 cfs Apr. 27, 1957 (gage height, 10.60 ft); minimum, 5.6 cfs Aug. 22, 1961 (gage height, 7.32 ft).

Remarks.--Records good.

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

7.4	6	8.1	171
7.5	14	8.5	377
7.6	28	9.0	710
7.7	47	10.0	1,490
7.9	97		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	28	20	75	30	20	18	*13	*605	286	885	39	49
2	28	20	75	28	20	18	12	661	250	787	39	60
3	*28	20	75	28	20	18	13	703	226	682	35	75
4	27	20	*72	28	19	18	13	703	198	577	34	94
5	25	19	72	28	19	18	14	703	176	486	30	114
6	27	20	70	28	19	18	17	724	167	402	27	155
7	25	20	67	27	19	18	18	794	159	342	25	176
8	24	20	67	27	19	18	18	843	159	318	24	194
9	22	20	65	27	19	18	18	878	167	281	22	216
10	24	22	60	27	19	17	18	871	163	245	24	245
11	22	22	58	27	18	17	24	850	163	216	24	260
12	20	24	56	25	18	17	37	801	159	*194	24	250
13	19	24	54	24	18	17	54	738	155	171	22	240
14	18	24	54	22	18	17	70	675	143	151	22	221
15	18	20	51	22	17	15	89	612	135	135	20	198
16	18	24	49	20	17	15	124	538	131	124	20	184
17	17	25	47	22	17	15	167	466	131	114	19	171
18	17	22	45	22	17	14	202	415	143	104	18	155
19	17	22	43	22	17	14	226	365	171	94	17	143
20	15	22	43	22	17	17	255	324	212	86	17	135
21	17	24	41	22	17	15	292	302	245	80	17	124
22	20	30	37	22	17	15	318	276	276	72	15	117
23	22	35	35	22	17	14	*348	276	408	65	15	128
24	22	39	34	24	17	14	377	270	584	60	15	131
25	24	45	32	25	17	14	396	286	822	58	17	135
26	22	56	32	24	*17	14	408	330	1,020	54	17	151
27	22	63	32	24	17	14	415	365	1,120	51	*15	171
28	22	70	32	24	17	14	427	*383	1,120	49	25	180
29	24	75	32	24	17	13	460	396	1,060	*47	32	194
30	22	75	30	20	---	13	524	365	980	43	35	202
31	*22	---	30	20	---	13	---	324	---	41	41	---
Total	678	942	1,565	757	520	490	5,367	16,842	11,129	7,014	746	4,868
Mean	21.9	31.4	50.5	24.4	17.9	15.8	179	543	371	226	24.1	162
Cfsm	0.122	0.174	0.281	0.136	0.099	0.088	0.994	3.02	2.06	1.26	0.134	0.900
In.	0.14	0.19	0.32	0.16	0.11	0.10	1.11	3.48	2.30	1.45	0.15	1.01

Calendar year 1963: Max 324 Min 9.1 Mean 77.6 Cfsm 0.431 In. 5.85
Water year 1963-64: Max 1,120 Min 12 Mean 139 Cfsm 0.772 In. 10.52

* Discharge measurement made on this day.

GPO 810-718-5

5-1270. Kawishiwi River near Winton, Minn.

Location.--Lat 47°56'05", long 91°45'50", in NE¼NW¼ sec.20, T.63 N., R.11 W., at powerplant of Minnesota Power & Light Co., just upstream from Fall Lake, and 1.8 miles east of Winton.

Drainage area.--1,200 sq mi, approximately.

Records available.--June 1905 to June 1907, October 1912 to September 1919 (fragmentary), September 1923 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Average discharge.--45 years (1905-6, 1915-17, 1918-19, 1923-64), 954 cfs (unadjusted).

Extremes.--Maximum daily discharge during year, 5,330 cfs June 20; minimum daily, 46 cfs Dec. 25.
1905-07, 1912-19, 1923-64: Maximum daily discharge, 16,000 cfs May 18, 1950; no flow at times.

Remarks.--Records good. Daily discharge computed from powerplant records. Flow regulated by powerplant and by Camp Six, Bald Eagle, Gabbro, Little Gabbro, Birch, White Iron, South Farm, Farm, and Garden Lakes.

Cooperation.--Records collected by Minnesota Power & Light Co., under general supervision of Geological Survey, in connection with a Federal Power Commission project.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	374	342	315	250	125	339	292	1,660	3,340	5,150	531	591
2	285	374	438	218	157	370	210	*1,920	3,120	4,690	564	363
3	406	392	372	218	125	495	274	2,190	2,880	4,410	499	747
4	341	277	282	282	157	527	242	2,170	2,390	4,450	467	354
5	373	362	315	218	125	494	274	2,800	2,140	3,620	467	341
6	304	342	404	250	125	462	274	2,960	2,140	3,490	402	439
7	370	374	340	250	156	462	306	3,070	2,120	2,910	370	439
8	499	342	391	218	188	526	278	4,280	2,210	2,320	434	535
9	465	374	282	218	157	430	246	4,580	2,310	1,700	434	358
10	497	251	218	218	125	526	246	4,680	2,380	1,770	309	406
11	465	342	250	218	123	462	273	4,660	2,250	1,790	443	374
12	497	406	250	175	190	460	283	4,730	2,040	1,780	281	439
13	465	342	250	185	125	460	370	4,640	2,080	1,410	314	503
14	465	374	282	124	158	460	338	4,580	1,980	1,150	314	471
15	497	342	250	157	156	492	408	4,450	1,720	922	314	717
16	341	348	250	160	157	395	370	4,420	1,580	1,020	281	688
17	405	252	218	125	125	426	496	4,000	1,710	1,080	323	871
18	405	213	282	130	125	426	396	3,850	1,690	1,080	314	804
19	438	342	437	65	157	458	477	3,980	1,620	1,020	414	804
20	194	314	345	157	125	458	370	3,500	1,810	1,100	249	868
21	374	218	313	157	157	520	686	2,790	1,620	957	377	804
22	535	286	218	125	125	359	576	2,660	1,430	924	455	804
23	325	286	185	125	157	424	797	2,960	2,220	795	291	1,170
24	422	254	250	125	188	391	750	2,900	2,480	666	346	1,190
25	406	222	46	190	188	497	875	3,720	3,210	649	378	1,170
26	374	284	347	190	188	113	972	3,590	3,130	486	281	1,270
27	314	347	250	125	281	376	1,100	3,820	4,140	591	281	1,050
28	342	315	282	125	243	226	1,190	3,740	4,770	576	627	1,020
29	374	360	250	125	403	161	1,270	3,680	4,510	467	619	954
30	374	298	185	157	----------	263	1,620	3,740	5,330	499	587	1,020
31	309	----------	250	157	----------	274	----------	3,550	----------	467	580	----------
Total	12,235	9,575	8,747	5,437	4,811	12,732	16,259	110,270	76,350	53,939	12,546	21,564
Mean	395	319	282	175	166	411	542	3,557	2,545	1,740	405	719
(≠)	-168	-97	-7	+10	-11	-281	+304	+250	+48	+1	-103	+115
Mean≠	227	222	275	185	155	130	846	3,807	2,593	1,741	302	834
Cfsm≠	0.189	0.185	0.229	0.154	0.129	0.108	0.705	3.17	2.16	1.45	0.252	0.695
In.≠	0.22	0.21	0.26	0.18	0.14	0.12	0.79	3.66	2.41	1.67	0.29	0.78

Calendar year 1963: Max 1,950 Min 0 Mean 575 Mean≠ 555 Cfsm≠ 0.462 In.≠ 6.27
Water year 1963-64: Max 5,330 Min 46 Mean 941 Mean≠ 946 Cfsm≠ 0.788 In.≠ 10.73

* Discharge measurement made on this day.
≠ Change in contents, equivalent in cubic feet per second, in Camp Six, Bald Eagle, Gabbro, Little Gabbro, Birch, White Iron, South Farm, Farm, and Garden Lakes.
≠ Adjusted for change in reservoir contents.

5-1275. Basswood River near Winton, Minn.

(International gaging station)

Location.--Lat 48°04'55", long 91°39'10", in sec.30, T.65 N., R.10 W., on Jackfish Bay of Basswood Lake, used to determine discharge at outlet (lat 48°06', long 91°39', in sec.19, T.65 N., R.10 W., on international boundary 14 miles northeast of Winton).

Drainage area.--1,740 sq mi, approximately (above outlet of Basswood Lake).

Records available.--March to June 1924, September 1925 to March 1928, January 1930 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,299.80 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Prior to June 2, 1938, staff gages at several sites on Jackfish Bay, at same datum. June 2 to Oct. 27, 1938, staff gage at Williams Island half a mile northeast of present gage at same datum.

Average discharge.--36 years (1925-27, 1930-64), 1,296 cfs.

Extremes.--Maximum discharge during year, 4,640 cfs July 5 (gage height, 2.80 ft); minimum, 261 cfs Feb. 20-22 (gage height, -0.58 ft).
1924, 1925-27, 1930-64: Maximum discharge, 15,600 cfs May 24, 1950 (gage height, 6.94 ft); minimum, 73 cfs Dec. 5, 1948.

Remarks.--Records excellent. Flow affected by storage on Kawishiwi River.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

-0.60	254	-0.20	442	0.5	1,060
-0.50	287	-0.10	507	1.0	1,640
-0.40	328	0	580	2.0	3,160
-0.30	380	.2	760	3.0	5,040

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	494	386	338	344	295	267	448	1,020	*3,700	4,240	1,350	840
2	*481	380	344	344	291	270	436	1,120	3,680	4,370	1,340	850
3	474	375	344	338	291	274	430	1,190	3,650	4,510	1,290	840
4	474	375	344	338	287	287	423	1,270	3,560	4,580	1,240	810
5	468	370	344	338	284	295	417	1,400	3,410	4,600	1,210	820
6	455	370	344	338	280	308	430	1,600	3,360	4,530	1,130	820
7	442	370	354	*338	280	320	436	1,840	3,320	4,490	1,050	840
8	442	370	370	338	277	328	436	2,030	3,270	4,390	1,010	830
9	442	375	375	338	277	338	436	2,220	3,380	4,130	990	820
10	442	370	375	338	274	349	430	2,460	3,360	3,860	960	780
11	442	364	375	333	274	354	430	2,650	3,320	3,680	950	760
12	442	364	375	333	270	364	436	2,850	3,210	3,500	910	732
13	442	370	380	333	270	375	455	3,040	3,160	3,360	870	712
14	448	370	380	333	267	380	474	3,210	3,090	3,180	850	675
15	448	370	380	333	267	386	481	3,340	2,990	2,990	820	665
16	448	364	375	328	267	392	494	3,470	2,900	2,800	820	648
17	455	364	370	333	264	399	500	3,560	2,820	2,650	810	648
18	455	364	370	333	264	417	507	3,700	2,740	2,520	790	656
19	455	359	364	333	264	430	507	3,740	2,650	2,410	760	675
20	448	359	364	328	261	448	522	3,740	2,650	2,270	732	703
21	455	364	364	324	261	462	551	3,680	2,590	2,180	722	712
22	468	380	364	320	261	474	606	3,610	2,550	2,120	703	741
23	462	380	364	312	264	481	631	3,630	2,770	2,030	675	860
24	455	375	359	312	264	488	665	3,630	2,960	1,920	665	900
25	442	375	359	320	264	500	703	3,700	3,090	1,840	648	950
26	430	370	359	320	264	500	732	3,660	3,250	1,770	640	990
27	423	364	359	316	264	500	780	3,680	3,390	1,710	622	1,020
28	417	359	359	312	264	488	840	3,700	3,560	1,630	703	1,050
29	417	354	354	308	264	481	900	3,720	3,740	1,560	750	1,060
30	405	344	349	308	---	468	970	3,740	4,070	*1,500	790	1,070
31	399	---	349	303	---	*455	---	3,720	---	1,420	820	---
Total	13,870	11,054	11,204	10,167	7,874	12,278	16,506	89,920	96,190	92,740	27,620	24,477
Mean	447	368	361	328	272	396	550	2,901	3,206	2,992	891	816
Cfsm	0.257	0.211	0.207	0.189	0.156	0.228	0.316	1.67	1.84	1.72	0.512	0.469
In.	0.30	0.24	0.24	0.22	0.17	0.26	0.35	1.92	2.06	1.98	0.59	0.52

Calendar year 1963: Max 1,820 Min 295 Mean 712 Cfsm 0.409 In. 0.56
Water year 1963-64: Max 4,600 Min 261 Mean 1,131 Cfsm 0.650 In. 0.88

* Discharge measurement made on this day.

5-1280. Namakan River at outlet of Lac la Croix, Ontario

(International gaging station)

Location.--Lat 48°21'20", long 92°12'50", at Campbell's Camp, 2½ miles west of outlet of Lac la Croix.

Drainage area.--5,165 sq mi.

Records available.--September 1921 to January 1922, April 1922 to September 1964, in reports of Geological Survey. Monthly discharge only for some periods, published in WSP 1308. August 1921 to September 1964 in reports of Water Resources Branch, Department of Northern Affairs and National Resources, Canada.

Gage.--Water-stage recorder. Gage readings have been reduced to elevations above mean sea level, United States and Canada Boundary Survey datum. Prior to October 1933, staff gages at various sites on Lac la Croix. October 1933 to March 13, 1963, staff gage at present site and datum.

Average discharge.--42 years (1922-64), 3,538 cfs.

Extremes.--Maximum discharge during year, 12,200 cfs July 9 (elevation, 1,188.10 ft); minimum, 910 cfs Mar. 17 (elevation, 1,182.10 ft).
1921-64: Maximum discharge, 28,200 cfs May 31 to June 2, 1950 (elevation, 1,193.30 ft); minimum, 535 cfs at times in February, March and April 1924 (elevation, 1,181.50 ft).

Remarks.--Records good.

Cooperation.--This station is maintained by Canada under agreement with the United States.

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

1,182.1	910	1,186.0	6,980
1,183.0	1,820	1,189.0	14,600
1,184.0	3,130		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,960	1,290	1,140	1,140	1,110	982	950	2,790	8,290	11,200	7,070	3,650
2	1,900	1,290	1,140	1,140	1,100	974	950	2,930	8,110	11,300	6,960	3,650
3	1,900	1,260	1,140	1,140	1,100	966	950	3,090	8,020	11,400	6,730	3,630
4	1,870	1,250	1,140	1,140	1,090	966	958	3,220	8,040	11,500	6,540	3,520
5	1,860	1,240	1,130	1,130	1,090	958	958	3,470	7,920	11,700	6,390	3,550
6	1,810	1,240	1,130	1,130	1,080	958	1,010	3,860	7,970	11,700	6,060	3,550
7	1,760	1,250	1,120	1,130	1,070	950	1,030	4,230	7,990	11,900	5,760	3,550
8	1,740	1,250	1,160	1,140	1,060	942	1,040	4,590	8,130	12,000	5,610	3,550
9	1,730	1,240	1,170	1,140	1,060	942	1,040	4,890	8,950	12,100	5,420	3,570
10	1,710	1,200	1,170	1,130	1,050	942	1,040	5,290	9,360	12,100	5,250	3,540
11	1,700	1,200	1,170	1,120	1,050	926	1,050	5,630	9,580	12,100	5,170	3,570
12	1,690	1,200	1,170	1,120	1,050	926	1,080	5,990	9,640	11,900	4,910	3,550
13	1,660	1,200	1,190	1,120	1,040	926	1,090	6,320	9,740	11,800	4,750	3,540
14	1,630	1,180	1,190	1,110	1,040	926	1,130	6,570	9,860	11,600	4,660	3,520
15	1,620	1,180	1,190	1,110	1,040	918	1,180	6,820	9,880	11,400	4,530	3,500
16	1,610	1,160	1,180	1,100	1,030	918	1,230	7,100	9,940	11,200	4,460	3,490
17	1,590	1,150	1,180	1,110	1,010	918	1,250	7,370	10,000	10,900	4,390	3,490
18	1,570	1,150	1,170	1,120	999	918	1,310	7,620	10,100	10,700	4,300	3,490
19	1,540	1,140	1,170	1,110	999	918	1,370	7,830	10,100	10,500	4,210	3,470
20	1,540	1,120	1,160	1,110	990	926	1,420	8,080	10,100	10,100	4,140	3,440
21	1,530	1,130	1,160	1,110	982	934	1,530	8,220	10,100	9,940	4,050	3,410
22	1,510	1,140	1,160	1,100	990	934	1,680	8,380	10,100	9,710	3,910	3,410
23	1,500	1,150	1,160	1,100	999	934	1,790	8,590	10,300	*9,460	3,810	3,540
24	1,480	1,170	1,160	1,110	999	942	1,900	8,610	10,600	9,120	3,740	*3,540
25	1,460	1,170	1,150	1,130	999	950	2,000	8,730	10,700	8,850	3,660	3,570
26	1,400	1,150	1,160	1,130	999	950	2,120	8,570	10,800	8,590	3,630	3,600
27	1,390	1,170	1,160	1,130	990	950	2,220	8,610	10,800	8,340	3,570	3,550
28	1,380	1,150	1,150	1,130	982	950	2,380	8,590	10,900	8,080	3,580	3,630
29	1,370	1,150	1,150	1,130	982	950	2,500	8,540	10,900	7,850	3,650	3,630
30	1,350	1,140	1,150	1,120	---	950	2,640	8,480	11,100	7,620	3,660	3,710
31	1,310	---	1,150	1,110	---	950	---	8,380	---	7,350	3,650	---
Total	50,070	35,710	35,920	34,790	29,980	29,194	42,796	201,390	288,020	324,010	148,220	106,410
Mean	1,615	1,190	1,159	1,122	1,034	942	1,427	6,496	9,601	10,450	4,781	3,547
Cfsm	0.313	0.230	0.224	0.217	0.200	0.182	0.276	1.26	1.86	2.02	0.926	0.687
In.	0.36	0.26	0.26	0.25	0.22	0.21	0.31	1.45	2.07	2.33	1.07	0.77

Calendar year 1963: Max 6,570 Min 950 Mean 2,487 Cfsm 0.482 In. 6.54
Water year 1963-64: Max 12,100 Min 918 Mean 3,624 Cfsm 0.702 In. 9.56

* Discharge measurement made on this day.

5-1282. Vermilion Lake near Soudan, Minn.

Location.--Lat 47°49'52", long 92°16'20", in SW¼SE¼ sec.20, T.62 N., R.15 W., on south shore of Vermilion Lake, at McKinley Park, 2 miles northwest of Soudan.

Records available.--October 1913 to July 1915, July 1941 to November 1942, June 1946 to September 1964 (fragmentary during 1947).

Gage.--Water-stage recorder. Datum of gage is 1,355.10 ft above mean sea level, datum of 1929. October 1913 to July 1915, staff gage 2 miles southwest of present gage at Tower, at datum about 0.5 ft lower. July 1941 to November 1942 and June 1946 to June 1951, staff gage approximately 13 miles northwest at Vermilion Dam near Tower, at same datum. All gage readings have been reduced to elevations above mean sea level, datum of 1929.

Extremes.--Maximum elevation during year, 1,358.55 ft May 19: minimum, 1,356.69 ft Nov. 8.
1913-15, 1941-42, 1946-64: Maximum elevation observed, 1,359.52 ft May 16, 1950; minimum observed, 1,356.02 ft Jan. 29, 1942.
Elevation on June 6, 1913, was 1,359.94 ft (determined from reference point set by local observers).

Mean daily elevation, in feet, October 1963 to September 1964

Oct. 31.....1,356.86	Feb. 29.....1,356.92	June 30.....1,358.34
Nov. 30.....1,356.90	Mar. 31.....1,356.91	July 31.....1,357.48
Dec. 31.....1,356.92	Apr. 30.....1,357.70	Aug. 31.....1,357.22
Jan. 31.....1,356.96	May 31.....1,358.15	Sept.30.....1,357.19

Note.--Elevations other than those shown above are available.

5-1285. Pike River near Embarrass, Minn.

Location.--Lat 47°39'36", long 92°18'54", in NE¼NW¼ sec.25, T.60 N., R.16 W., on left bank 75 ft below bridge on County Road 373, 5.4 miles west of Embarrass, and 8.5 miles downstream from Sandy River.

Drainage area.--115 sq mi.

Records available.--October 1953 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,410.27 ft above mean sea level, datum of 1929.

Average discharge.--11 years, 74.8 cfs.

Extremes.--Maximum discharge during year, 716 cfs May 9 (gage height, 8.34 ft); minimum daily, 3.4 cfs Mar. 29-31; minimum gage height, 3.18 ft Aug. 9.
1953-64: Maximum discharge, 1,750 cfs Apr. 17, 1954 (gage height, 10.28 ft); minimum daily, 0.4 cfs Jan. 29 to Feb. 3, 1963; minimum gage height, 3.08 ft Aug. 25-28, 1961.
Flood in May 1950 reached a stage of approximately 11.3 ft, from information by local residents (discharge, 2,400 cfs).

Remarks.--Records good except those for period of ice effect, which are fair.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-5)

3.2	5.2	5.0	119
3.3	7.6	6.0	221
3.4	10	7.0	353
3.5	14	8.0	595
4.0	41	9.0	990
4.5	77		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	15	23	5.6	4.7	4.1	3.5	316	65	250	7.4	36
2	18	13	23	5.6	4.8	4.3	4.0	*321	59	217	7.9	39
3	*16	13	22	5.7	4.8	4.5	7.0	318	52	186	7.9	46
4	15	13	22	5.7	4.9	4.5	10	311	48	153	*7.1	45
5	14	12	*21	5.8	5.0	4.5	13	321	43	126	6.6	41
6	14	12	21	5.6	5.0	4.4	16	353	43	104	6.2	41
7	14	12	21	5.4	4.9	4.3	17	461	73	91	5.4	72
8	20	12	22	5.3	4.8	4.2	17	644	103	90	5.0	116
9	16	13	21	*5.2	4.8	4.2	19	708	150	83	5.2	135
10	13	14	18	5.1	4.7	4.2	24	672	176	74	6.9	161
11	11	14	16	5.0	4.7	4.2	50	588	176	64	8.8	171
12	9.9	15	14	5.0	4.6	4.3	80	494	158	*57	9.6	166
13	9.6	15	12	4.8	4.6	4.5	145	414	133	49	7.9	148
14	9.6	15	11	4.8	4.5	4.6	220	360	114	42	7.6	121
15	9.6	15	10	4.8	4.5	4.7	266	318	104	35	7.6	97
16	9.3	14	9.5	4.8	4.5	4.6	278	276	88	30	7.9	85
17	9.3	15	9.0	4.8	4.5	4.4	283	237	79	26	7.1	79
18	9.6	15	8.5	4.8	4.5	4.1	290	209	93	24	6.6	72
19	13	15	8.0	4.9	4.5	4.0	285	199	112	20	5.9	65
20	16	15	7.5	4.9	4.4	4.0	279	191	122	18	5.4	66
21	14	15	7.3	5.0	4.3	3.9	266	179	117	18	6.6	67
22	18	24	7.0	5.1	4.3	3.9	282	164	105	17	8.8	64
23	20	26	6.8	5.1	4.3	3.9	303	152	158	14	8.8	91
24	22	28	6.6	5.0	4.2	3.9	*328	155	292	13	9.9	123
25	22	29	6.5	5.0	4.2	3.8	324	154	384	12	11	132
26	21	28	6.3	4.9	4.1	3.7	321	143	445	12	10	133
27	20	27	6.0	4.8	*4.1	3.6	284	126	427	12	10	142
28	19	26	5.8	4.8	4.0	3.5	274	108	378	12	*13	141
29	18	25	5.7	4.7	4.0	3.4	284	96	328	11	18	132
30	17	23	5.6	4.7	---	3.4	303	*87	290	9.0	26	119
31	*16	---	5.6	4.7	---	*3.4	---	75	---	7.9	34	---
Total	471.9	528	388.7	157.4	131.2	127.0	5,275.5	9,150	4,915	1,876.9	296.1	2,946
Mean	15.2	17.6	12.5	5.08	4.52	4.10	176	295	164	60.5	9.55	98.2
Cfsm	0.132	0.153	0.109	0.044	.039	0.036	1.53	2.57	1.43	0.526	0.083	0.854
In.	0.15	0.17	0.13	0.05	0.04	0.04	1.71	2.96	1.59	0.61	0.10	0.95

Calendar year 1963: Max 378 Min 0.4 Mean 52.0 Cfsm 0.452 In. 6.13
Water year 1963-64: Max 708 Min 3.4 Mean 71.8 Cfsm 0.624 In. 8.50

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23 to Apr. 14.

5-1290. Vermilion River below Vermilion Lake, near Tower, Minn.

Location.--Lat 47°57'41", long 92°28'33", in SE¼SW¼ sec.2, T.63 N., R.17 W., on left bank 200 ft downstream from dam at outlet of Vermilion Lake, 4.4 miles upstream from Twomile Creek, and 14.2 miles northwest of Tower.

Drainage area.--483 sq mi.

Records available.--May 1911 to September 1917, June 1928 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,350.36 ft above mean sea level, datum of 1929. May 17, 1911, to Sept. 30, 1917, and July 9, 1931, to Apr. 11, 1939, staff gage at same site and datum. June 26, 1928, to July 8, 1931, staff gage at datum 0.05 ft higher.

Average discharge.--42 years, 298 cfs.

Extremes.--Maximum discharge during year, 1,080 cfs May 18 (gage height, 2.97 ft); minimum, 6.5 cfs Nov. 23 (gage height, -0.66 ft, result of freeze down).
1911-17, 1928-64: Maximum discharge, 2,710 cfs May 23, 1950 (gage height, 4.68 ft); no flow Oct. 25-29, 1955, caused by temporary storage behind new concrete dam at outlet of Vermilion Lake.

Remarks.--Records good except those for period of no gage-height record, which are fair.

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

-0.3	18	1.0	176
- .1	29	1.5	312
.1	45	2.0	534
.5	88	3.0	1,100

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	100	22	45	64	71	67	61	462	689	844	298	210
2	84	31	50	64	71	65	57	484	659	806	312	207
3	91	27	51	63	72	63	57	514	644	794	288	202
4	97	27	51	63	71	63	57	534	629	789	*280	210
5	88	24	52	62	70	64	55	579	604	789	294	225
6	74	23	53	63	67	64	64	699	609	756	255	250
7	71	27	52	62	68	63	66	778	644	*734	201	260
8	70	28	57	63	67	63	70	811	664	740	203	240
9	71	28	64	65	67	63	68	833	689	724	208	210
10	65	23	*64	65	67	64	70	886	704	699	208	190
11	63	17	64	65	70	61	72	904	719	674	182	*176
12	65	19	64	65	65	62	74	904	704	649	176	174
13	65	22	65	66	65	61	84	947	679	624	172	176
14	*63	31	66	*64	65	58	97	960	679	609	166	157
15	58	31	66	64	63	58	108	929	649	589	157	166
16	56	28	67	62	65	57	117	923	654	564	153	174
17	57	27	66	66	63	56	125	910	669	554	149	165
18	56	31	66	66	61	55	138	935	664	534	151	166
19	54	27	65	66	60	56	151	874	644	534	155	159
20	51	31	64	66	60	63	161	916	644	504	155	157
21	66	22	63	63	61	64	182	898	634	484	140	157
22	62	32	63	63	62	64	*224	868	629	475	132	163
23	62	23	66	62	64	63	249	898	679	470	128	180
24	61	40	62	63	67	64	271	862	756	421	126	178
25	58	42	61	72	*68	63	288	886	789	398	126	186
26	44	46	62	74	68	63	305	838	794	377	128	208
27	40	45	64	74	71	63	328	*794	811	372	134	172
28	38	43	64	75	68	63	364	778	822	351	150	194
29	45	45	63	73	67	61	390	762	816	332	185	180
30	38	43	63	74	---	62	434	734	844	332	200	205
31	28	---	67	72	---	*60	---	704	---	320	210	---
Total	1,941	905	1,890	2,049	1,924	1,916	4,787	24,804	20,814	17,842	5,822	5,697
Mean	62.6	30.2	61.0	66.1	66.3	61.8	160	800	694	576	188	190
Cfsm	0.130	0.625	0.126	0.137	0.137	0.128	0.331	1.66	1.44	1.19	0.389	0.393
In.	0.15	0.07	0.15	0.16	0.15	0.15	0.37	1.91	1.60	1.37	0.45	0.44

Calendar year 1963: Max 624 Min 17 Mean 194 Cfsm 0.402 In. 5.46
Water year 1963-64: Max 960 Min 17 Mean 247 Cfsm 0.511 In. 6.97

* Discharge measurement made on this day.
Note.--No gage-height record Aug. 22 to Sept. 10.

5-1294. Rainy Lake at Fort Frances, Ontario

(International gaging station)

Location.--Lat 48°37'15", long 93°21'20", on Government dock at Pither's Point in town of Fort Frances.

Records available.--January 1910 to September 1917 and October 1934 to September 1964 in reports of Geological Survey. August 1911 to September 1964 in reports of Water Resources Branch, Department of Northern Affairs and National Resources, Canada. Prior to October 1949, published as "at Ranier, Minn."

Gage.--Water-stage recorder. Auxiliary staff gages read once daily. Datum of gage is at mean sea level (United States and Canadian Boundary Survey). Prior to Jan. 1, 1950, staff gage 3 miles northeast of Ranier, Minn., at same datum. Supplementary gage in town pumping station, half a mile south, used during winter months.

Extremes.--Maximum elevation during year, 1,109.30 ft June 18; minimum, 1,103.99 ft Apr. 11.
1910-17, 1934-64: Maximum elevation observed, 1,112.97 ft July 5, 1950; minimum observed, 1,101.26 ft Apr. 17, 1923, Apr. 2, 1930.

Cooperation.--This station is maintained by Canada under agreement with the United States.

Month-end elevation, in feet, water year October 1963 to September 1964

Oct. 31 ..... 6.78	Feb. 29 ..... 4.67	June 30 ..... 9.09
Nov. 30 ..... 6.39	Mar. 31 ..... 4.17	July 31 ..... 8.16
Dec. 31 ..... 6.20	Apr. 30 ..... 5.09	Aug. 31 ..... 8.53
Jan. 31 ..... 5.48	May 31 ..... 8.04	Sept.30 ..... 8.51

Note.--Add 1,100 ft to obtain elevation above mean sea level.

5-1305. Sturgeon River near Chisholm, Minn.

Location.--Lat 47°40'25", long 92°54'00", in NE¼NW¼ sec.20, T.60 N., R.20 W., on left bank 1,000 ft upstream from highway bridge, 0.6 mile downstream from East Branch Sturgeon River, and 11½ miles north of Chisholm.

Drainage area.--187 sq mi.

Records available.--August 1942 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,306.7 ft above mean sea level, datum of 1929. Prior to Aug. 24, 1944, staff gage at site 1,000 ft downstream at different datum.

Average discharge.--22 years, 116 cfs.

Extremes.--Maximum discharge during year, 1,230 cfs May 8 (gage height, 4.22 ft); minimum daily, 14 cfs several days; minimum gage height, 0.35 ft Mar. 11-13.
1942-64: Maximum discharge, 3,630 cfs May 7, 1950 (gage height, 6.41 ft) from rating curve extended above 1,600 cfs on basis of slope-area measurement of peak flow; minimum daily, 6.0 cfs Feb. 18-27, 1944; minimum gage height, 0.08 ft Jan. 28 to Feb. 1, 1963.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.3	14	2.0	225
.6	26	2.5	383
.9	44	3.0	585
1.2	72	4.0	1,120
1.6	134	5.0	1,770

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	42	46	31	18	15	15	14	366	130	165	23	68
2	42	45	32	18	15	15	14	355	123	144	24	71
3	42	44	32	18	15	15	16	334	115	124	24	72
4	41	43	32	18	15	15	17	348	107	110	*23	78
5	39	43	33	18	15	15	19	473	100	98	22	75
6	38	43	32	18	15	15	20	852	98	91	21	72
7	38	43	31	18	15	15	20	1,100	123	*85	20	134
8	38	43	29	17	15	15	22	1,210	161	85	19	178
9	37	47	*28	17	15	15	24	1,080	218	80	18	205
10	37	49	26	17	15	15	30	840	241	74	20	*238
11	36	50	26	16	15	14	50	643	225	68	21	254
12	37	50	25	16	14	14	100	509	188	62	21	271
13	36	48	26	*16	14	14	200	423	154	57	20	248
14	*36	47	26	16	14	15	350	362	142	52	19	193
15	36	46	26	15	14	15	400	314	119	48	19	156
16	36	43	25	15	15	15	450	277	*106	44	18	132
17	38	43	25	15	15	15	488	251	98	41	18	119
18	38	41	25	15	14	15	427	311	109	37	17	110
19	40	41	25	15	14	15	372	358	152	34	17	101
20	41	40	24	15	15	15	321	380	163	34	17	100
21	43	38	23	15	15	15	*304	362	152	34	21	97
22	48	37	22	15	15	15	376	314	134	32	24	94
23	51	36	21	15	15	15	415	277	257	30	25	104
24	54	35	21	15	*15	16	430	260	530	29	28	128
25	53	35	21	15	15	16	390	241	743	28	27	140
26	51	36	20	15	15	15	334	*218	788	27	26	148
27	50	35	20	15	15	15	283	190	609	27	25	154
28	48	34	20	15	15	15	290	174	401	27	46	158
29	48	33	19	15	15	15	321	163	266	26	55	150
30	47	32	19	15	------	15	355	150	198	25	65	140
31	47	------	19	15	------	*15	------	140	------	24	68	------
Total	1,308	1,246	784	496	429	464	6,852	13,275	6,950	1,842	811	4,186
Mean	42.2	41.5	25.3	16.0	14.8	15.0	228	428	232	59.4	26.2	140
Cfsm	0.226	0.222	0.135	0.086	0.079	0.080	1.22	2.29	1.24	0.318	0.140	0.749
In.	0.26	0.25	0.16	0.10	0.09	0.09	1.36	2.64	1.38	0.37	0.16	0.83

Calendar year 1963 Max 643 Min 7.2 Mean 83.8 Cfsm 0.448 In. 6.08
Water year 1963-64 Max 1,210 Min 14 Mean 106 Cfsm 0.567 In. 7.69

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
5-8	1200	4.22	1,230	6-26	0600	3.52	830

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 16 (no gage-height record Nov. 27 to Dec. 8).

5-1315. Little Fork River at Little Fork, Minn.

Location.--Lat 48°24', long 93°34', in NW¼ sec.9, T.68 N., R.25 W., on left bank 100 ft downstream from bridge on State Highway 65 at town of Little Fork and 1½ miles upstream from Beaver Creek, and 18 miles upstream from mouth.

Drainage area.--1,730 sq mi, approximately.

Records available.--June to November 1909, April to November 1910, April 1911 to June 1917, September 1917, October 1917 to March 1919 (gage heights only), June 1928 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,073.06 ft above mean sea level, datum of 1929. June 23, 1909, to Mar. 4, 1917, staff gage at same site and datum. Mar. 5 to Sept. 30, 1917, June 22, 1928, to June 21, 1936, chain gage and June 22, 1936, to July 20, 1937, wire-weight gage, at site 100 ft upstream at same datum.

Average discharge.--41 years (1911-16, 1928-64), 966 cfs.

Extremes.--Maximum discharge during year, 11,600 cfs May 9 (gage height, 24.84 ft); minimum daily, 74 cfs Mar. 11; minimum gage height, 5.47 ft Nov. 7.
1909-17, 1928-64: Maximum discharge, 25,000 cfs Apr. 18, 1916, May 11, 1950 (gage height, 37.00 ft); minimum observed, 21 cfs Aug. 26, 27, 1936.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating table, water year 1963-64, except period of ice effect or backwater from Rainy River (gage height, in feet, and discharge, in cubic feet per second)

5.4	153	12.0	2,600
6.0	265	16.0	4,820
7.0	528	20.0	7,530
9.0	1,200	25.0	11,700

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	242	182	220	118	90	78	90	4,520	940	3,040	319	2,660
2	234	178	218	117	88	79	91	4,500	*864	2,710	350	2,430
3	228	175	214	116	89	80	94	4,280	806	2,410	322	2,210
4	218	172	212	115	89	79	96	4,140	758	2,100	298	2,120
5	211	170	216	115	90	78	99	5,070	718	1,430	*281	1,940
6	207	167	218	115	91	77	105	7,070	654	960	275	1,690
7	201	167	218	115	90	76	109	9,440	714	980	272	1,420
8	194	172	210	114	88	76	114	11,100	1,020	*1,000	269	1,280
9	187	182	200	110	86	75	126	11,300	3,570	1,200	254	1,260
10	182	185	*192	108	86	75	142	9,810	5,910	1,500	237	1,250
11	180	191	185	106	86	74	166	7,790	6,300	1,400	222	1,170
12	178	192	180	104	85	75	200	6,160	5,100	1,250	213	1,150
13	172	194	175	103	85	76	250	4,980	4,110	1,080	207	1,060
14	168	203	169	102	85	77	310	4,100	2,630	900	201	982
15	*167	222	164	*102	84	78	470	3,410	2,410	797	201	927
16	167	218	158	101	83	78	810	2,920	2,040	661	192	864
17	167	220	154	101	83	76	1,400	2,570	*1,570	648	192	784
18	168	220	148	101	83	76	2,400	2,320	1,390	604	192	715
19	173	218	144	102	82	76	3,600	2,260	1,420	573	192	671
20	173	209	139	104	80	76	4,430	2,490	1,690	585	190	634
21	168	205	136	105	79	77	3,340	2,490	1,900	573	198	*600
22	172	200	133	105	77	79	*4,040	2,290	2,130	538	207	573
23	177	206	131	104	76	81	5,010	2,110	2,220	483	213	582
24	178	210	130	101	76	82	5,010	2,030	4,320	441	222	625
25	177	225	130	97	76	83	4,670	1,900	7,940	354	234	693
26	184	230	129	95	*77	83	4,150	1,750	8,180	375	240	803
27	189	235	126	94	77	*83	3,640	1,590	6,970	346	294	947
28	187	235	124	93	77	84	3,480	1,420	4,880	342	346	1,040
29	185	230	122	92	78	85	4,090	1,270	4,480	342	436	1,080
30	184	225	119	92	---	86	4,440	1,130	3,580	326	1,610	1,090
31	184	---	118	91	---	87	---	1,020	---	319	2,580	---
Total	5,802	6,038	5,132	3,238	2,416	2,445	56,972	129,230	91,214	30,267	11,459	35,250
Mean	187	201	166	104	83.3	78.9	1,899	4,169	3,040	976	370	1,175
Cfsm	0.108	0.116	0.096	0.060	0.048	0.046	1.10	2.41	1.76	0.564	0.214	0.679
In.	0.12	0.13	0.11	0.07	0.05	0.05	1.22	2.78	1.96	0.65	0.25	0.76

Calendar year 1963: Max 7,600 Min 15 Mean 752 Cfsm 0.435 In. 5.89
Water year 1963-64: Max 11,300 Min 74 Mean 1,037 Cfsm 0.599 In. 8.15

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 21 to Apr. 20 (no gage-height record Apr. 18, 19). Backwater from Rainy River June 6, 7, 14-24, June 28 to Aug. 7, Aug. 10-30, Sept. 2-4, 7-11 (no gage-height July 28-30).

5-1320. Big Fork River at Big Falls, Minn.

Location.--Lat 48°12', long 93°48', in sec.35, T.155 N., R.25 W., on left bank at village of Big Falls, 700 ft downstream from falls, 0.3 mile downstream from bridge on U.S. Highway 71, and 4¾ miles upstream from Sturgeon River.

Drainage area.--1,460 sq mi, approximately.

Records available.--August to November 1909, April to November 1910, April 1911 to September 1912 (gage heights and discharge measurements only), June 1928 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,144.71 ft above mean sea level, datum of 1929. Prior to June 10, 1911, staff gage at railroad bridge about 0.4 mile upstream at different datum. June 10, 1911, to Dec. 17, 1937, staff gage or chain gage at site 200 ft upstream at same datum.

Average discharge.--36 years (1928-1964), 635 cfs.

Extremes.--Maximum discharge during year, 4,840 cfs May 8 (gage height, 8.52 ft); minimum daily, 62 cfs Mar. 5-7; minimum gage height, 2.81 ft Oct. 19.
1909-12, 1928-64: Maximum discharge, 14,800 cfs May 8, 9, 1950; maximum gage height, 17.08 ft May 8, 1950; minimum discharge recorded, 7 cfs Aug. 7, 1939.

Remarks.--Records good except those for period of ice effect, which are fair. Some diurnal fluctuation at low flow caused by powerplant a quarter of a mile upstream.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.8	76	5.0	1,340
3.0	134	6.0	2,190
3.5	349	7.0	3,180
4.0	635	9.0	5,380

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	206	252	200	126	93	66	100	2,700	570	706	145	1,480
2	201	239	198	127	92	66	103	2,580	*527	602	134	1,520
3	193	239	197	127	90	64	105	2,420	498	552	134	1,440
4	193	239	197	127	89	63	111	2,520	463	533	131	1,250
5	193	235	195	127	88	62	117	3,430	436	509	*124	1,080
6	197	227	193	125	88	62	120	4,340	431	475	121	942
7	227	227	188	122	87	62	128	4,720	492	431	115	844
8	210	227	181	121	87	63	134	4,750	552	394	112	778
9	201	235	174	119	86	64	145	4,350	914	404	108	746
10	201	239	169	118	85	65	153	3,750	1,350	*420	108	732
11	206	248	*165	117	83	67	165	3,170	1,200	420	108	680
12	193	256	158	115	81	70	185	2,730	1,080	410	108	622
13	197	261	156	114	81	73	210	2,380	956	374	112	564
14	218	261	152	112	80	75	250	2,120	830	335	112	564
15	*222	261	148	*111	79	78	320	1,900	720	307	112	458
16	222	248	146	110	78	79	400	1,740	622	274	108	426
17	222	235	142	110	77	80	550	1,630	552	270	105	410
18	222	235	140	109	75	81	760	1,550	552	256	102	394
19	222	222	138	109	74	81	1,030	1,490	*687	214	99	374
20	231	200	136	110	73	81	1,740	1,420	810	252	97	364
21	235	201	135	111	72	82	1,830	1,350	830	227	121	*359
22	239	203	134	110	71	82	2,630	1,250	772	214	153	354
23	252	209	134	109	70	85	*3,060	1,180	935	189	176	374
24	279	219	134	108	68	86	3,070	1,120	1,610	176	189	441
25	270	228	134	107	67	89	2,890	1,060	2,060	189	197	475
26	270	230	132	106	*65	91	2,590	963	2,000	172	210	503
27	270	226	132	104	65	*93	2,270	879	1,740	164	227	583
28	270	220	131	102	66	94	2,230	804	1,440	161	384	622
29	274	212	130	100	67	95	2,590	746	1,100	161	865	628
30	265	203	127	99	---	96	2,710	674	872	161	1,140	628
31	256	---	124	95	---	97	---	616	---	153	1,410	---
Total	7,057	6,937	4,820	3,507	2,277	2,392	32,696	66,332	27,601	10,105	7,367	20,635
Mean	228	231	155	113	78.5	77.2	1,090	2,140	920	326	238	688
Cfsm	0.156	0.158	0.106	0.077	0.054	0.053	0.747	1.47	0.630	0.223	0.163	0.471
In.	0.18	0.18	0.12	0.09	0.06	0.06	0.83	1.69	0.70	0.26	0.19	0.53

Calendar year 1963: Max 3,810 Min 45 Mean 504 Cfsm 0.345 In. 4.70
Water year 1963-64: Max 4,750 Min 62 Mean 524 Cfsm 0.359 In. 4.89

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 20 to Apr. 20.

5-1335. Rainy River at Manitou Rapids, Minn.

(International gaging station)

Location.-- Lat 48°38'04", long 93°54'47", in sec.36, T.160 N., R.26 W., on left bank at Manitou Rapids, 3½ miles east of Manitou Post Office and 4 miles west of Indus.

Drainage area.--19,400 sq mi, approximately.

Records available.--July 1928 to September 1964. Monthly discharge only for some periods, published in WSP 1308. October 1911 to October 1924 (gage heights only) at site near Birchdale in files of Corps of Engineers. Published as "near Birchdale" 1932-34.

Gage.--Water-stage recorder. Datum of gage is 1,062.48 ft above mean sea level, datum of 1929. Prior to Nov. 10, 1934, chain gage at site near Birchdale 7 miles downstream at different datum.

Average discharge.--36 years, 11,890 cfs.

Extremes.--Maximum discharge during year, 47,600 cfs June 26 (gage height, 16.10 ft); minimum, 4,130 cfs Nov. 25 (gage height, 2.00 ft).
1928-64: Maximum discharge, 71,600 cfs May 12, 1950 (gage height, 21.04 ft); minimum daily, 928 cfs Dec. 26, 1929.

Remarks.--Records good except those for period of ice effect, which are fair. Diurnal fluctuation caused by powerplant at International Falls. Some regulation at low and medium flows by Rainy and Namakan Lakes.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.4	4,680	7.0	14,700
3.0	5,620	10.0	23,300
4.0	7,500	13.0	34,000
5.0	9,660	17.0	51,800

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7,640	9,590	7,700	8,350	8,800	8,000	7,800	17,300	20,200	38,200	16,400	27,800
2	9,680	9,410	5,500	7,000	8,800	7,300	7,200	17,700	17,800	37,000	17,100	32,700
3	10,400	8,600	8,100	8,400	7,700	7,600	7,100	16,700	16,600	36,000	16,900	34,700
4	10,300	6,000	8,300	8,400	8,600	8,100	7,000	15,000	16,300	35,200	17,200	34,100
5	9,960	7,840	8,700	8,400	8,600	8,300	6,500	17,600	16,100	34,400	17,200	33,100
6	9,480	8,950	8,800	7,400	8,600	8,400	4,940	21,700	16,000	33,900	*16,900	32,000
7	6,070	9,130	9,000	8,200	8,600	8,300	5,910	25,500	16,100	33,300	17,100	31,100
8	7,460	8,660	8,800	8,800	8,600	8,300	6,430	28,600	16,200	33,000	17,200	30,200
9	9,610	8,380	5,850	9,100	8,600	7,100	5,790	30,300	24,900	32,800	17,100	29,900
10	9,910	7,280	8,800	9,000	7,400	6,900	5,770	29,700	38,000	33,100	16,900	29,200
11	9,870	5,560	8,800	8,650	7,900	7,600	6,340	27,300	43,600	33,600	15,400	26,100
12	9,020	7,280	8,800	8,100	8,400	7,800	7,000	24,800	43,800	33,200	15,000	20,900
13	7,740	8,820	8,550	7,200	8,700	7,900	6,490	23,500	42,300	32,400	13,500	18,700
14	5,010	9,270	8,850	8,200	8,700	7,900	9,430	21,900	40,700	31,900	12,000	17,400
15	*6,450	9,340	8,850	8,600	8,700	8,000	11,600	19,400	39,100	31,500	11,300	14,800
16	8,930	9,220	5,100	8,700	8,600	5,500	13,200	17,800	38,000	31,000	11,300	13,700
17	9,180	8,140	8,500	8,800	6,800	5,500	14,300	16,400	36,900	30,600	11,300	13,200
18	9,290	4,860	8,500	9,000	7,800	7,400	15,400	14,800	36,500	30,400	11,600	13,000
19	9,290	6,960	8,500	9,000	8,500	8,200	15,800	15,400	37,100	30,300	12,500	12,800
20	8,750	8,310	8,400	7,400	8,900	8,400	15,000	15,700	*37,800	30,500	12,900	12,600
21	5,540	8,600	8,500	8,700	9,100	8,000	16,600	15,900	38,700	30,300	13,000	12,200
22	7,420	8,750	8,400	8,900	8,800	6,400	17,100	15,900	38,700	30,100	13,300	11,600
23	9,320	8,680	7,600	8,900	8,600	5,500	*18,500	18,000	39,700	29,200	13,500	11,600
24	9,540	7,820	6,200	8,900	6,600	5,700	19,300	18,600	42,700	27,500	12,900	12,100
25	9,430	4,720	6,200	8,800	8,200	6,300	18,600	18,800	45,700	25,500	12,500	12,800
26	9,110	7,220	6,400	8,800	8,100	7,200	16,500	20,500	47,500	24,000	11,800	13,400
27	9,020	8,460	8,000	8,100	7,800	7,800	14,300	21,400	46,700	21,800	11,700	14,400
28	6,600	8,140	8,500	8,600	*7,640	7,500	14,900	21,300	44,600	20,700	12,600	14,100
29	8,490	6,400	8,600	8,700	7,800	6,400	15,500	21,100	42,200	18,100	16,200	16,900
30	9,520	7,640	7,000	8,700	---------	5,200	16,800	20,800	39,900	16,800	19,200	21,000
31	9,680	---------	8,300	8,700	---------	6,000	---------	20,500	---------	16,100	21,600	---------
Total	267,710	238,030	246,100	262,500	239,940	224,500	347,100	629,900	1020,400	922,400	455,100	618,100
Mean	8,636	7,934	7,939	8,468	8,274	7,242	11,570	20,320	34,010	29,750	14,680	20,600
Cfsm	0.445	0.409	0.409	0.436	0.426	0.373	0.596	1.05	1.75	1.53	0.757	1.06
In.	0.51	0.46	0.47	0.50	0.46	0.43	0.67	1.21	1.96	1.77	0.87	1.18

Calendar year 1963: Max 29,400 Min 4,100 Mean 11,870 Cfsm 0.612 In. 8.31
Water year 1963-64: Max 47,500 Min 4,720 Mean 14,950 Cfsm 0.771 In. 10.49

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 1 to Apr. 5.

5-1342. Rapid River near Baudette, Minn.

Location.--Lat 48°32'10", long 94°33'45", in NE¼ sec.1, T.158 N., R.31 W., on left bank 75 ft upstream from bridge on State Highway 72, 1.2 miles downstream from North Branch Rapid River, and 12 miles south of Baudette.

Drainage area.--543 sq mi.

Records available.--October 1956 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,093.92 ft above mean sea level, datum of 1929 (Minnesota Highway Department bench mark).

Average discharge.--8 years, 269 cfs.

Extremes.--Maximum discharge during year, 3,480 cfs May 9 (gage height, 13.15 ft); minimum daily, 4.1 cfs Feb. 22-28; minimum gage height, 1.66 ft Nov. 2.
1956-64: Maximum discharge, 5,750 cfs May 24, 1962 (gage height, 17.13 ft); minimum, 0.1 cfs Aug. 13, 1961 (gage height, 1.18 ft).

Remarks.--Records good except those for period of ice effect, which are fair, and those for periods of shifting control or no gage-height record, which are poor.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.6	7.2	3.5	240
1.8	14	4.0	368
2.0	23	5.0	648
2.3	47	6.0	944
2.6	80	9.0	1,920
3.0	139	13.0	3,420

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	8.9	6.0	5.0	4.2	4.3	5.0	1,300	315	869	87	210
2	17	9.4	6.0	5.0	4.2	4.3	6.0	1,330	242	755	120	230
3	16	9.4	6.0	5.0	4.2	4.5	8.0	1,310	*174	648	153	240
4	14	9.4	6.0	5.0	4.2	4.5	10	1,420	155	550	252	250
5	14	10	7.0	5.0	4.3	4.3	18	1,760	165	457	274	265
6	13	10	7.0	5.0	4.5	4.3	25	2,630	180	395	*198	270
7	12	9.7	7.0	5.0	4.5	4.3	31	3,060	178	325	120	270
8	15	10	6.0	4.5	4.5	4.3	38	3,360	247	274	98	275
9	11	12	6.0	4.5	4.5	4.2	48	3,370	1,490	*307	80	280
10	11	13	5.5	4.5	4.3	4.2	60	2,950	2,520	368	70	295
11	10	14	*5.5	4.5	4.3	4.2	70	2,490	2,820	352	65	305
12	10	15	5.5	4.5	4.3	4.2	100	2,080	3,000	299	67	320
13	10	16	5.5	4.5	4.3	4.2	300	1,790	2,870	254	71	315
14	19	16	5.5	4.5	4.3	4.5	500	1,560	2,760	209	64	285
15	16	14	5.0	4.5	4.3	5.0	1,000	1,400	2,730	174	53	255
16	*12	14	5.0	*4.5	4.2	6.0	1,300	1,270	2,460	144	48	230
17	10	14	5.0	4.5	4.2	6.0	1,650	1,150	2,140	152	44	205
18	8.9	14	5.0	4.5	4.2	5.5	1,280	1,100	*1,810	186	40	190
19	8.6	13	5.0	4.5	4.2	5.3	1,000	1,170	1,780	196	38	185
20	8.3	14	5.0	4.5	4.2	5.0	872	1,110	2,050	186	78	180
21	8.9	13	5.0	5.0	4.2	5.0	941	1,060	2,290	178	91	180
22	10	11	5.0	5.0	4.1	5.5	1,570	999	2,210	170	97	*184
23	12	10	5.5	5.0	4.1	5.5	*1,690	935	2,200	152	103	365
24	14	9.0	5.5	4.5	4.1	6.0	1,530	869	2,180	139	108	782
25	12	9.0	5.0	4.5	4.1	6.0	1,340	809	2,110	127	110	1,010
26	11	9.0	5.0	4.5	4.1	*5.5	1,220	750	2,000	109	125	1,210
27	10	9.0	5.0	4.3	*4.1	5.5	1,130	692	1,710	93	160	1,640
28	10	8.0	4.5	4.3	4.1	5.5	1,140	619	1,420	91	180	1,880
29	10	7.0	4.5	4.3	4.2	5.0	1,320	550	1,190	95	175	1,980
30	9.7	6.0	4.5	4.2	---	5.0	1,320	474	1,010	95	175	1,970
31	9.2	---	5.0	4.2	---	5.0	---	392	---	100	180	---
Total	370.6	336.8	169.0	143.3	123.0	152.6	21,522	45,759	48,406	8,449	3,524	16,256
Mean	12.0	11.2	5.45	4.62	4.24	4.92	717	1,476	1,614	273	114	542
Cfsm	0.022	0.021	0.010	0.0085	0.0078	0.0091	1.32	2.72	2.97	0.503	0.210	0.998
In.	0.03	0.02	0.01	0.01	0.008	0.01	1.47	3.13	3.32	0.58	0.24	1.11

Calendar year 1963: Max 1,730 Min 3.4 Mean 246 Cfsm 0.453 In. 6.16
Water year 1963-64: Max 3,370 Min 4.1 Mean 397 Cfsm 0.731 In. 9.94

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 19, Nov. 21 to Apr. 16. No gage-height record Aug. 2, Aug. 21 to Sept. 21.
Shifting-control method used Oct. 1 to Nov. 16, May 28 to Sept. 30.

5-1395. Warroad River near Warroad, Minn.

Location.--Lat 48°52'00", long 95°21'20", in SE¼NE¼ sec.12, T.162 N., R.37 W., on upstream handrail of bridge near center of span, half a mile upstream from Bulldog Run and 2½ miles south of Warroad.

Drainage area.--110 sq mi, approximately.

Records available.--March 1946 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Chain gage read once daily. Datum of gage is 1,070.74 ft above mean sea level, datum of 1929 (levels by Stanley Johnson, consulting engineer and instructor at University of North Dakota).

Average discharge.--18 years, 36.1 cfs.

Extremes.--Maximum discharge during year, 851 cfs Sept. 28 (gage height, 8.26 ft); minimum daily, 0.3 cfs Oct. 3, 4.
1946-64: Maximum discharge, 1,460 cfs Aug. 7, 1962 (gage height, 9.61 ft, from floodmark); no flow Mar. 28, 1947, Aug. 20-29, 1953, Sept. 11-16, 19-22, 1960, June 25 to Sept. 2, 1961.

Remarks.--Records good except those for periods of ice effect, which are poor.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used July 18 to Sept. 20)

1.7	0.3	2.3	6.4	5.0	142
1.8	.7	2.6	13	6.0	227
1.9	1.3	3.0	26	7.0	355
2.0	2.1	3.5	47	8.0	711
2.1	3.2	4.0	76	8.2	818

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.4	4.8	1.8	1.6	1.0	0.6	1.0	186	23	59	9.2	34
2	.4	4.2	1.8	1.6	1.0	.6	1.0	170	*20	47	16	42
3	.3	2.7	1.8	1.5	1.0	.6	1.0	158	17	39	92	66
4	.3	1.9	1.8	1.5	1.0	.6	1.2	160	14	32	165	81
5	.5	1.8	2.0	1.5	1.0	.6	1.5	165	14	27	194	66
6	.7	1.9	2.2	1.5	1.0	.6	2.0	*202	14	24	99	58
7	.6	1.3	2.2	1.5	1.0	.6	2.2	214	15	21	47	54
8	.8	1.4	2.2	1.4	1.0	.7	2.2	234	20	*20	34	41
9	1.1	1.2	2.0	1.4	1.0	.7	*2.0	212	60	23	27	36
10	1.0	1.2	2.0	1.4	1.0	.7	7.0	176	132	24	20	44
11	1.0	1.2	1.8	1.4	.8	.7	45	156	214	20	19	66
12	1.3	1.3	1.8	1.4	.8	.7	50	134	323	16	18	63
13	1.7	1.2	1.7	1.4	.8	.7	65	110	361	16	17	58
14	2.0	1.4	1.7	1.4	.8	.7	100	93	416	14	23	42
15	1.9	2.0	1.7	1.4	.8	.7	*180	86	*366	11	16	39
16	2.1	1.8	1.7	1.4	.8	.8	225	83	310	13	15	33
17	2.2	1.8	1.7	1.4	.8	.8	264	75	252	18	13	33
18	2.6	1.7	1.7	1.3	.8	.8	338	83	225	26	11	35
19	2.5	1.6	1.7	1.3	.6	.8	310	97	199	21	10	30
20	2.1	1.7	*1.7	1.3	.6	.8	259	124	271	19	9.7	28
21	2.2	1.8	1.7	1.3	.6	.8	227	138	390	21	7.4	27
22	2.0	2.3	1.7	*1.3	.6	.8	*205	108	397	23	8.6	26
23	1.7	2.4	1.7	1.2	.6	.8	210	87	359	24	9.4	39
24	.9	2.0	1.7	1.2	.6	.8	216	75	318	32	11	116
25	.8	2.1	1.6	1.2	.6	.8	189	63	298	25	16	159
26	.9	*1.8	1.6	1.2	.6	.8	163	53	280	17	*15	279
27	1.0	1.8	1.6	1.2	.6	.8	132	42	238	14	11	436
28	1.2	1.8	1.6	1.2	*.6	.8	134	38	164	12	12	*775
29	2.8	1.8	1.6	1.2	.6	.8	138	36	107	*10	13	713
30	*15	1.8	1.6	1.2	---	.8	*153	32	75	9.0	17	701
31	8.4	---	1.6	1.2	---	*.8	---	26	---	8.6	28	---
Total	62.4	57.7	55.0	42.0	23.0	22.6	3,624.1	3,616	5,892	685.6	1,003.3	4,220
Mean	2.01	1.92	1.77	1.35	0.79	0.73	121	117	196	22.1	32.4	141
Cfsm	0.018	0.017	0.016	0.012	0.007	0.007	1.10	1.06	1.78	0.201	0.295	1.28
In.	0.02	0.02	0.02	0.01	0.01	0.01	1.22	1.22	1.99	0.23	0.34	1.43

Calendar year 1963: Max 497 Min 0.1 Mean 38.7 Cfsm 0.352 In. 4.78
Water year 1963-64: Max 775 Min 0.3 Mean 52.7 Cfsm 0.479 In. 6.52

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 14-16, Nov. 26 to Apr. 16 (no gage-height record Dec. 18, 19).

MISSISSIPPI RIVER MAIN STEM

5-2010. Winnibigoshish Lake near Deer River, Minn.

Location.--Lat 47°25'42", long 94°03'00", in sec.25, T.146 N., R.27 W., at dam on Mississippi River, 1 mile northwest of Little Winnibigoshish Lake and 14 miles northwest of town of Deer River.

Drainage area.--1,442 sq mi.

Records available.--April 1884 to September 1964. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,289.47 ft above mean sea level, adjustment of 1912. Prior to July 8, 1949, staff gage at same site and datum.

Extremes.--Maximum contents during year, 603,250 acre-ft June 23 (gage height, 10.54 ft); minimum, 471,830 acre-feet Mar. 18 (gage height, 8.58 ft).
1884-1964: Maximum contents observed, 996,500 acre-ft July 30, 1905 (gage height, 14.45 ft); minimum observed, 33,680 acre-ft below zero of capacity table Oct. 20, 1931 (gage height, -0.69 ft).

Remarks.--Reservoir is formed by Winnibigoshish Lake and several other natural lakes controlled by a concrete and timber dam, completed in 1884; storage began in 1884. Capacity between gage heights 6.00 ft and 14.2 ft (maximum allowable range) is 653,570 acre-ft, of which 416,270 acre-ft is controlled storage between gage heights 6.00 ft and 12.0 ft (normal operating range). Contents shown herein are contents above gage height 0.00 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1963 to September 1964

	Gage height (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	9.19	511,870	-
Oct. 31	9.18	511,220	-650
Nov. 30	8.99	498,740	-12,480
Dec. 31	8.97	497,450	-1,290
Calendar year 1963	-	-	+33,500
Jan. 31	8.88	491,520	-5,930
Feb. 29	8.72	481,010	-10,510
Mar. 31	8.69	479,050	-1,960
Apr. 30	9.46	529,610	+50,560
May 31	10.12	573,820	+44,210
June 30	10.10	572,410	-1,410
July 31	9.55	535,500	-36,910
Aug. 31	9.32	520,400	-15,100
Sept.30	9.18	511,220	-9,180
Water year 1963-64	-	-	-650

/ Gage height at 2400

5-2015. Mississippi River at Winnibigoshish Dam near Deer River, Minn.

Location.--Lat 47°25'42", long 94°03'00", in SW¼ sec.25, T.146 N., R.27 W., at dam 1 mile northwest of Little Winnibigoshish Lake and 14 miles northwest of town of Deer River.

Drainage area.--1,442 sq mi.

Records available.--May 1884 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder on headwater and staff gage on tailwater, read twice daily. Datum of gage is 1,289.47 ft above mean sea level, adjustment of 1912. Prior to July 8, 1949, staff headwater gage at same site and datum.

Average discharge.--80 years, 499 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 878 cfs June 23; minimum daily, 101 cfs Apr. 24.
1884-64: Maximum daily discharge, 4,370 cfs Aug. 6, 1905; no flow at times in several years.

Remarks.--Daily discharge is computed on the basis of modified weir formula and corrected to conform with discharge measurements, the head being determined from readings of headwater and tailwater gages. Flow completely regulated by Winnibigoshish Lake (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; one discharge measurement made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	251	265	289	324	309	249	244	119	112	820	381	301
2	263	245	290	324	309	247	244	121	116	844	381	292
3	250	242	290	325	307	245	245	116	208	834	385	308
4	244	240	290	324	326	244	245	128	285	809	381	341
5	245	239	289	322	325	243	245	124	399	776	372	309
6	249	295	290	321	326	243	251	106	519	770	388	303
7	253	288	290	321	325	241	260	116	526	811	417	307
8	249	285	293	321	325	239	261	118	529	795	388	309
9	245	293	296	324	323	239	261	116	646	787	347	304
10	244	307	296	322	323	237	263	112	736	805	288	332
11	244	321	295	321	321	236	265	114	776	802	308	320
12	242	315	293	320	321	235	269	118	776	795	288	308
13	240	297	295	318	321	234	278	112	804	787	282	300
14	240	286	297	318	319	235	293	111	770	778	280	298
15	240	283	296	316	319	233	291	116	764	760	280	290
16	243	283	296	316	316	233	295	118	740	754	280	291
17	243	284	295	316	314	233	299	118	786	794	275	293
18	255	282	296	316	314	230	300	117	799	768	272	288
19	255	283	295	316	313	231	301	133	856	760	268	290
20	252	278	295	315	313	236	303	125	839	766	270	294
21	244	283	293	315	310	239	233	105	821	754	281	291
22	260	285	291	315	306	237	208	108	803	730	284	291
23	259	315	290	313	310	239	152	110	878	695	290	301
24	261	288	291	313	306	243	101	111	871	668	293	313
25	261	289	328	316	310	243	*103	111	849	642	304	298
26	270	295	328	315	307	243	104	124	851	633	283	288
27	265	293	330	315	306	243	106	120	844	623	282	301
28	264	306	328	312	250	243	111	112	830	603	305	298
29	247	299	328	310	249	244	119	113	830	535	307	439
30	250	295	326	310	---	244	117	113	834	483	310	554
31	264	---	325	310	---	244	---	116	---	431	314	---
Total	7,792	8,559	9,324	9,844	9,023	7,425	6,767	3,601	20,397	22,612	9,784	9,452
Mean	251	285	301	318	311	240	226	116	680	729	316	315
Cfsm	0.174	0.198	0.209	0.221	0.216	0.166	0.157	0.080	0.472	0.506	0.219	0.218
In.	0.20	0.22	0.24	0.25	0.23	0.19	0.17	0.09	0.53	0.58	0.25	0.24

Calendar year 1963: Max 899 Min 46 Mean 324 Cfsm 0.225 In. 3.04
Water year 1963-64: Max 878 Min 101 Mean 340 Cfsm 0.236 In. 3.19

* Discharge measurement made on this day.

5-2060. Leech Lake at Federal Dam, Minn.

Location.--Lat 47°12'23", long 94°18'31", in lot 2, sec.14, T.143 N., R.29 W., at head of Leech Lake River on Waboose Bay, 5 miles southwest of town of Federal Dam.

Drainage area.--1,163 sq mi.

Records available.--April 1884 to September 1964. Month-end contents only for some periods, published in WSP 1308. Prior to October 1956, published as "Leech Lake Reservoir."

Gage.--Water-stage recorder. Datum of gage is 1,293.23 ft above mean sea level, adjustment of 1912. Prior to Dec. 31, 1884, staff gage half a mile north of outlet to Leech Lake River at datum 5.76 ft lower. Dec. 31, 1884, to May 24, 1931, staff gage half a mile north of outlet to Leech Lake River at present datum.

Extremes.--Maximum contents during year, 310,250 acre-ft July 23 (gage height, 2.21 ft); minimum, 170,210 acre-ft Mar. 18 (gage height, 1.08 ft).
1884-1964: Maximum contents observed, 734,300 acre-ft June 30, 1916 (gage height, 5.18 ft); minimum observed, 72,830 acre-ft below zero of capacity table Sept. 30, Nov. 19, 1934, Jan. 9, 1935 (gage height, -1.18 ft).

Remarks.--Reservoir is formed by Leech Lake and several other natural lakes controlled by concrete and timber dam; storage began in 1884; original timber structure completed in 1884, replaced by present dam in 1902. Capacity between gage heights 0.00 ft and 5.24 ft (maximum allowable range) is 689,780 acre-ft, of which 356,570 acre-ft is controlled storage between gage heights 0.00 ft and 3.00 ft (normal operating range). Contents shown herein are contents above gage height -0.50 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1963 to September 1964

	Gage height (feet)✓	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	1.43	211,640	-
Oct. 31	1.23	186,530	-25,110
Nov. 30	1.21	184,360	-2,170
Dec. 31	1.23	186,530	+2,170
Calendar year 1963	-	-	-33,970
Jan. 31	1.19	182,180	-4,350
Feb. 29	1.15	177,840	-4,340
Mar. 31	1.11	173,470	-4,370
Apr. 30	1.68	243,250	+69,780
May 31	1.83	262,020	+18,770
June 30	2.11	297,620	+35,600
July 31	1.89	269,790	-27,830
Aug. 31	1.81	259,700	-10,090
Sept. 30	1.90	271,060	+11,260
Water year 1963-64	-	-	+59,420

✓ Gage height at 2400.

GPO 819-718-6

5-2065. Leech Lake River at Federal Dam, Minn.

Location.--Lat 47°14'45", long 94°13'12", in sec.29, T.144 N., R.28 W., on right bank at dam on Leech Lake River at town of Federal Dam, 2 miles downstream from natural outlet of Leech Lake.

Drainage area.--1,163 sq mi.

Records available.--May 1884 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder, headwater gage, and staff tailwater gage, read twice daily. Datum of gage is 1,293.23 ft above mean sea level, adjustment of 1912. Prior to July 3, 1948, staff headwater gage at same datum. May 27 to Nov. 30, 1929, staff gage at site 600 ft downstream at different datum.

Average discharge.--80 years, 337 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 408 cfs Apr. 14; minimum daily, 90 cfs June 7.
1884-1964: Maximum daily discharge, 2,520 cfs June 7, 1957 (result of dam failure); no flow at times.

Remarks.--Discharge computed on basis of modified weir formula, the head being obtained from readings on tailwater gage and mean gage height from recording headwater gage. Flow completely regulated by Leech Lake (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; four discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	201	198	243	279	278	330	326	118	96	206	195	183
2	211	185	245	279	276	328	*325	120	100	206	197	186
3	197	188	243	285	276	330	325	96	96	200	200	195
4	194	183	243	283	276	330	326	120	94	195	199	218
5	194	204	243	283	276	328	325	131	95	190	195	195
6	191	256	245	282	285	328	335	103	94	190	202	188
7	195	253	243	282	282	328	345	118	90	204	200	188
8	192	251	250	283	276	326	345	105	93	196	178	189
9	192	266	252	287	272	326	345	115	100	193	173	191
10	188	279	252	279	272	324	341	104	109	196	179	213
11	182	280	250	282	270	326	339	107	132	194	195	211
12	186	265	250	279	274	320	339	102	224	193	188	211
13	189	252	250	279	276	304	343	104	192	194	183	205
14	186	250	250	278	274	337	408	105	178	194	182	185
15	181	252	250	279	274	324	380	117	182	192	195	186
16	*181	245	247	279	272	335	285	110	205	190	194	193
17	182	247	247	279	272	333	231	108	202	188	*192	194
18	202	245	247	279	274	318	93	109	211	185	187	191
19	202	245	245	278	274	318	107	122	241	180	183	193
20	195	245	243	278	274	330	108	112	195	188	193	193
21	191	241	243	279	270	335	112	115	188	187	180	193
22	211	245	241	279	270	328	135	116	183	196	201	194
23	208	260	239	279	272	322	102	114	207	191	210	209
24	212	243	241	*279	268	339	102	127	209	202	224	213
25	214	254	282	283	272	335	102	115	206	192	212	207
26	218	263	282	283	270	335	102	139	206	188	202	211
27	214	252	284	278	270	333	102	117	202	190	195	219
28	208	261	284	276	313	333	116	102	206	190	223	211
29	196	254	282	276	328	335	121	104	207	190	183	281
30	198	241	279	276	---	332	118	102	210	200	188	383
31	196	---	278	276	---	332	---	104	---	195	193	---
Total	6,107	7,303	7,873	8,676	8,036	10,182	7,083	3,481	4,953	5,995	6,021	6,229
Mean	197	243	254	280	277	328	236	112	165	193	194	208
Cfsm	0.169	0.209	0.218	0.241	0.238	0.282	0.203	0.096	0.142	0.166	0.167	0.179
In.	0.20	0.23	0.25	0.28	0.26	0.33	0.23	0.11	0.16	0.19	0.19	0.20

Calendar year 1963: Max 1,020 Min 51 Mean 298 Cfsm 0.256 In. 3.48
Water year 1963-64: Max 408 Min 90 Mean 224 Cfsm 0.193 In. 2.63

* Discharge measurement made on this day.

5-2105. Pokegama Lake near Grand Rapids, Minn.

Location.--Lat 47°10'00", long 93°33'20", in NW¼ sec.17, T.54 N., R.25 W., at narrows on State Highway 169, 4 miles south of Grand Rapids.

Drainage area.--3,265 sq mi.

Records available.--April 1884 to September 1964. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Pokegama Reservoir near Grand Rapids October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,264.89 ft above mean sea level, adjustment of 1912. Prior to May 30, 1949, staff gage at Pooles Arm of Pokegama Lake, 5 miles northwest at same datum.

Extremes.--Maximum contents during year, 63,260 acre-ft Sept. 7 (gage height, 9.43 ft); minimum, 36,270 acre-ft Apr. 5 (gage height, 7.42 ft).
1884-1964: Maximum contents, 121,400 acre-ft May 8, 1897 (gage height, 13.50 ft); minimum observed, 4,520 acre-ft below zero of capacity table Sept. 30, 1934 (gage height, 4.12 ft).

Remarks.--Reservoir is formed by Pokegama Lake and several other natural lakes controlled by concrete dam; storage began in 1884; original timber dam completed in 1884, replaced by present structure in 1888-89. Capacity between gage heights 6.00 ft and 12.0 ft (maximum allowable range) is 81,720 acre-ft, of which 53,150 acre-ft is controlled storage between gage heights 6.00 ft and 10.00 ft (normal operating range). Contents shown herein are contents above gage height 4.50 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1963 to September 1964

Date	Gage height (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	8.92	56,040	-
Oct. 31	9.17	59,550	+3,510
Nov. 30	9.26	60,840	+1,290
Dec. 31	8.96	56,580	-4,260
Calendar year 1963	-	-	+20,190
Jan. 31	8.58	51,460	-5,120
Feb. 29	7.90	42,530	-8,930
Mar. 31	7.48	37,040	-5,490
Apr. 30	8.78	54,160	+17,120
May 31	8.75	53,750	-410
June 30	9.28	61,120	+7,370
July 31	8.73	53,480	-7,640
Aug. 31	9.29	61,270	+7,790
Sept.30	9.06	57,980	-3,290
Water year 1963-64	-	-	+1,940

/ Gage height at 2400.

5-2110. Mississippi River at Grand Rapids, Minn.

Location.--Lat 47°13'56", long 93°31'48", in SW¼NW¼ sec.21, T.55 N., R.24 W., in super-calendar room of Blandin Paper Mill in Grand Rapids, 400 ft upstream from bridge on State Highway 169, 2.5 miles upstream from Prairie River, and at mile 1,182 above Ohio River.

Drainage area.--3,370 sq mi, approximately.

Records available.--October 1883 to September 1964. Monthly discharge only for some periods, published in WSP 1308. Published as "at Pokegama Dam near Grand Rapids" 1942-44.

Gage.--Water-stage recorder. Datum of gage is 1,242.00 ft above mean sea level, adjustment of 1912. Prior to Feb. 17, 1945, staff gages operated by Corps of Engineers at Pokegama Dam 3½ miles upstream at datum 22.89 ft higher. Feb. 17, 1945, to Sept. 3, 1948, water-stage recorder at site 300 ft upstream, within 0.10 ft of present datum. Sept. 9, 1948, to Jan. 6, 1949, staff gage at site 400 ft downstream at present datum. Jan. 7, 1949, to Jan. 16, 1951, tape float and inside staff gages at present site and datum.

Average discharge.--81 years, 1,107 cfs.

Extremes.--Maximum discharge during year, 3,120 cfs May 7 (gage height, 8.78 ft); maximum gage height, 9.06 ft May 11 (backwater from Prairie River); minimum discharge, 151 cfs Apr. 1 (gage height, 2.07 ft).
1883-64: Maximum discharge, 12,500 cfs Sept. 3, 1948 (gage height, 15.2 ft, from floodmark), caused by dam failure at gage, from rating curve extended above 4,500 cfs by logarithmic plotting; maximum daily, 5,250 cfs Sept. 5, 8, 1905; no flow at times in several years.

Remarks.--Records fair. Daily discharge, Oct. 1 to Mar. 12, is computed flow through Pokegama Dam and corrected to conform with discharge measurements. Flow completely regulated by Pokegama Lake (see preceding page). Backwater from Prairie River occurs at times in most years.

Cooperation.--Records furnished by Corps of Engineers, 1883-1944, 1959-64.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	436	480	696	729	782	771	*702	1,120	530	2,000	1,020	1,010
2	436	483	696	725	770	771	738	1,120	533	2,080	814	868
3	439	483	684	729	770	762	800	1,120	512	2,030	881	990
4	441	480	678	725	865	762	766	1,210	533	2,010	703	1,140
5	443	501	678	720	857	744	809	1,440	522	1,890	676	1,060
6	443	501	672	720	845	744	800	1,860	533	1,610	900	1,120
7	445	501	669	720	833	744	822	3,080	526	1,760	652	936
8	447	501	669	720	814	726	809	2,980	533	1,810	742	1,100
9	449	504	672	720	801	705	800	2,910	558	1,760	775	1,040
10	451	513	669	716	793	863	845	2,910	558	1,780	771	1,050
11	451	522	660	705	788	842	965	2,960	561	1,820	710	1,040
12	453	522	*660	699	839	826	1,030	2,890	596	1,720	779	1,040
13	453	531	660	693	830	762	1,120	2,790	600	1,650	*771	1,060
14	456	534	660	785	856	734	1,080	2,350	610	1,640	680	1,070
15	456	534	657	781	842	722	1,060	2,170	718	*1,670	575	1,040
16	456	540	660	773	832	750	1,280	2,090	1,030	1,620	652	1,040
17	*458	543	651	*773	818	734	1,160	1,940	1,020	1,590	656	1,040
18	458	549	651	768	804	691	1,020	1,760	1,110	1,590	634	1,010
19	461	549	648	762	790	742	1,060	1,380	1,350	1,610	638	990
20	461	564	648	758	782	722	1,150	a1,210	1,530	1,620	634	985
21	471	696	645	754	774	707	1,120	*1,140	1,600	1,550	738	868
22	483	714	642	743	767	699	940	1,100	1,600	1,520	652	915
23	485	711	639	738	767	703	688	950	1,750	1,410	648	980
24	490	708	653	738	746	710	758	950	1,730	1,550	656	920
25	487	702	715	743	832	691	970	975	1,870	1,400	771	881
26	487	708	760	738	815	684	1,100	890	1,950	1,500	666	910
27	485	702	757	725	801	688	1,390	762	1,950	1,500	666	854
28	485	702	751	715	789	666	*1,780	699	1,920	1,430	804	915
29	485	702	745	814	*789	688	1,720	558	1,890	1,330	1,080	965
30	485	696	737	801	----------	673	1,620	470	1,800	1,290	1,150	1,210
31	483	----------	733	794	----------	673	----------	522	----------	1,100	1,060	----------
Total	14,319	17,376	21,115	23,024	23,391	22,699	30,902	50,306	32,523	50,840	23,554	30,047
Mean	462	579	681	743	807	732	1,030	1,623	1,084	1,640	760	1,002
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1963: Max 2,220 Min 386 Mean 909 Ac-ft -
Water year 1963-64: Max 3,080 Min 436 Mean 929 Ac-ft -

* Discharge measurement made on this day.

5-2168. O'Brien Creek near Pengilly, Minn.

Location.--Lat 47°18'56", long 93°09'26", in SE¼ sec.20, T.56 N., R.22 W., on right bank 200 ft upstream from Duluth, Missabe and Iron Range Railroad bridge, 1.0 mile upstream from mouth and 2 miles southeast of Pengilly.

Records available.--April 1963 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,338.44 ft above mean sea level, datum of 1929 (Lake Survey reference mark). Prior to July 24, 1963, reference point at same site and datum.

Extremes.--Maximum discharge during year, 250 cfs June 24 (gage height, 4.27 ft); minimum, 3.2 cfs Feb. 21, 22; minimum gage height, 1.85 ft Jan. 13-16.
1963-64: Maximum discharge, that of June 24, 1964; minimum, that of Feb. 21, 22, 1964; minimum gage height, that of Jan. 13-16, 1964.

Remarks.--Records good. Flow affected by natural storage in lakes above station. One hundred and nine discharge measurements, ninety-eight were made by Hanna Mining, during the year.

Cooperation.--Additional discharge measurements furnished by M. A. Hanna Mining Co.

Rating tables, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 11		Apr. 12 to Sept. 30			
1.8	2.8	1.9	4.6	2.6	48
1.9	4.9	2.0	7.4	3.0	90
2.0	7.4	2.1	11	3.5	149
2.1	11	2.2	15	4.1	226
2.2	16	2.4	29		
2.4	30				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*7.4	6.9	6.9	4.2	4.2	4.4	*7.8	*45	*9.7	*21	5.4	31
2	6.9	7.4	6.4	4.4	4.0	*4.4	8.2	40	9.0	19	7.1	26
3	6.2	6.9	*6.2	4.4	*3.6	4.7	10	37	7.7	*18	*7.7	23
4	*5.4	6.4	5.9	4.4	3.8	5.4	14	46	*7.7	15	6.8	*23
5	5.4	*6.4	*6.2	4.4	3.8	8.5	15	*87	8.0	13	*6.0	24
6	5.6	6.6	6.2	4.4	3.8	10	*14	147	7.7	*11	6.0	20
7	6.2	*6.6	6.2	4.7	3.8	9.7	14	223	11	10	*5.2	20
8	*5.9	6.6	6.4	*4.7	3.6	8.9	12	186	14	*11	4.6	29
9	5.6	6.9	6.2	4.4	3.6	*8.5	11	101	*18	13	5.7	*34
10	5.1	8.2	*5.9	4.4	*3.6	8.5	15	59	16	*12	*7.7	29
11	*5.1	7.8	5.9	4.2	3.6	9.7	31	*42	*12	9.7	11	*22
12	4.9	8.2	*5.6	4.2	3.6	9.3	74	33	9.4	9.4	*13	18
13	4.9	8.2	5.6	*4.0	3.6	8.5	*125	26	7.7	*9.7	12	13
14	5.9	8.2	5.6	4.0	3.6	8.9	*155	*22	6.8	9.7	*11	*11
15	*6.4	8.2	5.4	3.8	3.6	11	112	*17	*6.5	*9.4	11	9.7
16	6.4	8.2	5.1	3.8	3.6	*12	77	18	*6.0	8.0	10	*9.0
17	*5.6	7.4	4.9	4.0	3.6	10	64	16	6.5	*7.7	*7.7	9.4
18	*5.1	7.2	4.7	4.2	3.6	8.9	49	*24	17	8.0	6.5	*9.0
19	5.1	*6.9	4.4	4.2	3.6	8.2	36	52	*40	7.4	5.2	8.0
20	6.4	6.6	4.2	*4.2	3.4	8.5	*30	*44	41	*8.7	6.0	8.4
21	7.8	*6.2	4.2	4.2	*3.2	8.5	*38	30	25	9.4	*16	*10
22	*8.9	8.9	4.2	4.4	3.2	8.9	89	*24	18	*9.4	24	12
23	11	15	4.0	*4.4	3.4	*8.9	*90	32	*63	9.0	18	*14
24	14	14	4.0	4.4	3.8	8.9	*60	48	*223	*9.4	*15	18
25	*19	12	4.2	4.4	*4.2	8.5	43	*41	192	9.0	14	*19
26	20	*10	*4.4	4.4	4.2	8.2	32	29	*86	8.7	12	27
27	16	9.3	4.4	4.4	4.2	7.8	*27	*19	39	*9.0	12	31
28	11	8.5	4.4	*4.2	4.4	7.8	32	14	25	9.0	*21	*28
29	*8.2	7.8	4.4	4.2	*4.4	7.4	*44	13	*18	*8.7	47	23
30	6.9	7.4	4.4	4.2	----------	*7.2	46	12	18	6.8	43	*19
31	*6.6	----------	*4.2	4.2	----------	7.4	----------	10	----------	*5.7	*36	----------
Total	244.9	244.9	160.7	132.4	108.6	257.5	1,375	1,537	968.7	324.8	413.6	577.5
Mean	7.90	8.16	5.19	4.27	3.76	8.31	45.8	49.6	32.3	10.5	13.3	19.2
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year : Max - Min - Mean - Ac-ft -
Water year 1963-64 Max 223 Min 3.2 Mean 17.3 Ac-ft -

* Discharge measurement made on this day.

5-2168.6 Swan River near Calumet, Minn.

Location.--Lat 47°17'20", long 93°13'54", in SW¼ sec.35, T.56 N., R.23 W., on left bank 1.0 mile downstream from Snowball Creek, 2.1 miles downstream from bridge on U. S. Highway 65 at outlet of Swan Lake and 3.1 miles southeast of Calumet.

Records available.--January to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,331.05 ft above mean sea level, datum of 1929 (Hanna Mining Company bench mark). Prior to June 5, 1964, reference point at same site and datum.

Extremes.--Maximum daily during period, 423 cfs May 8 (gage height, 4.16 ft); minimum daily, 8.1 cfs Aug. 16 (gage height, 1.47 ft).

Remarks.--Records good except those for period of May 6-17, which are fair.

Cooperation.--Additional discharge measurements and gage readings furnished by M. A. Hanna Mining Company.

Rating table, January to September 1964 (gage height, in feet, and discharge, in cubic feet per second) (Shifting-control method used May 5 to June 26)

1.5	8.4	3.0	140
1.7	16	3.5	230
2.0	33	4.0	350
2.5	75	4.3	435

Discharge, in cubic feet per second, January to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1				15	14	13	18	175	58	119	15	41
2				15	13	13	18	176	54	104	15	42
3				15	13	13	19	176	50	96	14	42
4				15	13	13	19	178	46	75	14	39
5				15	12	13	20	180	42	72	14	41
6				15	12	13	21	250	42	62	12	44
7				15	12	13	23	350	46	58	10	52
8				15	12	13	25	423	46	59	10	55
9				14	12	13	31	400	46	55	10	56
10				14	12	14	40	380	45	52	11	50
11				14	12	14	52	353	44	50	11	52
12				14	12	14	64	300	37	46	10	50
13				14	12	14	84	250	36	42	*9.4	48
14				14	12	14	105	220	36	39	9.1	46
15				14	12	14	130	187	35	36	9.1	44
16				14	12	14	155	176	31	*34	8.7	42
17				14	12	14	170	165	31	32	8.4	42
18				14	12	15	160	154	31	31	8.7	40
19				14	12	15	155	145	31	28	8.7	38
20				14	11	15	148	135	37	24	10	37
21				14	11	16	160	126	41	24	13	36
22				14	12	16	175	124	41	23	14	35
23				13	12	17	197	122	57	21	13	37
24				13	12	17	200	120	92	20	14	37
25				13	12	18	195	119	146	19	14	38
26				13	13	18	190	106	186	18	15	41
27				13	13	18	186	93	187	18	16	42
28				13	13	18	182	80	161	17	25	45
29				14	13	18	178	75	138	16	31	45
30				14	----------	18	175	70	130	16	34	47
31		----------		14	----------	18	----------	64	----------	16	37	----------
Total				436	355	466	3,295	5,872	2,003	1,322	444.1	1,304
Mean				14.1	12.2	15.0	110	189	66.8	42.6	14.3	43.5
Ac-ft				-	-	-	-	-	-	-	-	-

Calendar year	: Max	-	Min	-	Mean	-	Ac-ft	-	
Water year	: Max	-	Min	-	Mean	-	Ac-ft	-	

* Discharge measurement made on this day.

Note.--No gage-height record Jan. 1-5, 7-14, 16-19, 21-23, 25-29, Jan. 31 to Feb. 5, Feb. 7-12, 14-18, 20-25, Feb. 27 to Mar. 3, Mar. 5-10, 12-17, 19-24, 26-31, Apr. 2-7, 9-13, 15-19, 21-22, 24-26, 28-29, May 1-4, 6, 7, 9, 10, 12-14, 16, 17, 19, 20, 22-24, 26, 27, 30, 31, June 2-4.

5-2170. Swan River near Warba, Minn.

Location.--Lat 47°06'40", long 93°15'50", in SE¼ sec.33, T.54 N., R.23 W., on left bank 75 ft upstream from highway bridge, 1¾ miles south of Warba, 3¾ miles northwest of Swan River, and 22 miles upstream from mouth.

Drainage area.--254 sq mi.

Records available.--October 1953 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,259.80 ft above mean sea level (Minnesota State Highway Department bench mark).

Average discharge.--11 years, 120 cfs.

Extremes.--Maximum discharge during year, 570 cfs May 9 (gage height, 7.36 ft); minimum, 18 cfs Aug. 17 (gage height, 1.91 ft).
1953-64: Maximum discharge, 1,000 cfs Apr. 13, 1954 (gage height, 9.00 ft); maximum gage height, 9.02 ft Apr. 13, 1954 (backwater from ice); minimum discharge, 15 cfs Sept. 4, 5, 1961 (gage height, 1.65 ft).
Flood of May 1950 reached a stage of about 11.5 ft from information by local residents.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-3, Aug. 2 to Sept. 8)

1.7	17	4.0	175
2.0	31	6.0	378
2.4	54	7.0	510
3.0	95	8.0	698

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	49	55	61	41	38	*40	59	350	117	220	31	149
2	49	52	59	40	38	41	60	344	115	208	34	130
3	48	50	58	40	38	41	*61	332	100	182	44	123
4	47	49	57	40	38	42	63	344	89	153	47	122
5	47	49	56	40	38	42	65	394	85	134	37	102
6	54	49	54	39	38	43	68	463	82	124	32	98
7	49	59	52	39	38	43	75	531	87	115	32	134
8	49	61	51	39	38	43	82	559	90	100	28	195
9	49	65	50	39	38	44	100	568	100	130	24	199
10	48	66	49	39	38	44	135	556	100	125	22	178
11	46	63	49	39	38	44	175	534	89	111	21	154
12	46	60	49	39	38	45	235	516	78	101	*24	132
13	46	57	*48	39	38	45	320	497	73	93	24	117
14	45	55	48	39	38	46	420	476	69	84	21	108
15	44	54	48	39	38	46	455	449	68	*75	20	106
16	44	54	47	38	38	46	450	416	75	66	19	100
17	*44	54	47	38	38	47	430	375	87	62	19	96
18	46	53	46	38	39	47	345	345	95	56	26	*91
19	44	52	46	38	39	48	308	341	110	52	24	87
20	44	51	46	38	39	49	288	325	106	56	21	85
21	47	52	46	38	39	50	304	*295	91	61	26	85
22	76	67	46	*38	39	51	384	263	87	54	41	87
23	87	82	46	38	39	51	425	239	194	48	42	95
24	79	89	45	38	39	52	427	238	331	47	41	113
25	73	90	45	38	39	52	407	249	348	46	49	115
26	69	83	44	38	39	53	380	234	315	41	44	133
27	65	76	43	38	40	54	360	210	277	41	38	165
28	61	71	43	38	40	55	352	182	254	45	80	167
29	59	68	42	38	40	56	353	164	243	41	148	151
30	58	63	41	38	---	57	354	148	230	35	170	132
31	58	---	41	38	---	58	---	127	---	32	170	---
Total	1,670	1,849	1,503	1,199	1,117	1,475	7,940	11,064	4,185	2,738	1,399	3,749
Mean	53.9	61.6	48.5	38.7	38.5	47.6	265	357	140	88.3	45.1	125
Cfsm	0.212	0.243	0.191	0.152	0.152	0.187	1.04	1.41	0.551	0.348	0.178	0.492
In.	0.24	0.27	0.22	0.18	0.16	0.22	1.16	1.62	0.61	0.40	0.20	0.55

Calendar year 1963: Max 498 Min 26 Mean 99.1 Cfsm 0.390 In. 5.28
Water year 1963-64: Max 568 Min 19 Mean 109 Cfsm 0.429 In. 5.83

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 25 to Apr. 16 (no gage-height record Dec. 7-12).

5-2185. Sandy Lake at Libby, Minn.

Location.--Lat 46°46'40", long 93°19'20", in sec.36, T.50 N., R.24 W., on dam on Sandy River at Libby, 2.2 miles upstream from mouth, and 14 miles north of McGregor.

Drainage area.--421 sq mi.

Records available.--July to December 1893, October to December 1894, July 1895 to September 1964. Month-end contents only for some periods, published in WSP 1308. Published as Sandy Lake Reservoir at Libby October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,207.71 ft above mean sea level, adjustment of 1912. Prior to Sept. 23, 1949, float gage at same site and datum.

Extremes.--Maximum contents during year, 66,450 acre-ft May 14 (gage height, 10.42 ft); minimum, 34,950 acre-ft Mar. 3 (gage height, 7.00 ft).
1895-1964: Maximum contents, 167,200 acre-ft May 19, 1950 (gage height, 17.51 ft); minimum observed, 5,950 acre-ft below zero of capacity table Jan. 20, 1921 (gage height, 0.65 ft).

Remarks.--Reservoir is formed by Sandy, Flowage, Snake, and Aitkin Lakes controlled by concrete dam. Storage began in 1893; original timber crib dam completed in 1895, replaced by present structure in 1911. Capacity between gage heights 7.00 ft and 14.00 ft (minimum allowable limit to top of structure) is 73,330 acre-ft, of which 37,550 acre-ft is controlled storage between gage heights 7.00 ft and 11.00 ft (normal operating range). Contents shown herein are contents above gage height 1.72 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1963 to September 1964

	Gage height (feet)7/	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	9.06	53,080	-
Oct. 31	8.95	52,040	-1,040
Nov. 30	9.10	53,450	+1,410
Dec. 31	8.86	51,210	-2,240
Calendar year 1963	-	-	+6,110
Jan. 31	7.89	42,480	-8,730
Feb. 29	7.08	35,620	-6,860
Mar. 31	7.23	36,860	+1,240
Apr. 30	8.84	51,020	+14,160
May 31	9.02	52,690	+1,670
June 30	9.11	53,550	+860
July 31	8.95	52,040	-1,510
Aug. 31	9.05	52,980	+940
Sept. 30	9.03	52,780	-200
Water year 1963-64	-	-	-300

7/ Gage height at 2400.

5-2190. Sandy River at Sandy Lake Dam, at Libby, Minn.

Location.--Lat 46°47'18", long 93°19'06", in sec.25, T.50 N., R.24 W., at dam at outlet of Sandy Lake, a quarter of a mile north of Libby and 1.2 miles above mouth.

Drainage area.--421 sq mi.

Records available.--July 1893 to March 1894, July 1894, November 1894 to March 1895, August 1895 to September 1964. Monthly discharge only for some periods, published in WSP 1308. Published as "below Sandy Lake Reservoir" 1893-1916.

Gage.--Water-stage recorders on headwater and tailwater. Datum of gages is 1,207.71 ft above mean sea level, adjustment of 1912. Prior to June 20, 1949, staff gages at same site and datum.

Average discharge.--69 years (1895-1964), 200 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,740 cfs Sept. 15; minimum daily, 6 cfs many days.
1893-1964: Maximum daily discharge, 3,740 cfs July 12, 1897; no flow at times.

Remarks.--Discharge computed on basis of head over dam, using modified weir formula, head being obtained from headwater and tailwater recorder records. Flow completely regulated by Sandy Lake (see preceding page).

Cooperation.--Two discharge measurements made and records reviewed by Geological Survey. Computations of daily discharge furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6	6	92	140	171	108	23	280	6	745	6	370
2	6	6	94	140	171	*103	23	285	6	755	6	370
3	6	6	94	138	171	105	23	350	6	450	6	234
4	6	6	92	138	171	22	23	455	6	455	6	6
5	6	6	90	138	171	22	23	750	6	460	6	6
6	6	6	90	138	168	22	22	1,070	6	465	6	6
7	6	6	90	136	168	23	22	1,173	6	170	6	144
8	6	6	90	136	168	23	22	1,073	89	180	6	745
9	6	6	90	189	168	23	23	903	89	180	6	720
10	6	6	90	189	168	23	23	785	176	180	6	1,301
11	6	6	92	189	168	23	22	787	176	185	6	1,565
12	6	6	92	189	78	22	22	811	255	185	6	1,600
13	6	6	90	189	78	22	22	*832	256	185	6	1,650
14	6	6	90	186	114	22	390	824	223	6	6	1,690
15	6	6	90	186	112	22	360	866	172	6	6	1,740
16	6	6	90	186	112	22	340	936	87	6	6	1,700
17	6	6	90	183	112	22	340	1,068	87	6	6	1,695
18	6	6	90	180	112	22	330	1,186	82	6	6	1,675
19	6	6	90	180	112	23	330	1,201	109	6	6	1,670
20	6	94	90	180	112	23	335	1,297	152	6	6	1,650
21	6	94	90	180	112	23	515	1,412	148	6	6	1,635
22	47	92	88	180	112	23	800	1,510	146	6	6	700
23	138	92	88	180	112	23	755	1,605	206	6	6	750
24	138	90	90	180	112	23	780	1,579	392	6	6	770
25	138	92	90	177	112	23	820	1,200	560	6	80	735
26	142	92	90	177	112	23	663	429	690	6	92	730
27	140	92	90	180	112	23	445	108	705	6	92	335
28	142	92	88	177	110	23	450	6	725	6	231	340
29	142	92	88	177	110	23	290	6	730	6	400	350
30	142	92	88	174	----------	23	285	6	740	6	385	365
31	6	----------	140	171	----------	23	----------	6	----------	6	375	----------
Total	1,301	1,128	2,846	5,283	3,809	950	8,521	24,799	7,037	4,703	1,799	27,247
Mean	42.0	37.6	91.8	170	131	30.6	284	800	235	152	58.0	908
Cfsm	0.100	0.089	0.218	0.404	0.311	0.073	0.675	1.90	0.558	0.361	0.138	2.16
In.	0.11	0.10	0.25	0.47	0.34	0.08	0.75	2.19	0.62	0.42	0.16	2.41

Calendar year 1963: Max 910 Min 3 Mean 129 Cfsm 0.306 In. 4.13
Water year 1963-64: Max 1,740 Min 6 Mean 244 Cfsm 0.580 In. 7.90

* Discharge measurement made on this day.

5-2205. Mississippi River below Sandy River, near Libby, Minn.

Location.--Lat 46°47', long 93°20', in sec.25, T.50 N., R.24 W., on right bank 600 ft downstream from Sandy River, three-quarters of a mile northwest of Libby, and at mile 1,106 upstream from Ohio River.

Drainage area.--5,060 sq mi, approximately.

Records available.--April 1930 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,204.55 ft above mean sea level, adjustment of 1912. Prior to July 28, 1931, staff gage at site 600 ft upstream at datum 3.16 ft higher.

Average discharge.--34 years, 1,839 cfs.

Extremes.--Maximum discharge during year, 6,200 cfs May 14 (gage height, 12.89 ft); minimum, 625 cfs Aug. 17 (gage height, 2.79 ft).
1930-64: Maximum discharge, 16,000 cfs May 17, 1950 (gage height, 20.02 ft); minimum, 83 cfs Nov. 16, 1936 (gage height, 1.44 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated by powerplants and Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 70, 72, 74, 79).

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.5	499	7.0	2,780
3.0	718	9.0	3,880
4.0	1,190	11.0	5,020
5.0	1,710	13.0	6,270

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	745	722	930	920	1,000	*1,080	1,050	3,570	1,380	3,560	1,280	2,180
2	718	722	883	930	1,020	1,080	1,070	3,520	1,340	3,460	1,180	2,110
3	722	732	900	930	1,030	1,070	*1,090	3,370	1,300	3,320	1,100	1,810
4	750	736	920	940	1,040	1,070	1,110	3,450	1,190	3,300	997	1,510
5	714	732	940	940	1,050	1,060	1,140	3,820	1,080	3,240	968	1,610
6	700	732	960	960	1,050	1,060	1,170	4,420	1,060	3,100	911	1,770
7	709	736	980	970	1,040	1,050	1,180	5,080	1,070	2,700	897	2,270
8	718	732	980	970	1,030	1,040	1,220	5,450	1,130	2,480	963	2,960
9	714	754	970	970	1,020	1,040	1,290	5,700	1,140	2,510	846	2,960
10	718	777	960	980	1,020	1,040	1,380	5,880	1,250	2,500	832	3,410
11	700	777	950	980	1,020	1,040	1,500	6,020	1,250	2,450	855	3,540
12	696	781	940	980	1,020	1,050	1,620	*6,120	1,280	2,380	*832	3,440
13	686	768	*928	990	1,030	1,050	1,920	6,160	1,270	2,320	809	3,330
14	673	754	930	1,000	1,040	1,040	2,540	6,190	1,250	*2,080	837	3,250
15	682	745	920	1,020	1,040	1,040	2,860	6,180	1,210	1,960	837	3,210
16	669	768	920	1,030	1,050	1,030	3,140	6,080	1,150	1,910	750	3,190
17	682	768	920	1,040	1,060	1,030	3,250	5,900	1,350	1,870	651	3,170
18	*686	768	910	1,040	1,060	1,040	3,350	5,720	1,600	1,830	673	*3,150
19	709	777	910	1,050	1,060	1,040	3,350	5,540	2,010	1,780	686	3,120
20	718	837	900	1,060	1,060	1,040	3,300	*5,310	2,200	1,770	673	3,100
21	740	850	900	1,070	1,070	1,040	3,520	5,020	2,280	1,770	732	2,980
22	846	949	910	*1,090	1,070	1,050	4,020	4,690	2,340	1,720	777	2,540
23	949	1,110	920	1,080	1,070	1,050	4,080	4,450	2,960	1,610	832	2,470
24	944	1,120	940	1,040	1,070	1,060	3,910	4,200	3,850	1,550	827	2,520
25	897	1,020	940	1,030	1,070	1,070	3,710	3,710	4,110	1,500	907	2,520
26	916	1,070	940	1,020	1,080	1,040	3,460	2,970	4,050	1,510	930	2,550
27	897	1,100	940	990	1,080	1,040	3,180	2,470	3,910	1,510	987	2,550
28	893	1,070	940	980	1,080	1,040	3,230	2,190	3,830	1,590	1,310	2,520
29	878	1,080	930	1,000	1,080	1,040	3,280	2,020	3,740	1,610	1,660	2,420
30	860	1,050	920	1,000	---	1,040	*3,460	1,770	3,650	1,480	1,960	2,280
31	758	---	920	1,000	---	1,040	---	1,540	---	1,360	2,170	---
Total	23,687	25,537	28,851	31,000	30,410	32,500	74,380	138,510	61,230	67,730	30,669	80,440
Mean	764	851	931	1,000	1,049	1,048	2,479	4,468	2,041	2,185	989	2,681
Cfsm	0.151	0.168	0.184	0.198	0.207	0.207	0.490	0.883	0.403	0.432	0.195	0.530
In.	0.17	0.19	0.21	0.23	0.22	0.24	0.55	1.02	0.45	0.50	0.23	0.59

Calendar year 1963 Max 4,500 Min 669 Mean 1,605 Cfsm 0.317 In. 4.30
Water year 1963-64 Max 6,190 Min 651 Mean 1,707 Cfsm 0.337 In. 4.60

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 3 to Apr. 11.

5-2275. Mississippi River at Aitkin, Minn.

Location.--Lat 46°32'26", long 93°42'26", in W½ sec.24, T.47 N., R.27 W., at upstream side of highway bridge at north edge of Aitkin, 1 mile downstream from Mud River and at mile 1,055.9 upstream from Ohio River.

Drainage area.--6,140 sq mi, approximately.

Records available.--March 1945 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,185.41 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Mar. 1, 1945, to July 12, 1954, staff gage, July 13, 1954, to June 23, 1955, chain gage, June 24, 1955, to Mar. 14, 1961, wire-weight gage, at same site and datum.

Average discharge.--19 years, 2,732 cfs.

Extremes.--Maximum discharge during year, 8,990 cfs May 13 (gage height, 10.78 ft); minimum, 817 cfs Aug. 20 (gage height, -0.38 ft).
1945-64: Maximum discharge, 20,000 cfs May 20, 1950 (gage height, 19.49 ft); minimum, 151 cfs Sept. 1, 1961 (gage height, -2.40 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Slight regulation by powerplants and by Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p.70, 72, 74, 79). Water diverted at medium and high stages into Aitkin diversion channel 6½ miles above station, bypasses station and returns to river 15½ miles below station. Diversion began Apr. 2, 1955. These records include flow in diversion channel.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,030	1,010	1,160	1,050	1,180	1,130	1,140	4,960	2,130	4,290	1,700	3,460
2	1,010	943	1,140	1,050	1,180	1,140	1,170	5,000	1,930	4,170	1,660	3,350
3	974	922	1,140	1,050	1,190	1,140	1,240	4,930	1,820	4,010	1,570	3,190
4	957	922	1,180	1,050	1,200	1,130	1,300	5,000	1,740	3,850	1,470	2,790
5	964	922	1,220	1,050	1,190	1,120	1,400	5,400	1,640	3,730	1,330	2,380
6	943	918	1,260	1,040	1,190	1,110	1,580	6,220	1,530	3,630	1,220	2,360
7	918	915	1,260	1,040	1,190	1,110	1,720	7,220	1,470	3,490	1,260	3,690
8	908	918	1,250	1,040	1,180	1,100	1,880	7,770	1,450	3,190	1,190	5,360
9	908	929	1,200	1,040	1,180	1,100	2,060	8,150	1,510	2,910	1,190	5,790
10	908	940	1,160	1,050	1,190	1,100	2,290	8,390	1,570	2,850	1,200	5,970
11	908	960	1,120	1,060	1,200	1,110	2,640	8,610	1,660	2,870	1,160	6,210
12	890	974	1,080	1,060	1,200	1,130	3,010	8,860	1,690	2,790	1,150	6,230
13	873	978	1,050	1,070	1,200	1,140	3,370	*8,990	1,680	2,680	1,120	6,030
14	862	964	*1,000	1,080	1,190	1,150	4,330	8,980	1,650	*2,520	*1,050	5,800
15	862	946	1,000	1,090	1,180	1,160	5,020	8,910	1,610	2,350	1,020	5,530
16	859	932	1,000	1,100	1,160	1,170	*4,650	8,750	1,540	2,200	1,020	5,260
17	852	932	1,000	1,100	1,150	1,180	4,760	8,490	1,500	2,110	968	*5,090
18	*845	943	1,000	1,110	1,150	1,180	4,800	8,180	1,600	2,050	922	4,980
19	845	946	1,000	1,130	1,140	1,170	4,810	*7,760	1,830	1,990	859	4,750
20	852	950	1,000	1,140	*1,130	1,150	4,780	7,340	2,010	1,970	828	4,570
21	876	988	1,000	*1,150	1,130	1,130	4,870	6,900	2,010	1,940	834	4,350
22	954	1,060	1,000	1,150	1,130	1,100	5,450	6,460	2,100	1,900	915	4,130
23	1,030	1,140	1,000	1,160	1,120	1,100	5,920	6,030	3,000	1,850	985	3,860
24	1,170	1,260	1,030	1,160	1,120	1,100	6,040	5,650	3,770	1,770	1,060	3,820
25	1,230	1,330	1,040	1,160	1,110	*1,090	5,870	5,240	4,620	1,680	1,100	3,820
26	1,200	1,330	1,030	1,150	1,100	1,090	5,630	4,700	4,980	1,620	1,150	3,750
27	1,180	1,370	1,020	1,140	1,100	1,090	5,300	3,980	4,990	1,620	1,190	3,690
28	1,150	1,410	1,020	1,120	1,100	1,090	5,010	3,410	4,850	1,640	1,580	3,680
29	1,120	1,330	1,010	1,120	1,120	1,090	4,870	2,970	4,680	1,690	2,220	3,680
30	1,100	1,240	1,020	1,150	---	1,100	4,860	2,640	4,500	1,690	2,910	3,620
31	1,080	---	1,030	1,170	---	1,100	---	2,370	---	1,640	3,340	---
Total	30,258	31,322	33,420	34,030	33,600	34,800	111,770	198,260	73,060	78,690	41,171	131,190
Mean	976	1,044	1,078	1,098	1,159	1,123	3,726	6,395	2,435	2,538	1,328	4,373
Cfsm	0.159	0.170	0.176	0.179	0.189	0.183	0.607	1.04	0.397	0.413	0.216	0.712
In.	0.18	0.19	0.20	0.21	0.20	0.21	0.68	1.20	0.44	0.48	0.25	0.80

Calendar year 1963: Max 6,710 Min 845 Mean 2,020 Cfsm 0.329 In. 4.46
Water year 1963-64: Max 8,990 Min 828 Mean 2,272 Cfsm 0.370 In. 5.04

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 30 to Apr. 15. Computed from once-daily wire-weight gage readings by Corps of Engineers July 2-13, July 31 to Aug. 10, Aug. 17-24.

5-2305. Pine River Reservoir at Cross Lake, Minn.

Location.--Lat 46°40'09", long 94°06'44", in SW¼NW¼ sec.21, T.137 N., R.27 W., at dam on Pine River, at outlet of Cross Lake at village of Cross Lake.

Drainage area.--562 sq mi.

Records available.--March 1886 to September 1964. Month-end contents only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,216.32 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to May 3, 1949, staff gage at same site and datum.

Extremes.--Maximum contents during year, 99,980 acre-ft May 12 (gage height, 13.12 ft); minimum, 75,370 acre-ft Mar. 13 (gage height, 11.28 ft).
1886-1964: Maximum contents observed, 173,600 acre-ft July 10, 1916 (gage height, 18.24 ft); minimum observed, 1,310 acre-ft below zero of capacity table Aug. 20, 1918 (gage height, 1.35 ft).

Remarks.--Reservoir is formed by Trout, Whitefish, Rush, and Cross Lakes and several other natural lakes controlled by timber crib dams; storage began in 1886; dam completed in 1886. Capacity between gage heights 10.00 ft and 18.5 ft (maximum allowable range) is 118,710 acre-ft of which 53,280 acre-ft is controlled storage between gage heights 10.00 ft and 14.00 ft (normal operating range). Contents shown herein are contents above a gage height of 2.35 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1963 to September 1964

	Gage height (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	12.85	96,300	-
Oct. 31	12.85	96,300	0
Nov. 30	12.79	95,490	-810
Dec. 31	12.67	93,870	-1,620
Calendar year 1963	-	-	+10,720
Jan. 31	12.10	86,200	-7,670
Feb. 29	11.52	78,510	-7,690
Mar. 31	11.39	76,810	-1,700
Apr. 30	12.54	92,100	+15,290
May 31	12.81	95,760	+3,660
June 30	12.77	95,220	-540
July 31	12.59	92,790	-2,430
Aug. 31	12.94	97,500	+4,710
Sept.30	12.78	95,350	-2,150
Water year 1963-64	-	-	-950

/ Gage height at 2400.

5-2310. Pine River at Cross Lake Dam, at Cross Lake, Minn.

Location.--Lat 46°40'09", long 94°06'44", in SW¼NW¼ sec.21, T.137 N., R.27 W., at dam at outlet of Cross Lake at village of Cross Lake.

Drainage area.--562 sq mi.

Records available.--April 1886 to September 1964. Monthly discharge only for some periods, published in WSP 1308. Published as "below Pine River Reservoir" 1895-1916, 1929, and as "at Pine River Dam, at Cross Lake" 1941-56.

Gage.--Water-stage recorder, headwater gage, and tape float tailwater gage, read twice daily. Datum of gages is 1,216.32 ft above mean sea level, datum of 1929. Mar. 26, 1886, to May 31, 1929, staff gages on headwater and tailwater at same sites and datum. June 1 to Nov. 30, 1929, staff gage in tailwater at datum 1.60 ft lower. Dec. 1, 1929, to May 2, 1949, staff gage on headwater and Dec. 1, 1929, to August 1949, staff gage on tailwater at present sites and datum.

Average discharge.--78 years, 205 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 730 cfs Sept. 11-14; minimum daily, 35 cfs Nov. 3-8, 13-18.
1886-1964: Maximum daily discharge, 2,250 cfs in June 1896 (does not include flow bypassing dam through crevasse); no flow at times.

Remarks.--Discharge computed principally on basis of modified weir formula, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Pine River Reservoir (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; two discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	45	40	105	170	220	220	110	435	80	286	90	210
2	45	40	105	170	220	220	110	435	115	218	90	210
3	45	35	105	170	220	220	110	435	115	180	90	212
4	45	35	105	170	220	220	110	407	110	175	90	255
5	45	35	105	170	220	220	110	350	110	171	90	255
6	45	35	105	170	220	215	110	272	110	125	90	214
7	45	35	105	170	220	215	110	115	110	125	90	260
8	45	35	105	175	220	215	110	150	110	125	90	400
9	45	40	105	225	220	215	110	240	230	130	90	490
10	45	40	105	225	220	215	110	280	235	155	90	610
11	45	40	105	225	220	215	110	298	213	155	90	730
12	45	40	105	220	220	215	110	392	151	155	90	730
13	45	35	105	220	220	180	115	475	145	155	90	730
14	45	35	105	220	220	110	115	475	145	155	90	730
15	45	35	105	220	220	110	115	475	153	155	90	678
16	45	35	105	220	220	110	146	475	170	155	90	523
17	45	35	105	220	220	110	220	475	144	152	90	478
18	45	35	105	220	220	110	220	475	173	120	90	481
19	45	44	105	220	*220	110	220	475	300	120	*80	385
20	45	105	105	220	220	110	240	452	408	120	80	385
21	45	105	105	220	220	110	280	386	430	130	90	385
22	45	105	105	220	220	110	280	340	430	118	90	385
23	45	105	105	220	220	110	280	340	512	95	90	428
24	45	105	105	220	220	110	280	340	707	95	90	515
25	45	105	105	220	220	110	280	315	546	90	85	501
26	45	105	123	220	220	110	280	195	375	90	90	470
27	45	105	175	220	220	110	287	220	375	90	95	380
28	45	105	170	220	220	110	335	197	375	90	123	375
29	45	105	170	220	220	110	364	140	375	90	170	255
30	40	105	170	220	---	110	435	121	351	90	183	255
31	40	---	170	220	---	110	---	80	---	90	210	---
Total	1,385	1,859	3,603	6,440	6,380	4,765	5,812	10,260	7,803	4,200	3,096	12,915
Mean	44.7	62.0	116	208	220	154	194	331	260	135	99.9	430
Cfsm	0.080	0.110	0.206	0.370	0.391	0.274	0.345	0.589	0.463	0.240	0.178	0.765
In.	0.09	0.12	0.24	0.43	0.42	0.32	0.38	0.68	0.52	0.28	0.20	0.85

Calendar year 1963: Max 725 Min 35 Mean 126 Cfsm 0.224 In. 3.03
Water year 1963-64: Max 730 Min 35 Mean 187 Cfsm 0.333 In. 4.53

* Discharge measurement made on this day.

5-2315. Pelican Lake near Pequot Lakes, Minn.

Location.--Lat 46°37', long 94°11', in NE¼NE¼ sec.10, T.136 N., R.28 W., on downstream side of right abutment of dam and bridge on channel between Ossawinnamakee and Pelican Lakes, 0.5 mile upstream from Pelican Lake and 6 miles east of town of Pequot Lakes.

Records available.--April 1938 to September 1964 (fragmentary). Prior to October 1956, published as Pelican Lake diversion near Pequot Lakes.

Gage.--Staff gage read about three times weekly during open-water period. Datum of gage is 1,203.69 ft above mean sea level, datum of 1929 (levels by Minnesota Department of Conservation).

Extremes.--Maximum gage height observed during year, 2.69 ft Sept. 10; minimum observed, 1.94 ft Oct. 17.
1938-64: Maximum gage height observed, 4.12 ft May 23, 25, 27, 1950; minimum observed, 1.36 ft May 2, 1938.

Remarks.--Crest of stoplogs on dam is normally fixed at 1,207.19 ft, but may be lowered to 1,203.69 ft (elevation of sill and apron) by removal of stoplogs.

Gage height, in feet, October 1963 to September 1964

Oct. 17 .....1.94	June 30 .....2.34	Sept. 30 .....2.64
Apr. 30 .....2.26	July 30 .....2.18	
May 30 .....2.24	Aug. 31 .....2.48	

Note.--Gage readings other than those shown are available.

5-2440. Crow Wing River at Nimrod, Minn.

Location.--Lat 46°39', long 94°53', in sec.32, T.137 N., R.33 W., on right bank 200 ft upstream from highway bridge, 0.2 mile north of Minrod, and 0.7 mile upstream from Cat River.

Drainage area.--1,010 sq mi, approximately.

Records available.--April 1910 to September 1914, July 1930 to September 1964 (winter records incomplete prior to 1940).

Gage.--Water-stage recorder. Datum of gage is 1,313.27 ft above mean sea level, datum of 1929 (levels by Wadena County Highway Department from Minnesota Highway Department bench mark). Apr. 15, 1910, to Sept. 30, 1914, chain gage at bridge 10 ft downstream at datum 2.2 ft lower. July 28, 1930, to Aug. 19, 1948, chain gage and Aug. 20, 1948, to Nov. 4, 1949, wire-weight gage, at bridge 10 ft downstream at same datum.

Average discharge.--25 years (1939-64), 448 cfs.

Extremes.--Maximum discharge during year, 1,600 cfs Apr. 12 (gage height, 4.98 ft); maximum gage height, 5.68 ft Apr. 12 (backwater from ice); minimum discharge, 152 cfs Nov. 23.
1910-14, 1930-64: Maximum discharge, 2,750 cfs May 23, 1962 (gage height, 6.04 ft); maximum gage height, 7.64 ft Apr. 20, 1950 (backwater from ice); minimum discharge observed, 45 cfs Aug. 7, 1936.

Remarks.--Records good except those for period of ice effect, which are fair. Flow affected by natural storage in many lakes.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	410	278	320	265	250	260	310	865	355	504	333	482
2	394	278	320	270	245	260	330	839	338	476	306	476
3	372	268	320	270	245	255	360	796	328	448	294	470
4	360	257	320	270	250	255	400	833	306	421	289	460
5	333	247	330	270	250	250	420	926	*268	404	284	454
6	322	252	330	265	250	250	450	1,020	252	394	284	476
7	316	247	330	265	245	250	480	1,020	262	377	284	711
8	306	252	325	265	240	250	500	975	268	360	289	728
9	306	262	320	265	240	255	550	919	300	360	294	672
10	300	273	315	260	240	260	600	872	328	382	300	672
11	300	273	310	255	245	265	700	833	360	360	300	666
12	289	273	305	255	245	270	975	802	416	328	289	616
13	284	278	300	255	240	280	947	772	432	311	289	593
14	278	273	295	255	245	290	996	744	432	289	278	576
15	278	278	295	255	250	300	1,090	728	404	278	268	543
16	273	284	285	255	250	300	1,040	711	388	278	268	543
17	268	284	280	260	*255	290	996	688	416	*273	252	537
18	268	284	*270	255	250	295	975	672	504	262	*247	520
19	273	289	265	250	250	300	989	644	571	252	242	515
20	268	289	265	255	250	305	989	616	593	268	242	504
21	278	294	260	260	245	305	1,100	599	588	257	311	492
22	294	*328	260	260	245	305	1,230	582	593	257	316	476
23	300	203	260	255	245	*310	1,200	565	649	262	322	504
24	*300	330	260	250	245	300	1,140	543	677	311	333	*537
25	289	340	265	*245	245	295	1,070	532	666	300	333	537
26	284	350	265	240	245	290	1,000	509	655	294	328	548
27	289	345	260	240	245	290	968	482	649	284	366	599
28	294	340	255	240	250	290	*947	443	616	278	526	604
29	294	335	255	245	255	290	912	404	565	273	504	565
30	294	330	255	250	----------	290	879	382	526	268	520	537
31	289	----------	260	250	----------	300	----------	366	----------	262	504	----------
Total	9,403	8,614	8,955	7,950	7,155	8,705	24,543	21,682	13,705	10,071	9,995	16,613
Mean	303	287	289	256	247	281	818	699	457	325	322	554
Cfsm	0.300	0.284	0.286	0.253	0.245	0.278	0.810	0.692	0.452	0.322	0.319	0.549
In.	0.35	0.32	0.33	0.29	0.26	0.32	0.90	0.80	0.50	0.37	0.37	0.61

Calendar year 1963: Max 1,130 Min 168 Mean 379 Cfsm 0.375 In. 5.11
Water year 1963-64: Max 1,230 Min 203 Mean 403 Cfsm 0.399 In. 5.42

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 24 to Apr. 12.

5-2465. Gull Lake near Brainerd, Minn.

Location.--Lat 46°24'40", long 94°21'26", in N½ sec.20, T.134 N., R.29 W., in pool of dam on Gull River, 800 ft south of outlet of Gull Lake, a quarter of a mile upstream from Gull Lake Dam, and 8 miles northwest of Brainerd.

Drainage area.--287 sq mi.

Records available.--August 1911 to September 1964. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Gull Lake Reservoir October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,188.14 ft above mean sea level, adjustment of 1912. Prior to Aug. 10, 1949, staff gage 800 ft north of present site at same datum.

Extremes.--Maximum contents during year, 61,670 acre-ft Sept. 9 (gage height, 6.30 ft); minimum, 45,980 acre-ft Mar. 3 (gage height, 5.09 ft).
1911-64: Maximum contents, 74,800 acre-ft June 30, 1914 (gage height, 7.30 ft); minimum observed, 22,250 acre-ft Mar. 20, 1924 (gage height, 3.00 ft).

Remarks.--Reservoir is formed by Gull Lake and several other natural lakes controlled by concrete dam completed in 1913; storage began in 1912. Capacity between gage heights 5.00 ft and 7.00 ft (maximum allowable range and normal operating range) is 26,020 acre-ft. Contents shown herein are contents above gage height 1.00 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers, in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1963 to September 1964

	Gage height (feet)/	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	5.98	57,500	-
Oct. 31	5.88	56,190	-1,310
Nov. 30	5.73	54,260	-1,930
Dec. 31	5.59	52,460	-1,800
Calendar year 1963	-	-	+2,730
Jan. 31	5.31	48,820	-3,640
Feb. 29	5.10	46,120	-2,700
Mar. 31	5.22	47,660	+1,540
Apr. 30	5.97	57,370	+9,710
May 31	5.89	56,320	-1,050
June 30	6.02	58,020	+1,700
July 31	5.92	56,710	-1,310
Aug. 31	6.19	60,230	+3,520
Sept.30	5.97	57,370	-2,860
Water year 1963-64	-	-	-130

/ Gage height at 2400.

5-2470. Gull River at Gull Lake Dam, near Brainerd, Minn.

Location.--Lat 46°24'40", long 94°21'12", in sec.20, T.134 N., R.29 W., in headwater and tailwater of dam at outlet of Gull Lake, 8 miles northwest of Brainerd.

Drainage area.--287 sq mi.

Records available.--August 1911 to September 1964. Monthly discharge only for some periods, published in WSP 1308. Published as "at Gull Lake Reservoir" 1929.

Gage.--Water-stage recorder on headwater and staff gage on tailwater. Datum of gages is 1,188.14 ft above mean sea level, adjustment of 1912. August 1911 to May 23, 1929, and Dec. 1, 1929, to Aug. 1, 1949, both gages were staff gages at same site and datum. May 24 to Nov. 30, 1929, staff gage 500 ft downstream at different datum.

Average discharge.--53 years, 99.5 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 478 cfs June 24; minimum daily, 15 cfs many days.
1911-64: Maximum daily discharge, 1,120 cfs May 15, 1938; no flow at times.

Remarks.--Discharge computed at dam on basis of modified weir formulas, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Gull Lake (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; one discharge measurement made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	22	19	83	65	92	69	36	179	15	110	15	184
2	23	18	80	65	90	68	36	179	15	61	15	182
3	22	18	79	66	90	68	36	176	15	62	15	180
4	21	18	78	66	88	69	37	180	15	59	15	179
5	21	18	77	65	88	69	39	187	15	19	15	175
6	21	18	77	65	87	69	45	190	15	15	15	171
7	21	18	76	66	87	70	49	268	15	15	15	259
8	21	18	83	65	85	70	49	265	15	15	15	336
9	20	18	83	120	84	70	50	266	15	15	15	328
10	20	18	80	115	84	70	52	263	15	15	15	334
11	20	18	78	114	84	68	55	265	15	23	15	332
12	20	18	77	112	84	26	59	265	15	22	15	327
13	19	18	77	111	81	26	73	261	15	22	15	321
14	19	18	76	111	80	27	112	210	15	15	15	315
15	19	18	76	110	79	26	231	185	15	15	15	233
16	19	18	75	110	79	27	240	185	15	15	15	119
17	19	16	75	110	78	27	326	182	15	15	15	119
18	19	16	73	106	78	27	324	182	27	15	15	118
19	19	16	73	105	*77	29	324	112	122	15	15	118
20	19	92	71	102	76	32	323	110	188	15	15	118
21	19	90	70	101	75	33	346	59	184	15	15	116
22	22	96	70	101	73	33	413	60	252	15	15	115
23	22	96	69	97	73	34	409	62	383	15	15	123
24	23	91	69	98	73	35	409	63	478	15	15	253
25	22	90	69	101	72	35	407	22	386	15	15	240
26	22	88	69	98	72	35	319	22	235	15	15	242
27	22	87	69	97	71	35	243	22	242	15	15	171
28	21	88	68	95	70	35	247	20	235	15	31	63
29	20	86	67	93	70	35	171	15	102	15	119	23
30	19	85	67	93	---	36	179	15	110	15	124	63
31	19	---	66	92	---	35	---	15	---	15	191	---
Total	635	1,326	2,300	2,915	2,320	1,388	5,639	4,485	3,199	723	870	5,855
Mean	20.5	44.2	74.2	94.0	80.0	44.8	188	145	107	23.3	28.1	195
Cfsm	0.071	0.154	0.259	0.328	0.279	0.156	0.655	0.505	0.373	0.081	0.098	0.679
In.	0.08	0.17	0.30	0.38	0.30	0.18	0.73	0.58	0.41	0.09	0.11	0.76

Calendar year 1963: Max 445 Min 15 Mean 68.5 Cfsm 0.239 In. 3.24
Water year 1963-64: Max 478 Min 15 Mean 86.5 Cfsm 0.301 In. 4.09

* Discharge measurement made on this day.

GPO 819-718-7

5-2670. Mississippi River near Royalton, Minn.

Location.--Lat 45°51'40", long 94°21'30", in lot 2, sec.20, T.39 N., R.32 W., at plant of Minnesota Power & Light Co., 4 miles northwest of Royalton, and 4.5 miles downstream from Swan River, and at mile 956 upstream from Ohio River.

Drainage area.--11,600 sq mi, approximately.

Records available.--March 1924 to September 1964.

Average discharge.--40 years, 3,872 cfs.

Extremes.--Maximum daily discharge during year, 14,900 cfs May 13; minimum daily, 1,170 cfs Dec. 3.
1924-64: Maximum daily discharge, 29,400 cfs Apr. 13, 1952; minimum daily, 254 cfs Nov. 25, 1936.

Remarks.--Records fair. Discharge computed on basis of powerplant records. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see p. 70, 72, 74, 79, 87, 83).

Cooperation.--Records collected by Minnesota Power & Light Co. under general supervision of Geological Survey, in connection with a Federal Power Commission project.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,100	2.080	1,840	1,850	1,990	1,830	2,020	9,890	4,000	7,010	2,460	6,100
2	2,120	1,920	1,430	1,940	2,040	1,820	2,140	9,010	3,480	6,300	2,840	6,440
3	2,150	1,830	1,170	1,930	2,050	2,010	2,700	8,910	3,170	6,280	2,790	6,560
4	2,020	1,650	1,650	1,940	2,070	1,890	2,960	9,000	3,200	6,180	2,520	5,850
5	1,880	1,720	1,900	1,960	2,120	1,810	3,350	9,670	3,590	5,280	2,190	5,200
6	1,880	1,760	2,370	2,150	2,280	1,940	3,550	10,300	2,980	5,400	2,220	4,890
7	1,940	1,870	2,590	1,960	2,020	2,050	3,620	11,200	2,380	5,200	1,850	5,500
8	1,840	1,880	2,550	1,990	2,100	1,900	3,610	13,700	2,030	4,700	*1,800	7,370
9	1,800	1,720	1,910	1,880	2,150	1,850	4,190	14,000	2,400	4,700	1,850	9,840
10	1,820	1,790	1,520	1,980	2,120	1,860	4,590	14,200	2,660	4,280	1,820	10,700
11	1,760	1,760	1,480	1,920	2,020	1,790	5,240	14,800	2,580	4,160	1,900	10,600
12	1,770	2,130	1,830	1,940	1,680	1,860	5,950	14,800	*2,560	3,990	1,870	10,700
13	1,770	1,950	1,840	1,950	2,300	1,920	6,840	14,900	2,690	4,020	1,740	10,700
14	1,780	1,460	1,920	2,020	2,150	2,030	9,950	14,400	3,060	3,980	1,740	10,500
15	1,790	1,740	1,760	2,000	1,970	2,280	10,700	14,400	2,930	3,580	1,630	10,100
16	1,790	1,760	1,780	1,960	1,940	2,350	12,600	14,000	2,630	3,290	1,770	9,760
17	1,680	2,040	*2,120	1,930	1,860	2,120	13,500	13,500	2,700	3,340	1,750	9,170
18	1,760	2,030	1,720	1,980	*1,900	2,270	13,100	13,500	2,790	3,170	1,540	8,440
19	1,820	1,890	1,790	2,020	1,940	2,390	12,700	12,800	3,310	2,890	1,580	8,360
20	1,620	1,540	1,820	2,040	2,070	2,310	11,900	12,000	3,740	2,960	1,430	7,560
21	1,820	1,570	1,760	2,090	1,960	2,220	12,200	11,300	4,440	2,670	1,680	7,760
22	2,050	2,290	1,650	2,040	1,910	2,130	12,000	10,800	5,200	2,810	2,080	7,370
23	2,210	1,990	1,720	2,040	1,870	2,220	12,300	10,000	5,880	2,820	1,760	7,240
24	*2,160	2,060	1,720	2,000	1,940	2,060	12,800	9,580	6,520	2,710	2,020	7,090
25	2,200	1,920	1,840	2,100	1,870	1,920	13,100	8,810	7,420	2,520	2,260	6,230
26	2,180	2,190	1,840	2,020	1,840	2,120	12,600	8,220	8,120	2,330	1,960	6,660
27	2,190	2,660	1,970	2,040	1,760	1,990	*12,000	7,150	8,730	2,310	2,070	6,570
28	2,260	2,750	1,840	2,050	1,820	2,030	11,400	6,170	8,620	2,500	2,400	6,660
29	1,990	2,420	1,760	2,040	1,840	2,070	9,680	5,630	7,580	2,420	2,940	6,550
30	2,090	2,140	1,770	1,950	----------	1,990	9,900	4,700	7,540	2,090	4,700	6,320
31	2,140	----------	1,810	2,010	----------	1,980	----------	4,360	----------	2,320	5,470	----------
Total	60,380	58,510	56,670	61,720	57,580	63,010	253,190	335,700	128,930	118,210	68,630	232,790
Mean	1,948	1,950	1,828	1,991	1,986	2,033	8,440	10,830	4,298	3,813	2,214	7,760
Cfsm	0.168	0.168	0.158	0.172	0.171	0.175	0.728	0.934	0.371	0.329	0.191	0.669
In.	0.19	0.19	0.18	0.20	0.18	0.20	0.81	1.08	0.41	0.38	0.22	0.75

Calendar year 1963: Max 11,300 Min 1,170 Mean 3,619 Cfsm 0.312 In. 4.23
Water year 1963-64: Max 14,900 Min 1,170 Mean 4,086 Cfsm 0.352 In. 4.79

* Discharge measurement made on this day.

5-2705. Sauk River near St. Cloud, Minn.

Location.--Lat 45°33'35", long 94°14'00", in SE¼SW¼ sec.8, T.124 N., R.28 W., on right bank half a mile northwest of Waite Park, 3 miles west of St. Cloud, and 5 miles upstream from mouth.

Drainage area.--925 sq mi.

Records available.--July 1909 to December 1912, April to December 1913, May to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,034.95 ft above mean sea level, adjustment of 1912. Prior to Nov. 22, 1934, chain gage on highway bridge 1 mile downstream at datum 6.77 ft lower.

Average discharge.--34 years (1909-12, 1930-31, 1934-64), 239 cfs.

Extremes.--Maximum discharge during year, 1,350 cfs Apr. 23 (gage height, 4.05 ft); minimum, 23 cfs Nov. 30; minimum gage height, 0.54 ft Nov. 30, Dec. 8 (result of freezeup).
1909-13, 1929-64: Maximum discharge, 5,580 cfs Apr. 13, 1951 (gage height, 7.89 ft); minimum, 0.3 cfs Nov. 25, 1936.

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated by powerplants and reservoirs above station.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 21, July 15 to Sept. 1, Sept. 27-30)

0.7	44	2.0	346
1.0	89	3.0	748
1.5	199	4.0	1,320

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*84	75	62	52	50	52	171	458	125	52	43	64
2	89	72	60	52	50	52	199	441	123	54	38	64
3	86	67	59	52	50	52	237	416	116	51	*36	61
4	79	66	57	51	50	53	278	590	108	50	37	60
5	78	67	55	51	50	53	350	1,190	101	50	37	58
6	73	68	54	51	50	54	452	555	98	52	43	55
7	70	67	53	51	50	54	400	576	87	52	43	55
8	73	66	51	50	50	55	330	515	83	52	38	57
9	72	66	50	50	50	56	340	576	94	*57	43	62
10	70	66	50	50	50	57	362	543	84	60	43	67
11	68	64	50	50	50	59	389	535	81	64	45	62
12	66	68	51	50	51	60	403	535	*76	60	44	64
13	64	66	51	50	51	62	469	515	78	54	41	70
14	60	61	51	50	51	64	535	503	73	52	41	83
15	58	58	52	49	51	66	*519	476	66	51	47	94
16	58	58	52	49	51	67	543	448	67	51	40	*112
17	58	57	53	49	*51	70	576	410	73	50	33	129
18	58	55	*54	49	51	72	576	*382	78	54	33	138
19	58	57	54	49	51	73	572	366	79	47	36	152
20	58	58	55	49	52	75	568	327	76	43	37	164
21	66	61	55	49	52	79	604	306	67	44	61	172
22	89	79	55	49	52	82	822	286	62	43	51	183
23	94	72	55	50	52	*85	1,300	263	73	44	45	234
24	94	78	55	50	52	90	590	248	79	43	47	225
25	*94	81	55	50	52	96	507	225	68	41	50	194
26	91	80	55	*50	52	100	503	211	66	40	44	191
27	89	77	54	50	52	108	483	191	62	38	52	205
28	84	74	54	50	52	115	499	177	57	37	68	170
29	83	70	54	50	52	120	507	162	52	37	73	162
30	79	66	53	50	----------	129	507	147	51	41	112	150
31	76	----------	53	50	----------	140	----------	134	----------	43	67	----------
Total	2,319	2,020	1,672	1,552	1,478	2,350	14,591	12,707	2,403	1,507	1,468	3,557
Mean	74.8	67.3	53.9	50.1	51.0	75.8	486	410	80.1	48.6	47.3	119
Cfsm	0.081	0.073	0.058	0.054	0.055	0.082	0.525	0.443	0.087	0.052	0.051	0.129
In.	0.09	0.08	0.07	0.06	0.06	0.09	0.59	0.51	0.10	0.06	0.06	0.14

Calendar year 1963: Max 882 Min 48 Mean 148 Cfsm 0.160 In. 2.17
Water year 1963-64: Max 1,300 Min 33 Mean 130 Cfsm 0.141 In. 1.91

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23 to Apr. 8 (no gage-height record Dec. 11-17).

5-2750. Elk River near Big Lake, Minn.

Location.--Lat 45°20', long 93°40', in sec.23, T.33 N., R.27 W., on right bank at upstream side of highway bridge, 4 miles east of Big Lake and 4 miles downstream from St. Francis River.

Drainage area.--615 sq mi.

Records available.--April 1911 to September 1917, April to September 1931, April to November 1932, March to November 1933, March 1934 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 899.60 ft above mean sea level, datum of 1929. April 1911 to Sept. 30, 1917, staff gage and Apr. 1, 1931, to July 26, 1934, chain gage, at same site and datum.

Average discharge.--36 years (1911-17, 1934-64), 240 cfs.

Extremes.--Maximum discharge during year, 1,620 cfs May 13 (gage height, 4.80 ft); minimum discharge, 30 cfs Aug. 6 (gage height, 0.54).
1911-17, 1931-64: Maximum discharge, 5,330 cfs Apr. 10, 1952 (gage height, 10.36 ft), from rating curve extended above 3,800 cfs; minimum, 3.6 cfs July 31, 1934.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 4		Apr. 5 to Sept. 30			
0.9	87	0.5	23	2.0	500
1.1	142	0.7	58	3.0	880
1.5	285	1.0	128	4.0	1,270
		1.5	310	5.0	1,710

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*152	110	124	78	74	84	142	386	177	96	45	120
2	142	107	123	77	74	85	150	378	174	93	40	125
3	136	104	122	77	74	87	161	359	166	87	*38	125
4	130	102	120	77	74	90	170	*352	160	82	38	117
5	124	102	116	76	74	91	268	367	152	78	35	106
6	118	102	112	76	75	94	*333	538	146	78	36	98
7	112	102	106	76	75	97	390	698	142	78	40	96
8	110	102	102	76	76	104	*401	831	142	78	37	106
9	110	102	95	76	76	107	386	929	142	*98	40	111
10	112	102	94	76	76	109	405	1,050	156	89	53	108
11	112	102	92	76	76	112	432	*1,310	156	85	54	98
12	124	102	91	75	76	118	432	1,580	142	86	51	89
13	112	100	90	75	76	121	465	1,590	132	80	51	82
14	104	100	88	75	76	124	496	1,470	132	74	47	78
15	104	97	86	75	76	126	496	1,340	142	70	45	76
16	104	97	84	74	76	129	504	1,200	*138	66	49	*76
17	112	97	83	74	*76	*130	530	1,050	142	62	53	74
18	121	100	82	74	77	133	530	918	149	58	49	72
19	121	100	*82	74	77	136	504	785	142	58	47	72
20	118	102	80	74	78	140	458	671	128	56	53	76
21	124	102	79	74	78	142	439	580	132	54	80	80
22	136	127	78	74	78	144	428	492	132	53	100	80
23	139	130	78	74	78	149	420	443	135	51	108	89
24	136	112	78	74	79	148	432	394	132	49	100	93
25	*130	133	78	74	80	147	451	378	125	44	106	93
26	127	133	78	73	81	144	451	291	114	44	100	89
27	124	130	78	73	81	142	424	257	108	42	93	85
28	118	130	78	*72	82	141	397	235	103	49	98	85
29	115	124	78	72	82	140	378	216	96	49	103	80
30	115	125	78	72	---	140	375	202	89	47	114	76
31	110	---	78	73	---	140	---	188	---	47	120	---
Total	3,752	3,278	2,831	2,316	2,231	3,794	11,848	21,478	4,126	2,081	2,023	2,755
Mean	121	109	91.3	74.7	76.9	122	395	693	138	67.1	65.3	91.8
Cfsm	0.197	0.177	0.148	0.121	0.125	0.198	0.642	1.13	0.224	0.109	0.106	0.14
In.	0.23	0.20	0.17	0.14	0.13	0.23	0.72	1.30	0.25	0.13	0.12	0.1

Calendar year 1963: Max 974 Min 66 Mean 200 Cfsm 0.325 In. 4.42
Water year 1963-64: Max 1,590 Min 35 Mean 171 Cfsm 0.278 In. 3.79

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 30 to Apr. 4.

5-2780. Middle Fork Crow River near Spicer, Minn.

Location.--Lat 45°15'45", long 94°48'10", in NE¼ sec.27, T.121 N., R.33 W., on right bank 75 ft upstream from highway bridge, 1½ miles downstream from Lake Calhoun, 3 miles downstream from Green Lake, and 6.8 miles northeast of Spicer.

Drainage area.--179 sq mi.

Records available.--March 1949 to September 1964.

Gage.--Water-stage recorder and concrete and steel V-notch sharp-crested weir. Datum of gage is 1,147.93 ft above mean sea level, datum of 1929 (Kandiyohi County Highway Department bench mark). Prior to July 20, 1950, chain gage at bridge 75 ft downstream at same datum.

Average discharge.--15 years, 46.8 cfs.

Extremes.--Maximum discharge during year, 196 cfs May 6 (gage height, 4.99 ft); minimum, no flow Dec. 8; minimum gage height, 1.28 ft Dec. 8.
1949-64: Maximum discharge, 408 cfs June 29, 1953; maximum gage height, 6.67 ft June 25, 1957; no flow Mar. 15-24, 1949, Feb. 26 to Mar. 26, 1960, Dec. 8, 1963.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Flow affected by natural storage and some regulation from lakes above station.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used May 5-17)

1.6	0.5	2.3	17
1.7	.8	2.5	26
1.8	1.3	3.0	51
1.9	2.3	4.0	120
2.0	4.7	5.0	210
2.1	8.1		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6.1	6.1	2.0	2.5	1.2	1.1	2.8	150	62	26	2.6	5.0
2	6.4	4.0	2.0	2.6	1.2	1.1	4.8	163	78	25	2.6	4.4
3	5.0	3.5	2.1	2.6	1.2	1.1	7.5	159	92	23	2.4	5.0
4	3.7	3.5	2.1	2.6	1.3	1.0	11	165	100	21	2.4	5.4
5	3.2	3.5	2.1	2.6	1.3	1.0	13	170	105	20	3.0	3.7
6	3.2	4.0	2.0	2.5	1.3	1.0	20	183	102	*21	3.7	3.2
7	3.7	3.5	2.0	2.5	1.3	1.0	26	166	89	20	*2.6	3.7
8	3.5	3.5	.5	2.4	1.3	1.0	32	143	*75	18	2.0	4 0
9	3.2	5.4	.9	2.4	1.3	1.1	39	136	76	16	2 0	*4.4
10	3.0	7.1	1.5	2.4	1.3	1.1	*45	104	79	16	2.0	5.7
11	3.2	8.5	2.0	2.4	1.3	1.2	52	77	75	16	2.0	4.0
12	2.6	9.4	2.1	2.5	1.2	1.2	59	78	75	14	1.8	3.2
13	2.4	5.0	*2.2	2.6	1.2	1.3	95	*90	73	14	1.7	2.8
14	2.4	3.5	2.4	2.8	1.2	1.3	125	118	68	13	1.7	3.0
15	2.3	3.5	2.4	3.0	1.2	1.3	114	138	66	12	1.7	2.0
16	2.4	3.5	2.3	*3.4	1.3	1.3	110	150	57	11	1.7	1.9
17	2.4	3.5	2.3	3.6	1.3	1.3	117	141	55	11	1.6	1.8
18	2.4	3.2	2.3	3.8	1.3	1.2	106	119	53	11	1.6	1.8
19	2.6	3.0	2.2	3.9	1.2	1.2	88	101	57	9.4	1.7	1.8
20	3.2	*2.6	2.2	3.8	1.1	1.2	77	113	53	8.9	2.0	1.9
21	*6.7	2.6	2.2	3.6	1.1	1.3	92	134	47	8.1	3.0	1.7
22	13	7.8	2.2	3.3	1.0	1.3	95	142	43	6.7	2.6	2.4
23	12	6.4	2.2	2.8	1.0	1.3	106	124	47	5.4	2.1	7.4
24	12	3.2	2.3	2.2	*1.0	1.3	125	85	46	5.7	2.6	4.7
25	10	3.0	2.3	1.8	1.0	1.2	134	59	41	4.4	2.8	2.8
26	10	3.2	2.4	1.6	1.0	*1.2	131	68	37	4.0	2.3	4.4
27	9.8	3.0	2.3	1.4	1.0	1.0	124	81	34	3.7	2.1	3.0
28	9.4	4.0	2.3	1.3	1.0	.8	127	98	30	4.0	3.7	1.9
29	6.4	3.6	2.2	1.3	1.1	.8	117	109	27	3.0	5.7	1.9
30	5.7	2.4	2.2	1.3	---	1.0	126	104	26	3.0	9.8	1.6
31	6.7	---	2.4	1.3	---	1.6	---	80	---	2.6	7.1	---
Total	168.6	129.0	64.6	78.8	34.2	35.8	2,321.1	3,748	1,868	376.9	86.6	100.5
Mean	5.44	4.30	2.08	2.54	1.18	1.15	77.4	121	62.3	12.2	2.79	3.35
Cfsm	0.030	0.024	0.012	0.014	0.0066	0.0064	0.432	0.676	0.348	0.068	0.016	0.019
In.	0.03	0.03	0.01	0.02	0.007	0.007	0.48	0.78	0.39	0.08	0.02	0.02

Calendar year 1963: Max 195 Min 0.5 Mean 32.1 Cfsm 0.179 In. 2.42
Water year 1963-64: Max 183 Min 0.5 Mean 24.6 Cfsm 0.137 In. 1.87

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 29 to Dec. 2, Dec. 9 to Mar. 21, Mar. 23 to Apr. 8 (no gage-height record Feb. 21-23).

5-2785. South Fork Crow River at Cosmos, Minn.

Location.--Lat 44°56'05", long 94°40'20", in SW¼ sec.14, T.117 N., R.32 W., on downstream side of bridge on State Highway 7, 1 mile east of Cosmos, 2¼ miles upstream from small tributary, and 3¼ miles west of Corvuso.

Drainage area.--221 sq mi.

Records available.--March 1945 to September 1964.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 1,079.09 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Mar. 1 to Sept. 3, 1945, chain gage and Sept. 4, 1945, to June 12, 1959, wire-weight gage, at same site at datum 3.00 ft higher.

Average discharge.--19 years, 41.5 cfs.

Extremes.--Maximum discharge during year, 267 cfs Apr. 15 (gage height, 6.67 ft, from graph based on gage readings); minimum, 0.4 cfs July 29 (gage height, 2.27 ft).
1945-64: Maximum discharge, 1,890 cfs June 17, 1957 (gage height, 12.62 ft, present datum, from graph based on gage readings); no flow on many days.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-29, Sept. 24-30)

Oct. 1 to Apr. 11		Apr. 12 to Sept. 30					
2.7	4.6	2.2	0	3.0	12	4.5	91
3.0	10	2.3	.7	3.3	20	5.0	131
3.5	21	2.4	1.9	3.6	30	6.0	211
		2.5	3.2	4.0	51	7.0	303
		2.7	6.4				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	12	3.1	1.5	1.5	2.1	5.1	42	31	10	1.4	10
2	19	11	3.0	1.5	1.5	2.1	6.0	40	30	9.9	1.2	6.4
3	19	11	2.9	1.5	1.5	2.1	7.0	34	28	9.3	1.0	5.0
4	19	11	2.8	1.5	1.6	2.1	8.3	73	28	8.0	.8	4.4
5	18	11	2.7	1.4	1.6	2.2	10	129	28	7.3	*.5	3.5
6	18	11	2.6	1.4	1.6	2.2	12	174	27	*6.9	1.4	2.7
7	17	11	2.4	1.4	1.6	2.2	14	141	27	6.4	2.2	2.8
8	17	10	2.1	1.4	1.6	2.3	17	117	*26	5.9	1.5	4.7
9	17	10	2.0	1.4	1.6	2.3	20	143	26	33	1.4	*14
10	16	10	1.8	1.4	1.6	2.5	*23	120	23	104	1.9	18
11	16	10	1.7	1.4	1.6	2.6	25	101	22	129	1.8	11
12	16	9.9	*1.6	1.3	1.6	2.8	44	90	19	36	1.7	6.2
13	16	9.1	1.6	1.3	1.6	2.9	108	*80	17	18	1.7	3.6
14	15	8.5	1.6	1.3	1.6	3.0	181	75	17	12	1.4	4.6
15	15	8.1	1.6	1.3	1.7	3.1	*245	73	21	9.0	1.2	3.6
16	14	7.9	1.6	*1.3	1.7	3.2	145	73	17	6.9	1.5	2.9
17	14	7.3	1.6	1.3	1.7	3.3	105	77	20	5.6	1.4	2.8
18	14	6.7	1.6	1.3	1.7	3.4	69	80	18	4.7	1.2	2.7
19	13	*6.5	1.6	1.3	1.7	3.6	57	73	17	3.8	2.3	2.8
20	14	6.1	1.6	1.3	1.8	3.7	55	69	17	2.8	3.4	3.5
21	15	6.1	1.6	1.3	1.8	3.7	69	59	18	2.4	8.4	2.7
22	15	5.6	1.6	1.3	1.9	3.7	64	46	16	1.9	9.0	2.4
23	14	4.0	1.6	1.3	2.0	3.7	54	45	18	1.5	6.8	3.5
24	14	4.3	1.6	1.3	*2.0	3.7	50	35	16	1.4	6.1	4.4
25	14	4.5	1.6	1.3	2.0	3.7	49	65	14	1.2	6.1	3.8
26	14	4.6	1.6	1.3	2.1	3.8	40	54	13	.8	5.4	2.4
27	14	4.4	1.6	1.3	2.1	*3.8	42	43	12	.6	4.4	2.7
28	*14	4.1	1.6	1.3	2.1	3.9	44	39	11	.5	9.7	1.9
29	13	3.7	1.5	1.4	2.1	4.0	41	38	10	.5	9.2	1.2
30	12	3.2	1.5	1.4	---	4.0	39	36	10	2.4	20	.5
31	12	---	1.5	1.5	---	4.5	---	33	---	2.2	17	---
Total	478	232.6	58.8	42.2	50.5	96.2	1,648.4	2,297	597	443.9	133.0	140.7
Mean	15.4	7.75	1.90	1.36	1.74	3.10	55.0	74.1	19.9	14.3	4.29	4.69
Cfsm	0.070	0.035	0.0086	0.0062	0.0079	0.014	0.249	0.335	0.090	0.065	0.019	0.021
In.	0.08	0.04	0.01	0.007	0.008	0.02	0.28	0.39	0.10	0.07	0.02	0.02

Calendar year 1963 : Max 970 Min 0 Mean 38.4 Cfsm 0.174 In. 2.36
Water year 1963-64 : Max 245 Min 0.5 Mean 17.0 Cfsm 0.077 In. 1.04

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23 to Apr. 11.

5-2790. South Fork Crow River near Mayer, Minn.

Location.--Lat 44°54'20", long 93°53'05", in SW¼SW¼ sec.30, T.117 N., R.25 W., near center of span on downstream side of bridge on State Highway 7, 1.3 miles north of Mayer, 4.3 miles southwest of Watertown, and 16 miles upstream from confluence with North Fork.

Drainage area.--1,170 sq mi, approximately.

Records available.--April 1934 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 926.00 ft above mean sea level (levels by Hennepin County Park Board Survey). Prior to June 14, 1940, chain gage at same site and datum.

Average discharge.--30 years, 212 cfs.

Extremes.--Maximum discharge during year, 506 cfs May 10 (gage height, 3.97 ft); minimum daily, 3.7 cfs Jan. 9-17; minimum gage height, 0.75 ft Aug. 5.
1934-64: Maximum discharge, 11,000 cfs Apr. 10, 1952 (gage height, 15.70 ft); no flow at times.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 4		Apr. 5 to Sept. 30			
0.9	6.5	0.7	3.2	1.6	82
1.0	12	.8	6.4	2.0	148
1.1	20	.9	11	3.0	321
1.2	28	1.1	22	4.0	512
1.3	39	1.3	40		
1.5	66				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	55	27	9.7	4.3	4.1	7.2	54	138	82	14	6.7	64
2	50	26	9.6	4.2	4.2	7.2	56	138	74	18	6.3	64
3	41	26	9.5	4.1	4.3	7.3	60	133	67	14	5.9	64
4	43	25	9.4	4.0	4.4	7.4	70	122	64	13	5.1	57
5	43	23	9.4	3.9	4.5	7.5	101	134	56	12	*4.4	50
6	29	23	9.4	3.9	4.7	7.6	117	206	49	*11	8.4	40
7	25	23	9.4	3.8	4.8	7.7	122	359	46	8.0	8.4	38
8	26	24	9.4	3.8	5.0	8.0	148	241	*47	8.4	9.4	47
9	27	23	9.3	3.7	5.1	8.2	162	287	42	11	12	*61
10	28	23	9.2	3.7	5.2	8.8	179	483	38	13	12	100
11	25	27	9.2	3.7	5.5	9.4	204	464	47	18	9.4	85
12	24	26	*9.2	3.7	5.7	10	133	440	38	29	9.4	67
13	24	25	9.1	3.7	6.0	11	131	*429	36	40	7.6	52
14	20	25	9.0	3.7	6.2	13	*179	397	43	114	6.3	52
15	21	25	8.7	3.7	6.5	16	233	359	32	114	7.1	49
16	22	22	8.6	3.7	6.6	20	182	312	28	87	5.5	50
17	20	22	8.3	*3.7	6.7	25	235	278	30	67	5.1	40
18	22	*21	8.1	3.8	6.8	29	299	278	30	49	4.8	38
19	22	20	8.0	3.8	6.8	32	334	233	34	36	4.8	38
20	22	20	7.7	3.8	6.8	37	326	206	38	28	7.1	38
21	25	20	7.5	3.8	6.9	41	298	187	53	24	32	38
22	34	26	7.3	3.8	6.9	43	265	170	32	20	59	36
23	41	14	7.0	3.8	6.9	44	250	155	36	17	30	38
24	47	20	6.6	3.8	6.9	45	208	150	32	16	21	40
25	42	26	6.2	3.8	*7.0	46	185	148	40	13	26	56
26	43	24	5.9	3.8	7.0	46	170	140	25	11	22	42
27	38	18	5.5	3.9	7.1	*46	160	151	22	9.4	19	32
28	*37	21	5.1	3.9	7.1	46	148	146	19	7.1	34	26
29	32	13	4.9	3.9	7.1	47	140	119	18	7.1	68	30
30	26	9.7	4.6	4.0	----------	49	148	103	16	6.3	38	30
31	27	----------	4.5	4.0	----------	51	----------	93	----------	6.7	56	----------
Total	981	667.7	245.3	119.2	172.8	783.3	5,297	7,199	1,214	842.0	550.7	1,462
Mean	31.6	22.3	7.91	3.85	5.96	25.3	177	232	40.5	27.2	17.8	48.7
Cfsm	0.027	0.019	0.0068	0.0033	0.0051	0.022	0.151	0.198	0.035	0.023	0.015	0.042
In.	0.03	0.02	0.008	0.004	0.005	0.02	0.17	0.23	0.04	0.03	0.02	0.05

Calendar year 1963: Max 3,610 Min 0 Mean 220 Cfsm 0.188 In. 2.55
Water year 1963-64: Max 483 Min 3.7 Mean 53.4 Cfsm 0.046 In. 0.63

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 24, Dec. 2 to Apr. 4.

5-2800. Crow River at Rockford, Minn.

Location.--Lat 45°05'15", long 93°44'00", in sec.29, T.119 N., R.24 W., on right bank at Rockford, 150 ft downstream from bridge on State Highway 55 and 1 mile downstream from confluence of North and South Forks.

Drainage area.--2,520 sq mi, approximately.

Records available.--April to July 1906 (published as "near Dayton"), June 1909 to September 1917, April to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 893.65 ft above mean sea level, adjustment of 1912. Apr. 13 to July 21, 1906, staff gage at Berning Mill 14 miles downstream at different datum. June 4, 1909, to Sept. 30, 1917, staff gage at site 600 ft downstream at different datum. Apr. 23, 1929, to Aug. 21, 1934, chain gage at site 600 ft downstream at present datum.

Average discharge.--39 years (1909-17, 1930-31, 1934-64), 549 cfs.

Extremes.--Maximum discharge during year, 1,420 cfs May 12 (gage height, 4.64 ft); minimum daily, 25 cfs Dec. 30, 31.
1909-17, 1929-64: Maximum discharge, 13,900 cfs Apr. 13, 1952 (gage height, 16.24 ft); minimum, 1.8 cfs Nov. 15, 1936 (gage height, 1.05 ft), caused by ice jam upstream.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.7	46	2.2	136	3.5	662
1.8	57	2.5	220	4.0	1,010
2.0	89	3.0	401	5.0	1,760

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	124	107	58	26	40	38	123	557	330	105	41	131
2	119	100	58	26	40	38	126	563	311	103	38	154
3	110	98	55	27	40	38	142	563	289	100	37	149
4	105	98	55	28	40	37	170	530	266	98	37	136
5	100	100	54	28	41	38	253	530	253	94	34	119
6	94	98	53	28	42	39	296	713	247	87	36	110
7	85	94	52	29	43	39	342	921	241	81	37	110
8	81	91	51	30	44	39	304	1,110	238	80	35	126
9	78	94	52	30	45	40	354	1,160	235	89	35	139
10	78	96	49	31	46	40	397	1,270	235	81	40	141
11	80	91	48	32	48	42	406	1,370	235	103	45	157
12	78	89	47	34	49	44	428	1,410	235	105	42	146
13	78	89	46	36	49	48	437	1,410	223	107	39	134
14	74	91	45	38	*49	54	*446	1,380	208	129	39	126
15	74	96	45	40	49	65	525	1,320	196	176	38	122
16	74	98	*44	*40	49	79	585	1,240	199	162	38	117
17	72	94	43	40	48	*96	626	1,140	220	134	37	110
18	72	85	42	40	47	108	726	1,070	211	117	35	105
19	72	80	41	40	47	114	760	972	205	98	34	103
20	74	80	40	40	46	120	760	892	196	81	35	107
21	83	80	39	40	46	124	766	814	196	72	60	103
22	94	87	38	40	45	128	746	713	193	65	80	110
23	96	85	36	40	45	131	713	650	193	60	107	122
24	107	65	34	40	43	135	662	632	176	56	87	131
25	*119	74	32	40	42	136	596	585	173	53	81	129
26	129	91	31	40	41	135	585	*536	173	51	78	144
27	126	100	29	40	40	134	591	520	162	48	74	139
28	124	103	27	40	*39	133	580	484	141	45	*87	126
29	119	*91	26	40	38	132	552	428	*126	42	91	117
30	117	72	25	*40	---	*130	*552	380	114	*44	119	*114
31	112	---	*25	40	---	128	---	350	---	42	105	---
Total	2,948	2,717	1,320	1,103	1,281	2,602	14,549	26,213	6,420	2,708	1,721	3,777
Mean	95.1	90.6	42.6	35.6	44.2	83.9	485	846	214	87.4	55.5	126
Cfsm	0.038	0.036	0.017	0.014	0.018	0.033	0.192	0.336	0.085	0.035	0.022	0.050
In.	0.04	0.04	0.02	0.02	0.02	0.04	0.21	0.39	0.09	0.04	0.03	0.06

Calendar year 1963: Max 4,610 Min 25 Mean 492 Cfsm 0.195 In. 2.64
Water year 1963-64: Max 1,410 Min 25 Mean 184 Cfsm 0.073 In. 1.00

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 3-8, Nov. 10 to Apr. 4.

5-2840. Mille Lacs Lake at Garrison, Minn.

Location.--Lat 46°18'05", long 93°49'05", in SW¼SE¼ sec.12, T.44 N., R.28 W., at pumphouse of Minnesota Division of Game and Fish, a quarter of a mile southwest of Borden Lake Outlet and three-quarters mile northeast of Garrison.

Records available.--June 1931 to September 1964. Prior to October 1939, published as "at Wealthwood."

Gage.--Water-stage recorder. Datum of gage is 1,240.40 ft above mean sea level, datum of 1929. Prior to Oct. 1, 1941, staff gage at Wealthwood at various datums; gage readings have been reduced to elevations above mean sea level, adjustment of 1912. Oct. 1, 1941, to Sept. 30, 1958, water-stage recorder at datum 1,240.50 ft above mean sea level, adjustment of 1912. To convert these records to datum of 1929, subtract 0.10 ft.

Extremes.--Maximum elevation during year, 1,251.43 ft Sept. 9 (affected by wind action); minimum, 1,249.79 ft Nov. 1 (affected by wind action).
1931-64: Maximum elevation, 1,253.51 ft July 25, 1952; minimum observed, 1,245.74 ft Oct. 16-19, 1936.

Remarks.--Water level affected by fixed-crest spillway at outlet of Ogechie Lake with crest at elevation 1,250.50 ft. Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

Mean daily elevation, in feet, October 1963 to September 1964

Oct. 31 ..... 1,250.00	Feb. 29 ..... 1,249.97	June 30 ..... 1,250.94
Nov. 8 ..... 1,250.04	Mar. 31 ..... 1,250.07	July 31 ..... 1,250.77
Dec. 31 ..... 1,249.96	Apr. 30 ..... 1,250.48	Aug. 31 ..... 1,250.69
Jan. 31 ..... 1,249.97	May 31 ..... 1,250.87	Sept.30 ..... 1,250.77

Note.--Elevations other than those shown are available.

5-2847.5. Rum River at Spencer Brook, Minn.

Location.--Lat 45°31'45", long 93°26'21", in NW¼NE¼ sec.15, T.35 N., R.25 W., near center of right span on downstream side of county highway bridge, 200 ft downstream from Spencer Brook, ½ mile north of Spencer Brook store, and 7½ miles southeast of Princeton.

Records available.--July 1960 to September 1964 (discontinued).

Gage.--Wire-weight gage read once daily. Datum of gage is 925.65 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Extremes.--Maximum discharge during year, 4,500 cfs May 8 (gage height, 11.87 ft); minimum daily, 26 cfs Aug. 18-20; minimum gage height, 0.26 ft Aug. 19, 20.
1960-64: Maximum discharge, 7,350 cfs May 25, 1962 (gage height, 13.12 ft); minimum daily, 14 cfs Jan. 27 to Feb. 3, 1961; minimum gage height, that of Aug. 19, 20.

Remarks.--Records good except those for periods of ice effect, which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used May 27 to June 19)

Oct. 1-23		Oct. 24 to Sept. 30			
0.6	42	0.2	22	5.0	787
.8	58	.5	41	7.0	1,270
1.0	77	1.0	81	9.0	2,040
		2.0	195	11.0	3,520
		3.0	362	12.0	4,680

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	71	62	95	37	34	39	68	381	137	94	38	69
2	66	65	91	36	34	40	94	417	*133	91	35	*76
3	62	64	86	36	34	40	129	433	125	83	33	86
4	*61	64	83	36	34	41	133	433	118	79	32	77
5	60	63	78	36	34	42	172	435	114	74	*31	67
6	59	63	74	35	35	42	357	1,040	111	70	30	61
7	57	*63	72	34	35	43	303	1,770	107	66	30	58
8	56	63	72	34	35	44	358	4,040	103	63	31	54
9	53	62	72	33	35	45	500	4,220	100	59	32	53
10	52	61	*73	33	36	46	538	3,410	99	61	32	51
11	52	60	74	33	36	48	533	*2,960	98	66	32	58
12	51	61	74	33	36	50	519	2,260	98	71	31	96
13	51	60	71	*33	*36	54	529	2,120	97	*65	30	112
14	51	60	67	32	37	58	580	1,690	97	61	30	96
15	52	61	66	32	37	62	700	1,420	96	57	30	82
16	51	60	62	32	37	67	858	1,160	86	54	29	68
17	52	60	59	32	37	73	893	911	90	52	28	61
18	53	59	57	32	38	78	810	753	90	49	26	58
19	54	58	54	33	38	82	665	643	90	46	26	54
20	55	58	52	33	38	88	*586	554	87	50	26	53
21	58	58	51	33	38	92	580	485	83	54	32	52
22	62	59	49	33	38	100	578	409	84	50	34	53
23	67	71	48	33	38	106	588	364	92	47	35	54
24	70	85	48	34	38	104	700	315	90	44	36	54
25	69	94	47	34	38	*95	858	282	88	42	42	56
26	67	112	46	33	38	91	705	251	85	40	44	57
27	66	113	45	33	39	85	595	218	81	40	44	56
28	64	108	43	33	39	77	468	192	77	38	47	55
29	62	104	40	34	39	71	423	178	86	38	49	54
30	61	99	38	34	----------	67	385	160	95	38	54	54
31	60	----------	37	34	----------	65	----------	145	----------	39	62	----------
Total	1,825	2,130	1,924	1,043	1,061	2,035	15,205	34,049	2,937	1,781	1,091	1,935
Mean	58.9	71.0	62.1	33.6	36.6	65.6	507	1,098	97.9	57.5	35.2	64.5
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1963: Max 4,860 Min 30 Mean 270 Ac-ft -
Water year 1963-64: Max 4,220 Min 26 Mean 183 Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 1-6, Dec. 8 to Apr. 1 (no gage-height record Dec. 27 to Jan. 12).

5-2860. Rum River near St. Francis, Minn.

Location.--Lat 45°19'40", long 93°22'20", in SE¼ sec.19, T.33 N., R.24 W., on left bank at upstream side of highway bridge, 4 miles south of St. Francis and 15¾ miles upstream from mouth.

Drainage area.--1,360 sq mi, approximately.

Records available.--May to November 1929, March 1930 to September 1931, April to November 1932, March 1933 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 861.12 ft above mean sea level, adjustment of 1912. Prior to Nov. 9, 1933, chain gage at site 50 ft downstream at same datum.

Average discharge.--32 years (1930-31, 1933-64), 528 cfs.

Extremes.--Maximum discharge during year, 4,100 cfs May 13 (gage height, 7.02 ft); minimum, 94 cfs Aug. 20 (gage height, 2.14 ft).
1929-64: Maximum discharge, 9,260 cfs Apr. 13, 1952 (gage height, 11.03 ft); minimum, 29 cfs Aug. 18, 1934 (gage height, 1.91 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.1	80	4.0	1,060
2.5	202	5.0	1,940
3.0	400	6.0	2,940
3.5	690	7.0	4,080

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	240	186	196	110	125	130	210	729	342	247	133	154
2	229	186	185	111	125	130	212	710	*326	240	127	*154
3	216	183	178	112	125	130	222	703	321	233	127	158
4	*205	*183	170	113	126	131	254	696	309	216	127	158
5	199	186	168	115	126	131	321	703	297	202	*121	161
6	196	189	164	116	126	132	435	840	289	192	118	161
7	192	189	148	117	126	132	553	1,260	285	183	118	164
8	186	189	135	118	127	134	*571	1,620	273	183	112	173
9	183	189	*126	119	127	136	625	1,940	266	189	112	167
10	183	196	124	119	127	138	690	2,390	262	266	121	164
11	180	199	122	120	127	140	755	3,000	254	281	118	158
12	176	196	118	120	127	142	804	3,730	251	273	118	151
13	173	192	116	121	127	147	870	*4,070	243	*277	118	145
14	170	189	114	121	128	152	956	3,980	243	254	115	161
15	170	186	112	*121	128	159	1,010	3,670	262	229	112	173
16	170	183	111	122	128	165	1,070	3,250	258	205	109	176
17	170	183	110	123	128	175	1,140	2,780	262	189	109	167
18	170	183	109	123	129	185	1,170	2,290	273	186	106	154
19	170	183	108	123	129	200	1,170	1,810	266	180	100	145
20	170	186	107	123	129	208	1,120	1,410	254	167	97	151
21	176	186	106	124	129	216	1,040	1,120	240	158	112	148
22	186	209	106	124	129	228	964	932	229	148	130	148
23	199	236	106	124	129	238	916	783	309	151	127	173
24	205	247	107	124	*129	244	916	729	440	145	121	173
25	205	243	107	124	129	250	1,040	684	472	142	142	170
26	205	240	108	124	129	255	1,120	601	435	133	139	158
27	205	247	108	124	129	*255	1,110	523	368	130	136	148
28	202	258	109	124	130	240	996	461	301	133	145	142
29	199	254	109	124	130	230	862	435	266	133	148	136
30	192	236	109	124	---	220	769	396	247	133	148	133
31	189	---	110	125	---	215	---	364	---	136	154	---
Total	5,911	6,112	3,906	3,732	3,703	5,588	23,891	48,609	8,843	5,934	3,820	4,724
Mean	191	204	126	120	128	180	796	1,568	295	191	123	157
Cfsm	0.140	0.150	0.093	0.088	0.094	0.132	0.585	1.15	0.217	0.140	0.090	0.115
In.	0.16	0.17	0.11	0.10	0.10	0.15	0.65	1.33	0.24	0.16	0.10	0.13

Calendar year 1963: Max 4,080 Min 106 Mean 453 Cfsm 0.333 In. 4.53
Water year 1963-64: Max 4,070 Min 97 Mean 341 Cfsm 0.251 In. 3.40

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 2 to Apr. 1.

5-2885. Mississippi River near Anoka, Minn.

Location.--Lat 45°07'36", long 93°17'48", in SW¼ sec.12, T.119 N., R.21 W., on right bank half a mile downstream from Coon Creek, 1½ miles downstream from hydroelectric plant of Northern States Power Co. at Coon Rapids, 6½ miles downstream from Anoka, and at mile 864.8 upstream from Ohio River.

Drainage area.--19,100 sq mi, approximately.

Records available.--June 1931 to September 1964. Prior to October 1931 published as "at Coon Rapids, near Anoka."

Gage.--Water-stage recorder. Datum of gage is 805.02 ft above mean sea level, adjustment of 1912. Prior to June 14, 1932, at site 1¼ miles upstream at different datum.

Average discharge.--33 years, 6,712 cfs.

Extremes.--Maximum discharge during year, 24,100 cfs May 12 (gage height, 8.20 ft); minimum, 1,570 cfs Dec. 13 (gage height, 1.13 ft).
1931-64: Maximum discharge, 75,900 cfs Apr. 14, 1952 (gage height, 17.51 ft); minimum, 586 cfs Sept. 13, 1934 (gage height, 0.37 ft).

Remarks.--Records excellent except those for periods of ice effect, which are good. Flow slightly regulated by six reservoirs on headwaters; total usable capacity, 1,640,600 acre-ft. Diurnal regulation caused by power-plant above station.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.3	1,820	4.0	8,160
2.0	3,090	6.0	15,100
3.0	5,320	9.0	27,600

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,640	2,820	2,740	2,360	2,560	2,460	3,490	13,200	6,370	8,220	2,840	6,290
2	3,030	2,960	2,220	2,460	2,580	2,520	3,090	13,100	5,540	7,750	2,840	6,930
3	*3,380	2,960	2,150	2,500	2,420	2,550	3,550	12,300	5,320	7,070	2,920	7,370
4	2,940	2,820	2,530	2,700	2,660	2,470	4,120	*12,400	5,000	6,930	*3,640	6,870
5	2,820	2,820	2,530	2,650	2,500	2,500	5,250	13,000	4,810	6,760	3,310	6,420
6	3,090	2,420	2,570	2,750	2,620	2,560	6,020	14,800	4,680	5,770	2,960	6,050
7	3,110	2,400	3,130	2,650	2,700	2,510	6,590	15,700	4,980	5,910	2,640	6,020
8	2,570	2,680	3,680	2,780	2,840	2,540	7,000	18,100	4,480	5,790	2,400	6,120
9	2,780	2,840	2,800	2,620	2,690	2,700	6,910	20,200	3,350	5,680	2,260	8,420
10	2,820	2,620	2,400	2,600	2,760	2,800	6,970	20,700	3,640	*5,320	2,330	10,400
11	2,680	2,380	2,360	2,590	2,710	2,760	7,810	21,500	3,640	5,490	2,260	11,000
12	2,450	2,530	2,300	2,680	2,680	3,100	8,860	23,200	3,900	5,570	2,420	11,000
13	2,190	2,780	1,870	2,500	2,660	4,430	10,500	23,700	3,880	5,000	2,400	11,300
14	2,660	3,070	1,750	3,000	2,640	3,510	11,400	23,700	3,950	4,970	2,360	11,400
15	2,530	2,530	2,200	2,710	2,700	3,050	14,200	23,100	4,280	4,770	2,570	*11,300
16	2,620	2,600	2,320	2,620	2,810	3,860	14,500	22,300	4,370	4,680	2,160	10,800
17	2,450	2,380	2,550	2,500	2,740	3,900	16,600	21,200	*3,830	4,390	2,190	10,300
18	2,310	2,620	2,450	2,490	2,510	4,100	17,100	19,800	4,240	4,260	2,090	10,300
19	2,490	2,900	2,700	2,430	2,540	3,710	16,700	18,800	4,060	4,680	2,220	9,350
20	2,490	2,800	2,700	2,530	2,540	3,570	16,400	17,200	4,150	3,680	1,820	9,650
21	2,680	2,850	2,300	2,490	2,440	4,060	15,900	*15,900	4,970	3,200	2,040	8,280
22	2,780	2,650	2,550	2,790	2,560	3,840	16,200	14,800	5,370	3,460	2,510	8,830
23	3,030	2,920	2,340	2,910	2,560	4,010	15,700	14,100	6,540	3,320	2,490	8,500
24	*3,270	3,050	2,380	2,940	2,520	3,490	16,900	12,900	7,060	3,320	2,780	8,000
25	3,310	2,860	2,480	2,750	2,550	3,290	16,300	12,400	7,810	3,420	2,760	8,160
26	3,310	2,940	2,560	2,460	2,520	3,680	16,400	11,400	8,640	3,250	2,940	7,620
27	3,400	2,780	2,480	2,500	2,500	3,420	16,100	10,600	9,220	2,820	3,160	8,010
28	3,070	3,490	2,510	2,470	2,620	3,090	15,200	9,580	9,480	3,160	2,980	7,490
29	3,350	4,260	2,700	2,580	2,560	3,330	14,300	8,420	9,190	2,840	3,160	7,940
30	3,310	3,550	2,600	2,520	---	2,900	13,000	7,620	8,260	2,740	4,190	7,430
31	3,070	---	2,300	2,710	---	3,660	---	6,910	---	2,900	5,510	---
Total	89,630	85,280	77,150	81,240	75,690	100,370	343,060	492,630	165,010	147,120	85,150	257,550
Mean	2,891	2,843	2,489	2,621	2,610	3,238	11,440	15,890	5,500	4,746	2,747	8,585
Cfsm	0.151	0.149	0.130	0.137	0.136	0.170	0.599	0.832	0.288	0.248	0.144	0.449
In.	0.17	0.17	0.15	0.16	0.15	0.20	0.67	0.96	0.32	0.29	0.17	0.50

Calendar year 1963: Max 22,100 Min 1,750 Mean 5,854 Cfsm 0.306 In. 4.15
Water year 1963-64: Max 23,700 Min 1,750 Mean 5,464 Cfsm 0.286 In. 3.91

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 20-22, Dec. 3, 9-12, Dec. 14 to Mar. 12.

5-2890. Minnetonka Lake near Wayzata, Minn.

Location.--Lat 44°57'00", long 93°29'55", in SW¼SW¼ sec.8, T.117 N., R.22 W., on east side of Wayzata Bay, 150 ft north of bridge over channel connecting Grays Bay and Wayzata Bay on State Highway 101.

Records available.--June 1938 to September 1964 (discontinued), fragmentary prior to October 1941. Lake elevations collected in this vicinity since 1881, are contained in files of Hennepin County Highway Department. Published as "at Excelsior" prior to June 1947.

Gage.--Water-stage recorder. Datum of gage is 922.30 ft above mean sea level, datum of 1929. Prior to Sept. 10, 1939, staff gage and Sept. 10, 1939, to July 28, 1952, water-stage recorder, at Excelsior, at elevation 920.00 ft, above mean sea level, 1903 adjustment, which is 0.96 ft higher than present datum. Gage readings have been reduced to elevations above mean sea level, datum of 1929, subsequent to June 30, 1947.

Extremes.--Maximum elevation during year, 929.03 ft May 23 (affected by wind action); minimum observed, 928.05 ft Feb. 27 (affected by wind action).
1938-64: Maximum elevation, 930.42 ft Sept. 17, 1951; minimum, 922.72 ft Dec. 21, 1938, to Jan. 3, 1939 (datum of 1929).

Remarks.--Water level subject to fluctuation caused by wind action.

Mean daily elevation, in feet, October 1963 to September 1964

Oct. 31.....928.36	Feb. 29.....928.08	June 30.....928.43
Nov. 30.....928.17	Mar. 31.....928.17	July 25.....928.14
Dec. 31.....928.16	Apr. 30.....928.40	Sept.30.....928.11
Jan. 31.....928.14	May 31.....928.54	

Note.--Elevations other than those shown are available.

5-2895. Minnehaha Creek at Minnetonka Mills, Minn.

Location.--Lat 44°56'30", long 93°26'45", near center of E½ sec.15, T.117 N., R.22 W., on left bank 40 ft upstream from bridge on county highway at Minnetonka Mills, 2.2 miles downstream from outlet of Minnetonka Lake, and 2.9 miles northwest of Hopkins.

Drainage area.--130 sq mi.

Records available.--August 1953 to September 1964 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 916.11 ft above mean sea level, datum of 1929.

Average discharge.--11 years, 12.8 cfs.

Extremes.--Maximum discharge during year, 34 cfs May 12 (gage height, 5.38 ft); no flow on many days.
1953-64: Maximum discharge, 235 cfs May 23, 1962 (gage height, 6.66 ft); maximum gage height, 6.97 ft Mar. 23, 1963 (backwater from ice); no flow for many days each year.

Remarks.--Records good. Discharge affected by storage in Minnetonka Lake controlled by fixed-crest dam.

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 6		Apr. 7 to Sept. 30			
4.35	0	4.3	0	4.8	4.4
4.4	.1	4.4	.1	4.9	6.5
4.5	.3	4.5	.4	5.0	9.8
4.6	.7	4.6	1.2	5.1	14
		4.7	2.6	5.3	27

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.2						0	0.2	0.2	0	0	0.2
2	.2						0	.1	.1	0	0	.1
3	.2						0	.1	.1	0	0	.1
4	.1						0	.1	0	0	0	0
5	.1						.2	.1	0	0	0	
6	0						.2	.3	0	0	0	0
7	*0						.1	.1	0	0	0	2.1
8	0						.1	2.8	0	0	0	5.3
9	0		(*)	(*)			.1	13	0	0	0	*1.8
10	0						.1	9.0	0	0	0	1.6
11	0						.1	5.6	0	.1	0	.5
12	0						.1	21	0	.2	0	.2
13	0						3.3	10	0	0	0	.2
14	0						5.8	4.0	0	0	0	.1
15	0						1.0	3.2	*0	0	0	.1
16	0						.9	3.0	0	0	0	.1
17	0				(**)		1.1	1.4	0	0	0	0
18	0	(*)					.6	*1.4	0	0	0	.1
19	0						.6	1.6	0	0	0	.1
20	0						*.6	.6	0	0	0	1.4
21	0						3.1	.6	0	0	0	.3
22	0						2.8	.4	0	0	1.2	*.5
23	0					(*)	1.6	3.8	2.7	*0	.6	1.6
24	0						1.3	3.7	.2	0	.2	2.1
25	0						.9	1.0	0	0	.3	1.0
26	0						.1	1.0	0	0	.1	.6
27	0						.1	.6	0	0	0	.3
28	0						.1	.3	0	0	1.0	.2
29	0				-		.1	.3	0	0	3.2	.2
30	0	-			---		.2	.2	0	0	3.0	.3
31	0	---	-	-	---	-	---	.2	---	0	.3	---
Total	.8	0	0	0	0	0	25.2	89.7	3.3	0.3	9.9	21.1
Mean	0.03	0	0	0	0	0	0.84	2.89	0.11	0.01	0.32	0.70
Cfsm	0.00023	0	0	0	0	0	0.0065	0.022	0.00085	0.000076	0.0025	0.0054
In.	0.0002	0	0	0	0	0	0.007	0.03	0.0009	0.00009	0.003	0.006

Calendar year 1963: Max 139 Min 0 Mean 18.2 Cfsm 0.140 In. 1.90
Water year 1963-64: Max 21 Min 0 Mean 0.41 Cfsm 0.0032 In. 0.047

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 6.

5-2900. Little Minnesota River near Peever, S. Dak.

Location.--Lat 45°36'05", long 96°52'18", in SW¼ sec.13, T.125 N., R.50 W., on right bank, 2 miles northwest of town of Browns Valley, Minn., 3¼ miles upstream from proposed Lake Traverse diversion, 5.3 miles northeast of Peever, 7¼ miles downstream from Jorgenson River, and 8 miles upstream from Big Stone Lake.

Drainage area.--447 sq mi.

Records available.--October 1939 to September 1964.

Gage.--Water-stage recorder. Altitude of gage is 1,000 ft (from topographic map). Oct. 1, 1939, to Mar. 20, 1940, staff gage at site 4½ miles downstream at different datum. Mar. 21 to Apr. 12, 1940, staff gage at site 100 ft downstream at present datum. Apr. 13 to Aug. 27, 1940, staff gage at present site and datum.

Average discharge.--25 years, 47.3 cfs (34,240 acre-ft per year).

Extremes.--Maximum discharge during year, 236 cfs Apr. 17 (gage height, 3.89 ft); maximum gage height, 5.39 ft Apr. 3 (backwater from ice); minimum discharge, 0.1 cfs Oct. 6; minimum gage height, 1.86 ft Aug. 19, 20. 1939-64: Maximum discharge, 4,730 cfs Apr. 8, 1952 (gage height, 12.16 ft); maximum gage height, 13.35 ft Mar. 25, 1943, from floodmark (backwater from ice); no flow at times in 1940, 1942, 1950, 1954, 1957, 1959, 1963.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to May 20				May 21 to Sept. 30			
2.0	0.2	2.6	16	1.8	0.1	2.3	4.8
2.1	.9	2.9	42	1.9	.3	2.4	7.1
2.2	2.1	3.2	80	2.0	.6	2.5	10
2.3	3.9	3.6	163	2.1	1.4	2.6	16
2.4	6.3	4.0	264	2.2	2.9		
2.5	9.9						

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.6	1.6	1.5	0.6	0.6	0.8	43	91	4.1	1.9	1.2	0.3
2	.3	1.5	1.5	.6	.6	.8	73	87	4.1	1.6	1.0	.3
3	.2	1.3	1.5	.6	.6	.9	150	78	4.1	1.4	.6	.3
4	.2	1.3	1.4	.7	.6	.9	120	76	3.7	1.2	.5	.2
5	.2	1.5	1.5	.6	.6	1.0	125	77	3.1	1.4	.4	.2
6	.2	1.5	1.4	.6	.6	1.0	128	85	2.9	2.0	.5	.2
7	.2	1.4	1.3	.6	.7	1.0	*129	82	2.6	1.6	*.4	1.2
8	.2	1.3	1.2	.6	.7	1.0	147	70	2.6	*1.4	.4	.5
9	.2	1.3	1.0	.6	.7	1.0	138	61	2.9	1.2	.4	.4
10	.2	1.5	1.0	.6	.7	1.1	116	55	*2.7	1.0	.3	.3
11	.4	1.4	.9	.5	.7	1.3	108	49	2.4	1.0	.3	.3
12	.4	1.4	.8	.5	.7	1.4	96	43	2.4	1.6	.3	*.3
13	.4	1.5	.8	.5	.7	1.6	108	37	2.0	1.3	.3	.3
14	.5	1.5	.7	.5	.7	1.7	180	35	1.9	1.0	.3	.4
15	.8	1.5	.7	*.6	.7	1.9	196	33	1.9	.8	.3	.4
16	.9	1.8	.7	.6	.7	2.1	198	28	1.6	.8	.3	.3
17	.7	2.1	.6	.6	.7	2.3	213	25	2.6	.6	.3	.3
18	.6	2.1	.6	.6	*.7	2.6	186	21	4.1	.5	.2	.3
19	.6	1.8	*.6	.6	.7	3.1	154	*20	3.3	.4	.2	.5
20	.7	*2.0	.6	.6	.7	3.5	*127	16	2.7	.4	.6	.5
21	1.2	2.2	.6	.6	.7	4.1	118	13	2.2	.5	1.4	.5
22	1.0	2.3	.6	.6	.7	4.7	145	11	2.4	.5	.7	.4
23	*.9	2.4	.6	.6	.7	5.5	166	9.9	5.0	.5	.3	.4
24	1.0	2.2	.6	.6	.7	*6.5	158	8.5	5.8	.5	.3	.4
25	1.2	1.9	.6	.5	.7	7.1	142	7.4	8.5	.4	.4	.5
26	1.4	1.9	.6	.5	.7	7.8	127	6.8	5.4	.4	.3	.5
27	1.4	1.9	.6	.6	.7	8.6	114	5.8	3.7	.4	.3	.4
28	1.0	1.8	.6	.6	.7	10	110	5.4	2.4	.4	.3	.5
29	1.5	1.7	.6	.6	.7	12	106	5.0	1.7	.5	.3	.5
30	2.6	1.6	.6	.6	---	15	100	4.8	1.4	.6	.4	.5
31	2.0	---	.6	.6	---	23	---	4.3	---	.6	.3	---
Total	23.7	51.2	26.9	18.1	19.7	135.3	4,021	1,150.9	96.2	28.4	13.8	12.1
Mean	0.76	1.71	0.87	0.58	0.68	4.36	134	37.1	3.21	0.92	0.46	0.40
Cfsm	0.0017	0.0038	0.0019	0.0013	0.0015	0.098	0.300	0.083	0.0072	0.0021	0.0010	0.00090
In.	0.002	0.004	0.002	0.002	0.002	0.11	0.33	0.10	0.008	0.002	0.001	0.001

Calendar year 1963: Max 142 Min 0 Mean 12.2 Cfsm 0.027 In. 0.35
Water year 1963-64: Max 213 Min 0.2 Mean 15.3 Cfsm 0.034 In. 0.56

Peak discharge (base, 450 cfs).--No peak above base.

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 21 to Apr. 10.

5-2910. Whetstone River near Big Stone City, S. Dak.

Location.--Lat 45°17'32", long 96°29'14", in SE¼NW¼ sec.18, T.121 N., R.46 W., on right bank 20 ft downstream from highway bridge, 1½ miles west of Big Stone City, and 4½ miles upstream from Big Stone Lake.

Drainage area.--389 sq mi.

Records available.--March 1910 to November 1912 (no winter records) and March 1931 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 996.96 ft above mean sea level, adjustment of 1912. Mar. 8, 1910, to Nov. 30, 1912, staff gage 2 miles downstream at different datum. Mar. 18, 1931, to Aug. 27, 1938, chain gage and Aug. 28, 1938, to May 3, 1939, wire-weight gage, at site 20 ft upstream at present datum. May 4, 1939, to Nov. 8, 1952, water-stage recorder at site 80 ft downstream at present datum.

Average discharge.--33 years (1931-64), 45.5 cfs (32,940 acre-ft per year).

Extremes.--Maximum discharge during year, 701 cfs Apr. 3 (gage height, 8.61 ft); minimum, 0.1 cfs Aug. 16 (gage height, 1.59 ft).
1910-12, 1931-64: Maximum discharge, 5,710 cfs Apr. 8, 1952 (gage height, 13.64 ft, from floodmark); maximum gage height, 13.95 ft Apr. 11, 1947; no flow at times in most years.
Maximum stage known, about 26 ft in June 1919, present site and datum, from information by local resident.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9.1	6.9	7.6	4.4	4.8	8.7	110	58	7.2	11	1.7	5.1
2	8.2	6.6	7.4	4.4	4.9	9.0	200	54	7.2	9.1	1.5	4.3
3	7.5	6.8	7.2	4.3	5.1	9.3	275	56	7.5	6.4	1.1	3.6
4	6.9	7.5	7.2	4.3	5.3	9.6	220	58	6.6	5.4	1.0	2.8
5	6.4	7.9	7.3	4.2	5.4	9.8	205	57	6.4	5.8	.3	2.6
6	6.4	8.0	7.4	4.2	5.6	10	*200	54	5.8	5.6	*1.7	2.1
7	6.6	7.8	7.2	4.1	5.7	10	379	66	5.8	*4.6	1.7	3.6
8	8.5	7.7	6.9	4.1	5.9	10	178	57	5.8	4.2	1.3	3.8
9	7.2	8.1	6.7	4.1	6.0	10	135	46	6.4	3.8	1.4	3.3
10	6.4	8.6	6.3	4.0	6.1	10	102	41	*6.1	3.8	1.4	2.8
11	6.1	9.1	5.9	4.0	6.2	11	85	36	5.8	3.8	1.1	*2.4
12	6.6	9.1	5.6	4.0	6.2	11	83	33	5.1	4.2	1.4	2.2
13	6.6	8.5	5.4	4.0	6.3	11	174	30	4.6	4.0	1.3	2.4
14	6.1	9.1	5.2	*4.1	6.4	12	268	28	4.4	3.7	1.1	2.2
15	6.6	9.4	5.0	4.1	6.4	12	216	*26	4.6	3.7	1.1	1.8
16	7.8	8.8	4.9	4.2	6.5	12	202	25	4.3	3.2	1.4	1.8
17	7.8	9.1	4.8	4.3	6.6	13	*206	24	4.3	2.6	.9	1.7
18	5.6	9.1	4.7	4.4	6.7	13	143	24	4.5	2.4	1.2	1.7
19	7.8	*8.5	4.7	4.5	*6.7	14	103	22	4.0	2.1	1.2	1.5
20	8.5	8.8	*4.7	4.6	6.9	14	83	21	3.8	1.8	2.1	1.5
21	9.4	9.1	4.7	4.6	7.0	15	84	19	3.6	1.7	20	1.5
22	11	9.2	4.7	4.7	7.1	15	98	16	3.7	1.5	14	1.5
23	*12	9.5	4.7	4.7	7.2	16	158	14	5.1	.8	7.5	1.5
24	12	9.6	4.8	4.8	7.5	17	132	12	8.5	.6	5.8	1.6
25	12	9.5	4.8	4.8	7.9	*18	101	12	7.2	.6	4.5	1.3
26	10	9.1	4.8	4.8	8.1	19	84	11	7.5	.5	3.7	1.2
27	9.1	8.7	4.8	4.8	8.2	20	74	9.7	7.8	.9	3.2	1.1
28	8.2	8.4	4.7	4.7	8.3	21	69	8.5	5.8	1.2	3.1	1.3
29	7.8	8.1	4.6	4.7	8.4	24	66	8.5	5.1	1.3	5.0	1.4
30	8.5	7.8	4.5	4.7	----------	30	62	7.5	6.6	1.7	6.4	1.4
31	8.8	----------	4.5	4.8	----------	45	----------	7.5	---------	2.0	5.8	----------
Total	251.5	254.4	173.7	136.4	189.4	460.4	4,495	941.7	171.1	104.0	104.9	67.0
Mean	8.11	8.48	5.60	4.40	6.53	14.9	150	30.4	5.70	3.35	3.38	2.23
Cfsm	0.021	0.022	0.014	0.011	0.017	0.038	0.386	0.078	0.015	0.009	0.009	0.006
In.	0.02	0.02	0.02	0.01	0.02	0.04	0.43	0.09	0.02	0.01	0.01	0.01
Ac-ft	499	505	345	271	376	913	8,920	1,870	339	206	208	133

Calendar year 1963: Max 1,290 Min 2.6 Mean 34.1 Cfsm 0.088 In. 1.19 Ac-ft 24,700
Water year 1963-64: Max 379 Min 0.3 Mean 20.1 Cfsm 0.052 In. 0.70 Ac-ft 14,580

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-3	0100	8.61	701	4-14	2300	4.19	293
4-7	1130	4.84	466				

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 21 to Apr. 5 (no gage-height record Nov. 21-25, Nov. 27 to Dec. 1, Dec. 3-6, 8-15, 17-19, 21, 22, 24, Jan. 12, 15-18, 20-26, Jan. 28 to Feb. 2, Feb. 4-8, 10-17, 20-23, 25-27, Mar. 20).

5-2915. Big Stone Lake at Ortonville, Minn.

Location.--Lat 45°18'18", long 96°26'57", in NW¼SW¼ sec.9, T.121 N., R.46 W., at powerplant intake at west edge of Ortonville, half mile north of concrete dam at outlet, half a mile southwest of Ortonville.

Records available.--March 1937 to September 1964.

Gage.--Wire-weight gage read once a day. Datum of gage is 957.69 ft above mean sea level, datum of 1929. Prior to Sept. 17, 1947, staff gage at site ½ mile south at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site ½ mile south at same datum. Sept. 21, 1959, to June 30, 1963, supplementary wire-weight gage read once daily, at present site and datum.

Extremes.--Maximum gage height during year, 7.85 ft Apr. 30, May 4, 5, 8; minimum, 5.72 ft Aug. 19.
1937-64: Maximum gage height, 12.73 ft Apr. 17, 1952; minimum observed, 2.20 ft Nov. 20, 1940.

Remarks.--Reservoir is formed by natural lake with concrete dam at outlet. Fixed crest of dam is at elevation 963.64 ft, with one 5-foot gate and two 2½-foot gates with lowest sill at elevation 958.40 ft (all elevations are referred to datum of 1929). Changes in gate openings are not made.
Silt barrier dam 700 ft upstream in outlet channel of lake completed July 7, 1958; crest elevation, 963.6 ft. Supplementary wire-weight gage readings used for stages below crest of silt barrier to June 30, 1963. Water level subject to fluctuation caused by wind action.

Gage height, in feet, October 1963 to September 1964

Oct. 31.....6.58	Feb. 29.....6.19	June 30.....6.65
Nov. 30.....6.33	Mar. 31.....6.44	July 31.....5.84
Dec. 31.....6.12	Apr. 30.....7.85	Aug. 31.....6.10
Jan. 31.....6.18	May 31.....7.10	Sept.30.....6.20

Note.--Gage-height record other than shown above is available.

GPO 819-718-6

5-2920. Minnesota River at Ortonville, Minn.

Location.--Lat 45°17'44", long 96°26'38", in NE¼NW¼ sec.16, T.121 N., R.46 W., on left bank 400 ft downstream from bridge on U. S. Highway 12 and 1,300 ft downstream from dam at outlet of Big Stone Lake, at Ortonville.

Drainage area.--1,160 sq mi, approximately.

Records available.--February 1938 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 956.38 ft above mean sea level, datum of 1929. Prior to Mar. 31, 1939, staff gage on downstream side of dam 1,300 ft upstream at datum 1.31 ft higher.

Average discharge.--26 years, 114 cfs (82,530 acre-ft per year).

Extremes.--Maximum discharge during year, 956 cfs Apr. 13 (gage height, 9.55 ft); minimum, 0.6 cfs Sept. 13 (gage height, 1.07 ft).
1938-64: Maximum discharge, 3,060 cfs Apr. 13, 1952 (gage height, 12.92 ft); no flow Dec. 13, 1940.

Remarks.--Records fair. Flow affected by natural storage in Big Stone Lake (see preceding page).

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 17)

Oct. 1 to May 11				May 12 to Sept. 30			
1.3	9.4	4.0	148	1.4	15	3.0	98
1.5	19	5.0	221	1.5	20	4.0	148
2.0	43	6.0	330	2.0	46	5.0	221
3.0	98	8.0	608				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	75	42	23	21	17	22	36	146	74	50	16	11
2	82	19	23	22	17	22	45	126	73	48	16	11
3	64	33	23	23	17	22	58	120	69	39	16	10
4	58	28	22	20	16	23	76	146	66	32	16	8.4
5	56	27	22	21	17	23	101	137	63	30	15	5.3
6	65	30	22	20	17	24	*114	185	61	35	17	5.8
7	59	19	25	21	17	23	149	159	62	*41	*18	8.9
8	55	26	62	20	16	23	152	179	58	42	16	6.6
9	52	29	35	19	17	23	120	175	80	41	13	4.5
10	51	36	23	20	18	24	110	149	*49	36	14	4.5
11	53	46	22	19	17	27	123	196	39	37	14	*1.2
12	44	88	21	18	18	29	122	195	36	37	11	1.2
13	44	51	26	17	18	32	564	124	35	44	8.0	1.6
14	43	15	26	*16	18	35	112	121	42	39	6.2	3.3
15	49	17	25	17	18	44	68	*126	42	33	5.8	8.6
16	52	27	22	16	18	45	78	125	36	33	6.2	19
17	49	26	23	17	19	45	161	104	38	39	5.3	19
18	44	21	22	16	20	45	87	130	44	41	8.4	20
19	44	*22	24	16	*21	46	82	126	49	32	4.9	27
20	40	26	*22	16	21	47	63	98	58	29	5.3	23
21	40	42	22	17	20	47	172	94	51	24	8.0	20
22	46	87	21	17	21	47	126	93	49	23	5.3	22
23	*38	33	20	17	23	47	110	104	59	23	6.6	29
24	52	24	21	18	22	50	105	104	52	22	6.6	16
25	46	25	20	19	22	*52	100	86	60	20	6.2	5.3
26	51	23	23	18	21	50	114	114	62	19	4.5	21
27	46	24	24	18	21	46	131	84	51	19	6.6	7.1
28	52	46	22	17	21	42	233	78	38	18	9.4	4.9
29	22	26	21	17	22	45	248	78	48	17	10	5.3
30	36	29	21	16	----------	43	177	80	51	16	11	3.3
31	54	----------	19	16	----------	39	----------	74	----------	16	11	----------
Total	1,562	987	747	565	550	1,132	3,937	3,856	1,595	975	317.3	333.8
Mean	50.4	32.9	24.1	18.2	19.0	36.5	131	124	53.2	31.5	10.2	11.1
Ac-ft	3,100	1,960	1,480	1,120	1,090	2,250	7,810	7,650	3,160	1,930	629	662

Calendar year 1963: Max 448 Min 9.9 Mean 60.7 Ac-ft 43,990
Water year 1963-64: Max 564 Min 1.2 Mean 45.2 Ac-ft 32,840

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Jan. 8 to Apr. 4.

5-2930. Yellow Bank River near Odessa, Minn.

Location.--Lat 45°13'35", long 96°21'12", in SE¼SE¼ sec.1, T.120 N., R.46 W., on left bank 150 ft downstream from highway bridge, 2½ miles southwest of Odessa, and 4½ miles upstream from mouth.

Drainage area.--398 sq mi.

Records available.--October 1939 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 953.34 ft above mean sea level, datum of 1929 (Corps of Engineers bench mark). Prior to Aug. 28, 1940, wire-weight gage at site 150 ft upstream at same datum.

Average discharge.--25 years, 55.8 cfs (40,400 acre-ft per year).

Extremes.--Maximum discharge during year, 378 cfs Apr. 15 (gage height, 4.66 ft); maximum gage height, 8.90 ft Apr. 3 (backwater from ice); minimum daily discharge, 0.2 cfs Aug. 17, Sept. 19; minimum gage height, 1.57 ft Aug. 17.
1939-64: Maximum discharge, 6,260 cfs Apr. 4, 1952 (gage height, 17.06 ft); maximum gage height, 17.98 ft Mar. 25, 1943, from floodmark (backwater from ice); no flow Jan. 26 to Feb. 8, 1940, Jan. 8, 9, 1942, Jan. 25 to Feb. 25, 1959.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 18-30)

Oct. 1 to Apr. 10		Apr. 11 to Sept. 30			
1.9	4.7	1.5	0.1	2.2	14
2.0	7.8	1.6	0.3	2.3	19
2.1	12	1.7	1.3	2.5	35
2.2	17	1.8	2.5	3.0	94
2.3	23	1.9	4.6	4.0	250
		2.0	7.3	5.0	455
		2.1	11		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	11	7.9	1.9	1.8	5.9	58	94	11	7.6	1.0	3.7
2	17	9.8	7.7	1.8	1.9	5.9	110	89	10	9.8	.9	2.5
3	15	10	7.5	1.8	2.0	5.8	214	88	10	7.3	.6	1.8
4	14	10	7.4	1.8	2.0	5.8	227	86	9.8	4.8	.5	1.5
5	12	9.8	7.3	1.7	2.0	5.7	180	82	8.9	4.6	.4	1.3
6	11	11	7.2	1.7	2.0	5.9	*167	80	8.7	4.4	*1.6	1.1
7	9.4	11	7.0	1.6	1.9	6.2	170	73	8.5	*3.1	1.0	1.3
8	9.0	11	6.7	1.4	1.9	6.5	190	67	8.4	2.3	.7	1.4
9	8.6	11	6.1	1.4	2.1	7.0	180	62	*8.6	2.0	.3	1.4
10	7.8	11	5.7	1.3	2.3	7.4	170	58	8.0	1.7	.5	1.4
11	7.4	11	5.2	1.2	2.5	7.9	165	56	7.6	1.9	.5	*1.4
12	7.8	11	4.7	1.2	2.7	8.5	160	53	7.0	2.0	.4	1.2
13	9.0	11	4.3	1.1	3.0	9.0	170	51	6.4	1.8	.4	1.1
14	8.2	9.8	3.7	*1.1	3.3	9.8	250	46	5.9	1.7	.3	1.1
15	7.1	9.8	3.5	1.1	3.6	10	359	*42	6.4	1.7	.4	.6
16	8.2	10	3.3	1.1	3.9	11	296	38	6.4	1.6	.4	.4
17	9.4	11	3.1	1.2	4.2	12	*220	35	6.7	1.5	.2	.6
18	10	10	3.0	1.2	4.3	12	180	33	6.7	1.4	.3	.3
19	9.0	*10	2.9	1.3	*4.4	13	150	30	5.9	1.3	.3	.2
20	10	11	*2.8	1.3	4.5	13	126	28	5.6	1.2	.8	.4
21	11	11	2.7	1.4	4.5	13	116	26	5.4	.9	3.9	.5
22	*12	11	2.6	1.4	4.5	14	123	23	5.1	1.0	1.8	.5
23	12	10	2.6	1.4	4.5	15	160	20	5.9	.9	2.1	1.4
24	12	9.7	2.5	1.4	4.6	16	174	18	5.6	.7	2.1	1.7
25	13	9.5	2.4	1.4	4.8	*16	148	16	4.8	.6	2.0	1.5
26	14	9.3	2.3	1.4	5.2	18	128	15	4.2	.6	1.6	1.5
27	13	9.2	2.2	1.4	5.6	20	117	14	3.5	.6	1.4	1.4
28	13	9.2	2.1	1.4	5.9	22	108	13	2.9	.7	1.7	1.2
29	12	9.0	2.0	1.5	5.9	26	102	12	3.3	.7	2.3	1.2
30	11	8.2	2.0	1.6	----------	34	99	12	4.2	1.1	7.0	1.0
31	11	----------	1.9	1.7	----------	44	----------	11	----------	1.3	5.1	----------
Total	343.9	306.3	132.3	44.2	101.8	406.3	5,017	1,371	201.4	72.8	42.5	36.6
Mean	11.1	10.2	4.27	1.43	3.51	13.1	167	44.2	6.71	2.35	1.37	1.22
Cfsm	0.028	0.026	0.011	0.003	0.009	0.033	0.420	0.111	0.017	0.006	0.003	0.003
In.	0.03	0.03	0.01	0.004	0.01	0.04	0.47	0.13	0.02	0.007	0.004	0.003
Ac-ft	682	608	262	88	202	806	9,950	2,720	399	144	84	73

Calendar year 1963: Max 1,040 Min 1.8 Mean 51.5 Cfsm 0.129 In. 1.75 Ac-ft 37,280
Water year 1963-64: Max 359 Min 0.2 Mean 22.1 Cfsm 0.056 In. 0.76 Ac-ft 16,020

Peak discharge (base, 300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-15	0645	4.66	378				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 10.

5-2940. Pomme de Terre River at Appleton, Minn.

Location.--Lat 45°12'10", long 96°01'20", in SW¼NW¼ sec.14, T.120 N., R.43 W., on left bank at Appleton, 60 ft upstream from bridge on U.S. Highway 59 and State Highway 119 and 8 miles upstream from mouth.

Drainage area.--905 sq mi, approximately.

Records available.--March 1931 to September 1935 (no winter records), October 1935 to September 1964. Prior to October 1953, published as "near Appleton."

Gage.--Water-stage recorder and concrete control. Datum of gage is 978.00 ft above mean sea level, datum of 1929. Prior to Dec. 22, 1952, staff gage at site 4 miles upstream at datum 25.17 ft higher.

Average discharge.--29 years (1935-64), 91.5 cfs (66,240 acre-ft per year).

Extremes.--Maximum discharge during year, 525 cfs Apr. 17 (gage height, 6.16 ft); minimum, 1.2 cfs Nov. 22 (gage height, 3.36 ft).
1931-64: Maximum discharge, 5,050 cfs Apr. 8, 1952 (gage height, 10.13 ft, site and datum then in use); no flow for several periods.

Remarks.--Records good except those for periods of ice effect and shifting control, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used July 17 to Sept. 30)

Oct. 1 to Mar. 29				Mar. 30 to Sept. 30			
4.1	7.7	4.8	59	4.1	7.7	5.0	85
4.3	15	5.0	98	4.3	15	5.3	160
4.5	26			4.5	26	5.7	310
				4.8	54	6.1	495

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	44	37	26	16	13	18	55	242	76	47	14	54
2	40	36	38	18	13	19	82	230	75	47	14	40
3	38	37	35	18	13	20	160	215	71	55	13	32
4	34	36	36	20	13	20	242	208	68	50	11	29
5	33	36	38	22	14	21	204	212	65	48	9.6	27
6	32	34	40	21	15	21	180	197	64	48	*13	25
7	28	34	41	21	16	21	*186	193	60	*40	16	25
8	28	34	20	19	17	23	167	186	57	41	17	27
9	28	38	9.9	18	17	22	186	183	*61	58	15	30
10	28	36	12	18	17	24	258	183	60	41	14	28
11	29	35	16	17	17	25	163	173	62	25	*12	*28
12	30	33	24	15	17	27	151	170	64	28	11	29
13	28	38	28	*14	17	35	173	157	57	34	11	33
14	28	38	25	11	18	50	230	146	55	36	10	36
15	28	40	22	9.9	18	59	302	*143	55	32	9.9	36
16	28	36	20	10	19	72	495	140	55	30	9.6	38
17	28	36	20	12	18	45	460	143	58	30	9.3	38
18	29	*33	20	12	19	58	377	146	58	30	9.9	37
19	31	34	18	13	*20	58	382	148	62	26	10	36
20	34	33	19	14	18	49	382	146	60	25	15	35
21	45	34	*18	15	21	48	382	140	57	23	18	34
22	*55	26	16	16	19	44	386	124	58	21	19	33
23	50	17	16	16	14	42	395	121	57	18	17	30
24	43	32	17	16	19	41	350	116	54	17	16	29
25	42	36	20	15	18	42	310	114	57	16	16	29
26	40	42	22	14	17	*41	294	106	54	16	15	28
27	38	46	21	13	17	46	290	98	47	15	22	27
28	40	46	21	13	17	45	282	93	43	13	31	25
29	40	27	21	12	17	44	266	89	40	13	31	24
30	41	25	18	11	----------	47	254	83	40	14	30	24
31	38	----------	16	12	----------	45	----------	82	----------	15	55	----------
Total	1,098	1,045	713.9	471.9	488	1,172	8,044	4,727	1,750	952	514.3	946
Mean	35.4	34.8	23.0	15.2	16.8	37.8	268	152	58.3	30.7	16.6	31.5
Cfsm	0.039	0.038	0.025	0.017	0.019	0.042	0.296	0.168	0.064	0.034	0.018	0.035
In.	0.05	0.04	0.03	0.02	0.02	0.05	0.33	0.19	0.07	0.04	0.02	0.04
Ac-ft	2,180	2,070	1,420	932	968	2,320	15,950	9,360	3,470	1,890	1,020	1,880

Calendar year 1963: Max 515 Min 9.9 Mean 87.1 Cfsm 0.096 In. 1.32 Ac-ft 63,030
Water year 1963-64: Max 495 Min 9.3 Mean 59.9 Cfsm 0.066 In. 0.90 Ac-ft 43,480

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-4	1800	5.66	294	4-17	0020	6.16	525
4-10	1200	5.66	294				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 14-18, 22, 23, Nov. 29 to Dec. 4, Jan. 8-12, 15, 16, Mar. 23-29.

5-3000. Lac qui Parle River near Lac qui Parle, Minn.

Location.--Lat 45°00', long 95°55', in SW¼SW¼ sec.27, T.118 N., R.42 W., on right bank 40 ft downstream from highway bridge and half a mile southwest of village of Lac qui Parle.

Drainage area.--983 sq mi.

Records available.--April 1910 to November 1914; March 1931 to September 1964 (winter records incomplete prior to 1934). Published as "at Lac qui Parle", 1910-14.

Gage.--Water-stage recorder. Datum of gage is 951.98 ft above mean sea level (Minnesota Highway Department bench mark). Apr. 27, 1910, to Nov. 15, 1914, staff gage at site 2 miles downstream at different datum. Mar. 17, 1931, to Mar. 9, 1937, staff gage at site 40 ft upstream at present datum.

Average discharge.--33 years (1912-13, 1931-32, 1933-64), 112 cfs (81,080 acre-ft per year).

Extremes.--Maximum discharge during year, 427 cfs Apr. 10 (gage height, 3.00 ft); minimum, 0.1 cfs Aug. 6 (gage height, 0.48 ft, backwater from beaver dam).
1910-14, 1931-64: Maximum discharge, 11,100 cfs Apr. 6, 1952 (gage height, 18.18 ft); maximum gage height, 18.52 ft Mar. 24, 1948 (backwater from ice); no flow at times in several years.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	44	16	19	3.5	2.7	4.7	64	220	*37	11	0.9	9.5
2	38	14	*18	3.5	2.8	4.8	96	210	36	15	.6	*9.5
3	31	14	18	3.5	2.8	5.0	135	204	33	7.9	*.2	9.5
4	26	14	17	3.4	2.8	5.1	170	208	32	6.1	.2	6.9
5	22	13	16	3.3	2.8	5.1	244	*210	29	6.1	.2	5.3
6	20	13	15	3.3	2.8	5.2	308	*213	27	5.7	1.0	4.5
7	18	13	14	3.2	2.8	5.3	324	204	25	*4.9	1.0	4.2
8	15	13	13	3.1	2.8	5.4	322	206	23	4.2	.5	4.5
9	15	13	12	3.1	2.8	5.5	333	225	22	4.5	.3	4.5
10	14	13	11	3.1	2.9	5.7	407	215	22	4.9	.3	5.3
11	13	18	11	3.0	2.9	6.0	389	222	20	6.6	.3	3.8
12	13	18	10	3.0	2.9	6.5	324	249	18	6.5	.3	3.4
13	24	17	9.3	*2.9	2.9	7.3	281	220	17	4.9	.3	3.1
14	20	16	8.6	2.9	2.9	9.0	*263	190	16	4.0	.3	3.3
15	15	14	7.6	2.9	2.9	12	253	170	16	3.4	.3	2.8
16	14	14	6.8	2.9	2.9	14	289	155	16	2.9	.3	2.6
17	15	14	6.2	2.9	*2.9	16	319	146	15	2.9	.2	2.6
18	14	14	6.0	2.9	3.0	18	297	138	14	3.1	.3	2.5
19	13	14	5.6	2.8	3.1	27	268	129	14	3.1	.3	2.4
20	14	14	5.4	2.8	3.2	26	237	126	13	3.1	.4	3.0
21	19	14	5.4	2.8	3.4	28	213	117	13	2.8	2.2	1.9
22	22	20	5.4	2.8	3.5	31	199	104	14	2.5	1.5	2.1
23	22	22	5.4	2.8	3.6	*33	190	92	24	2.1	6.1	2.1
24	24	22	5.4	2.7	3.6	33	208	87	18	1.8	8.4	2.1
25	25	22	5.3	2.7	3.7	32	241	80	12	1.5	6.9	2.2
26	24	21	5.2	2.7	3.8	32	246	74	8.4	1.6	6.9	2.2
27	23	21	4.6	2.7	4.1	33	241	66	7.9	1.8	6.8	1.8
28	22	21	4.0	2.7	4.4	36	220	57	6.1	1.4	14	1.4
29	19	20	3.5	2.7	4.6	40	201	50	5.3	.9	14	1.3
30	*17	20	3.4	2.7	------	44	208	48	7.4	1.0	15	1.2
31	17	------	3.4	2.7	------	49	------	41	------	1.2	9.5	------
Total	632	492	280.5	92.0	92.3	584.6	7,490	4,676	561,1	129.4	99.5	111.5
Mean	20.4	16.4	9.05	2.97	3.18	18.9	250	151	18.7	4.17	3.21	3.72
Cfsm	0.021	0.017	0.0092	0.0030	0.0032	0.019	0.254	0.154	0.019	0.0042	0.0033	0.0038
In.	0.02	0.02	0.01	0.003	0.003	0.02	0.28	0.18	0.02	0.005	0.004	0.004
Ac-ft	1,250	976	556	182	183	1,160	14,860	9,270	1,110	257	197	221

Calendar year 1963: Max 814 Min 0.3 Mean 76.8 Cfsm 0.078 In. 1.06 Ac-ft 55,630
Water year 1963-64: Max 407 Min 0.2 Mean 41.6 Cfsm 0.042 In. 0.57 Ac-ft 30,220

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 4 (no gage-height record Dec. 9-27).

5-3010. Minnesota River near Lac qui Parle, Minn.

Location.--Lat 45°01'17", long 95°52'05", in NW¼NE¼ sec.24, T.118 N., R.42 W., on left bank 200 ft downstream from dam at Lac qui Parle Outlet, 2.4 miles northeast of village of Lac qui Parle, and 3.5 miles west of Watson.

Drainage area.--4,050 sq mi approximately.

Records available.--October 1942 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 900.00 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Nov. 10, 1944, at datum 0.20 ft lower.

Average discharge.--22 years, 628 cfs (454,700 acre-ft per year).

Extremes.--Maximum discharge during year, 1,480 cfs Apr. 17 (gage height, 26.88 ft); minimum, 26 cfs Mar. 24 (gage height, 20.48 ft).
1942-64: Maximum discharge, 19,700 cfs Apr. 10, 1952 (gage height, 37.98 ft, from floodmark); no flow Nov. 17, 1942, Sept. 29, 1947, Oct. 19 to Nov. 18, 1951, Nov. 24, 1952.

Remarks.--Records good except those for periods of ice effect, which are fair. Part of flow from 2,050 square miles of Chippewa River basin at times diverted into Minnesota River above station. Some regulation by Big Stone Lake since Apr. 17, 1927, Lac qui Parle Lake since January 1938, and Marsh Lake since Nov. 1, 1939.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 5 to Nov. 22, May 20 to June 22)

20.5	28	23.0	510
20.7	52	24.0	745
21.0	103	25.0	995
21.5	195	27.0	1,520
22.0	300		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	254	59	260	66	56	62	180	1,080	*212	103	38	41
2	254	59	*260	64	56	79	193	1,070	256	137	38	*41
3	256	60	262	62	56	110	243	1,040	258	135	*38	41
4	126	59	254	60	56	128	264	1,060	258	132	38	41
5	55	59	252	60	56	163	266	932	258	130	38	41
6	55	59	250	60	57	174	346	*815	258	128	39	41
7	55	59	248	60	57	172	472	818	258	*128	38	41
8	55	59	248	59	57	172	497	825	258	170	38	42
9	55	59	250	58	57	174	568	830	256	197	38	42
10	55	59	258	57	57	174	678	830	258	199	38	42
11	55	59	273	56	57	212	683	835	256	199	38	42
12	55	59	300	56	57	277	683	845	256	197	38	42
13	55	59	320	55	58	279	812	835	254	195	38	42
14	57	59	332	*54	58	279	*1,090	830	254	195	38	42
15	57	60	334	54	58	281	1,260	828	252	144	38	42
16	57	59	303	54	59	290	1,350	820	180	122	38	44
17	57	57	146	53	*60	315	1,480	810	141	120	39	42
18	57	57	144	53	60	323	1,460	637	141	122	39	42
19	57	57	148	53	60	323	1,440	432	139	122	39	42
20	57	57	151	52	60	319	1,420	249	137	122	41	42
21	57	57	157	52	60	317	1,420	142	137	66	41	42
22	57	123	164	52	60	319	1,370	141	137	37	41	42
23	59	184	117	53	62	*296	1,230	144	79	38	41	42
24	59	271	69	54	64	146	1,140	144	54	37	41	42
25	59	260	67	55	62	174	1,060	144	54	38	41	42
26	59	258	66	55	62	201	1,060	144	55	38	41	42
27	59	256	66	55	64	182	1,060	144	55	38	41	42
28	59	256	66	54	62	178	1,090	144	57	37	41	42
29	*60	256	66	54	62	184	1,100	144	57	38	41	41
30	*60	256	66	55	----------	178	1,090	144	55	38	41	41
31	59	----------	66	56	----------	176	----------	144	----------	38	41	----------
Total	2,431	3,351	5,963	1,741	1,710	6,657	27,005	18,000	5,280	3,440	1,218	1,253
Mean	78.4	112	192	56.2	59.0	215	900	581	176	111	39.3	41.8
Ac-ft	4,820	6,650	11,830	3,450	3,390	13,200	53,560	35,700	10,470	6,820	2,420	2,490

Calendar year 1963: Max 1,480 Min 52 Mean 368 Ac-ft 266,700
Water year 1963-64: Max 1,480 Min 37 Mean 213 Ac-ft 154,800

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 29, Dec. 1-3, 8-13, Jan. 9 to Feb. 21 (no gage-height record Jan. 30 to Feb. 7).

5-3045. Chippewa River near Milan, Minn.

Location.--Lat 45°06'39", long 95°47'57", in SE¼SE¼ sec.16, T.119 N., R.41 W., on right bank 800 ft upstream from bridge on State Highway 40, 2.0 miles upstream from small tributary, and 5½ miles east of Milan.

Drainage area.--1,870 sq mi, approximately.

Records available.--March 1937 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 959.69 ft above mean sea level, datum of 1929. Prior to Mar. 23, 1940, chain gage and Mar. 23, 1940, to June 14, 1942, wire-weight gage, on bridge 800 ft downstream at same datum.

Average discharge.--27 years, 231 cfs (167,200 acre-ft per year).

Extremes.--Maximum discharge during year, 1,380 cfs Apr. 15 (gage height, 4.53 ft); minimum, 14 cfs Aug. 15 (gage height, 1.20 ft).
1937-64: Maximum discharge, 6,930 cfs Apr. 9, 1952 (gage height, 12.12 ft); maximum gage height, 12.29 ft Apr. 7, 1952 (backwater from ice); no flow at times during 1940.

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated by several small lakes above gage.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to June 15				June 16 to Sept. 30	
1.6	54	3.5	744	1.1	9.0
1.7	73	3.7	852	1.2	14
2.0	138	4.0	1,020	1.4	34
2.5	283	5.0	1,580	1.6	60
3.0	479			1.8	93

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	133	110	85	24	19	30	64	636	165	62	21	73
2	101	108	85	23	19	31	150	615	157	62	20	63
3	89	101	84	23	19	31	305	594	152	62	19	52
4	87	101	81	23	20	31	270	572	143	56	19	44
5	87	101	78	22	20	31	235	556	136	59	17	37
6	83	99	76	22	20	31	255	599	128	59	*21	34
7	79	97	75	22	20	31	271	604	124	*54	22	35
8	77	95	73	22	20	31	*288	594	121	49	23	36
9	73	93	67	21	20	32	400	636	*116	46	19	42
10	73	91	61	20	20	32	580	685	114	45	20	46
11	73	87	56	19	20	33	535	663	112	71	16	*45
12	73	83	52	19	21	34	494	615	108	56	15	42
13	71	75	48	18	21	35	588	567	106	50	16	44
14	71	75	45	18	21	36	1,080	*541	99	52	15	46
15	69	67	41	*18	21	38	1,350	510	93	45	14	42
16	69	110	38	18	22	40	*1,150	474	90	40	15	37
17	67	99	35	18	23	42	968	446	91	37	15	36
18	77	*91	33	18	24	45	868	419	93	35	17	37
19	79	93	32	18	25	48	880	389	93	30	18	36
20	81	89	31	19	*26	51	793	362	93	27	21	40
21	157	87	*31	19	27	53	782	332	84	26	30	41
22	173	96	30	19	27	55	755	309	83	25	32	42
23	185	91	29	19	27	56	733	283	86	22	29	46
24	182	89	29	19	27	54	690	261	86	20	27	47
25	171	91	29	19	27	54	647	243	81	20	28	49
26	157	92	29	18	27	*55	631	228	76	20	26	46
27	149	90	28	18	27	56	787	216	71	20	25	37
28	141	88	27	18	29	58	744	202	62	19	29	40
29	*131	82	26	18	30	60	663	190	57	18	31	39
30	124	83	25	18	----------	59	636	182	56	20	31	37
31	116	----------	24	18	----------	59	----------	173	----------	21	40	----------
Total	3,298	2,754	1,483	608	669	1,332	18,592	13,696	3,076	1,228	691	1,291
Mean	106	91.8	47.8	19.6	23.1	43.0	620	442	102	39.6	22.3	43.1
Cfsm	0.057	0.049	0.026	0.010	0.012	0.023	0.332	0.236	0.054	0.021	0.012	0.023
In.	0.07	0.05	0.03	0.01	0.01	0.03	0.37	0.27	0.06	0.02	0.01	0.03
Ac-ft	6,540	5,460	2,940	1,210	1,330	2,640	36,880	27,170	6,100	2,440	1,370	2,560

Calendar year 1963: Max 825 Min 24 Mean 192 Cfsm 0.103 In. 1.39 Ac-ft 139,000
Water year 1963-64: Max 1,350 Min 14 Mean 133 Cfsm 0.071 In. 0.96 Ac-ft 96,640

Peak discharge (base, 400 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-10	1615	4.37	701	4-27	0930	3.54	803
4-15	0900	4.53	1,380				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 10.

5-3110. Minnesota River at Montevideo, Minn.

Location.--Lat 44°56'00", long 95°44'00", in NW¼NW¼ sec.19, T.117 N., R.40 W., on right bank 100 ft upstream from bridge on U. S. Highway 212, at Montevideo, and 400 ft downstream from Chippewa River.

Drainage area.--6,180 sq mi, approximately.

Records available.--July 1909 to September 1917, October 1917 to September 1929 (no winter records), October 1929 to September 1964. Prior to October 1939, published as "near Montevideo." Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 910.87 ft above mean sea level, adjustment of 1912. July 22, 1909, to Feb. 4, 1932, chain gage at bridge 600 ft downstream at present datum. Feb. 5, 1932, to Nov. 26, 1934, chain gage at bridge 100 ft downstream at present datum.

Average discharge.--43 years (1909-17, 1929-64), 616 cfs (446,000 acre-ft per year).

Extremes.--Maximum discharge during year, 2,380 cfs Apr. 17 (gage height, 9.21 ft); minimum daily, 55 cfs Aug. 15.
1909-64: Maximum discharge, 24,500 cfs, Apr. 10, 1952 (gage height, 20.02 ft, from floodmark); no flow for several days in 1933-34, 1936.

Remarks.--Records good except those for periods of ice effect or no gage-height records, which are fair. Flow regulated by Big Stone Lake since Apr. 17, 1937, Lac qui Parle since January 1938 and Marsh Lake since Nov. 1, 1939.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 22-30)

Oct. 1 to Apr. 17				Apr. 18 to Sept. 30			
2.5	139	5.0	685	1.6	48	4.0	450
3.0	225	7.0	1,370	1.7	57	5.0	690
4.0	449	10.0	2,740	2.0	92	7.0	1,370
				2.5	164	10.0	2,740
				3.0	246		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*408	186	360	99	88	125	330	1,770	309	201	62	115
2	394	182	360	98	88	155	428	1,740	*399	204	61	110
3	389	175	*360	96	88	180	559	1,710	404	210	61	*102
4	327	172	360	95	89	205	626	1,670	397	209	*61	90
5	170	172	353	94	89	218	617	*1,620	386	207	60	84
6	145	170	350	94	90	228	622	1,390	377	*207	75	80
7	147	167	340	93	90	230	749	1,380	374	199	66	80
8	145	167	340	92	90	230	804	1,410	368	204	66	80
9	144	165	340	91	90	230	872	1,440	308	256	60	85
10	141	162	345	90	90	265	1,120	1,450	337	260	60	84
11	141	157	355	89	90	310	1,290	1,470	361	265	60	84
12	142	150	370	87	91	345	1,200	1,460	352	335	58	85
13	141	147	380	*86	91	350	1,300	1,430	344	306	58	85
14	141	145	400	86	92	350	*1,760	1,400	341	282	59	82
15	142	145	410	86	92	355	2,130	1,370	339	258	55	82
16	142	147	410	86	93	360	2,260	1,350	319	201	56	81
17	147	179	340	86	94	365	2,370	1,330	244	196	58	76
18	142	169	230	86	*95	385	2,300	1,230	231	193	61	75
19	147	160	200	86	96	390	2,240	948	226	188	63	76
20	155	164	200	86	98	390	2,200	789	224	186	68	78
21	174	158	207	86	97	390	2,190	560	226	177	73	78
22	231	182	210	86	95	390	2,190	508	222	92	77	79
23	245	205	215	86	95	370	2,010	392	214	72	74	79
24	249	250	165	86	96	*322	1,910	273	201	60	72	78
25	247	370	125	86	97	217	1,730	277	201	60	73	79
26	235	365	107	87	100	250	1,720	368	199	60	70	80
27	223	370	104	87	102	265	1,740	355	199	60	71	79
28	216	370	102	87	103	270	1,780	339	201	59	73	75
29	210	365	102	88	104	270	1,800	325	201	60	77	75
30	*203	365	101	88	----------	275	1,790	309	201	60	85	75
31	194	----------	100	88	----------	285	----------	302	----------	62	98	----------
Total	6,277	6,281	8,341	2,761	2,713	8,970	44,637	32,365	8,705	5,389	2,071	2,491
Mean	202	209	269	89.1	93.6	289	1,488	1,044	290	174	66.8	83.0
Ac-ft	12,450	12,460	16,540	5,480	5,380	17,790	88,540	64,200	17,270	10,690	4,110	4,940

Calendar year 1963: Max 2,330 Min 86 Mean 580 Ac-ft 419,900
Water year 1963-64: Max 2,370 Min 55 Mean 358 Ac-ft 259,800

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23 to Mar. 23, Mar. 26 to Apr. 1 (no gage-height record Dec. 15 to Jan. 12). No gage-height record July 23 to Aug. 3, Aug. 9 to Sept. 2.

5-3114. South Branch Yellow Medicine River at Minneota, Minn.

Location.--Lat 44°33'50", long 95°59'50", in SE¼ sec.26, T.113 N., R.43 W., on downstream side of bridge on State Highway 68, 0.5 mile northwest of Minneota, and 6 miles upstream from confluence with North Branch Yellow Medicine River.

Drainage area.--111 sq mi, approximately.

Records available.--July 1960 to September 1964.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,150.00 ft above mean sea level, datum of 1929. Prior to Mar. 21, 1963, staff gage at same site and datum.

Extremes.--Maximum discharge during year, 100 cfs Apr. 23 (gage height, 5.05 ft); maximum gage height, 6.61 ft Mar. 13 (backwater from ice); no flow at times.
1959-64: Maximum discharge, 1,660 cfs July 27, 1963 (gage height, 10.66 ft); no flow at times.
Flood of Apr. 6, 1960 reached a stage of 11.10 ft, from readings by Corps of Engineers' observer (discharge, 1,830 cfs).

Remarks.--Records good except those for period of ice effect, which are fair.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	*12	6.8	3.9	3.0	3.3	38	57	4.9	2.0	0.5	1.0
2	*16	11	6.9	3.9	3.0	3.5	40	51	4.5	2.5	.4	.6
3	15	11	7.1	3.8	3.0	3.7	32	46	*4.2	1.9	.3	.4
4	16	10	*7.1	3.8	3.1	3.8	27	49	4.0	1.4	0	*0
5	14	12	7.1	3.8	3.1	3.9	26	43	3.8	4.0	*0	0
6	13	11	7.1	3.8	3.1	3.9	50	39	3.6	2.7	.7	0
7	11	10	7.0	3.7	3.1	3.9	45	*35	3.5	1.6	.4	.7
8	11	10	6.4	3.6	3.0	4.0	41	34	3.5	*1.3	0	.5
9	11	9.3	6.1	3.5	3.0	4.0	48	35	3.3	1.2	0	.8
10	11	9.1	5.8	3.4	3.0	4.1	40	34	3.1	1.1	0	.7
11	10	9.5	5.5	3.3	3.0	4.3	38	32	3.0	1.1	0	2.4
12	10	9.5	5.3	3.2	3.0	4.5	37	29	2.9	1.3	0	1.4
13	10	9.3	5.1	3.2	3.0	4.7	44	26	2.5	1.2	0	1.1
14	9.8	9.5	4.9	*3.3	3.0	5.2	65	24	2.2	1.1	0	.9
15	9.3	9.3	4.9	3.3	2.9	5.6	59	22	4.0	1.1	0	.6
16	9.5	9.5	4.8	3.4	2.9	5.9	*46	21	3.5	.9	0	.5
17	11	9.3	4.7	3.4	2.9	6.0	41	20	3.1	.8	0	.4
18	11	9.5	4.6	3.5	2.9	6.1	36	20	3.0	.7	0	.4
19	10	9.5	4.5	3.5	3.0	6.2	33	19	3.1	.5	0	.3
20	13	9.3	4.5	3.4	*3.1	6.3	32	17	3.0	.5	0	.5
21	33	10	4.4	3.4	3.1	6.5	40	15	2.6	.4	.3	.5
22	36	10	4.4	3.3	3.1	6.8	47	14	2.5	.4	.4	1.4
23	26	8.5	4.4	3.3	3.2	7.4	100	12	3.3	.4	1.6	.9
24	20	9.1	4.5	3.2	3.2	8.2	65	11	2.6	.4	1.3	.9
25	17	9.5	4.5	3.2	3.2	9.3	50	10	2.1	.4	1.2	.6
26	16	9.8	4.5	3.1	3.2	*11	62	9.1	1.7	.4	1.1	.6
27	14	10	4.4	3.1	3.2	12	46	8.2	1.4	.5	1.0	.4
28	14	9.7	4.3	3.0	3.2	13	95	7.1	1.2	.2	.8	.3
29	13	8.6	4.2	3.0	3.2	15	95	6.8	1.1	0	1.3	.4
30	12	7.0	4.0	3.0	----------	17	65	6.2	1.3	.6	1.1	.4
31	12	----------	3.9	3.0	----------	21	----------	5.4	----------	.9	.9	----------
Total	452.6	291.8	163.7	105.3	88.7	220.1	1,483	757.8	88.5	33.5	13.3	19.6
Mean	14.6	9.73	5.28	3.40	3.06	7.10	49.4	24.4	2.95	1.08	0.43	0.65
Ac-ft	898	579	325	209	176	437	2,940	1,500	176	66	26	39

Calendar year 1963: Max 1,420 Min 0 Mean 28.7 Ac-ft 20,760
Water year 1963-64: Max 100 Min 0 Mean 10.2 Ac-ft 7,370

* Discharge measurement or observation of no flow made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 8.

5-3135. Yellow Medicine River near Granite Falls, Minn.

Location.--Lat 44°43', long 95°31', in sec.35, T.115 N., R.39 W., on right bank 50 ft downstream from highway bridge, 6 miles upstream from mouth, and 8 miles south of town of Granite Falls.

Drainage area.--653 sq mi.

Records available.--March 1931 to September 1935 (no winter records), October 1935 to September 1938, October 1939 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 971.59 ft above mean sea level, datum of 1929. Mar. 16, 1931, to June 10, 1936, chain gage and June 11, 1936, to June 13, 1938, wire-weight gage, on bridge 50 ft upstream at same datum. Oct. 12, 1939, to Nov. 30, 1952, staff gage 500 ft downstream at same datum.

Average discharge.--28 years (1935-38, 1939-64), 99.3 cfs (71,890 acre-ft per year).

Extremes.--Maximum discharge during year, 486 cfs Apr. 24 (gage height, 3.83 ft); maximum gage height, 3.89 ft Apr. 9 (backwater from ice); minimum discharge, 2.1 cfs Sept. 26, 27.
1931-38, 1939-64: Maximum discharge, 11,800 cfs June 18, 1957 (gage height, 12.41 ft); no flow at times in 1931, 1933, 1948, 1959.
Flood in June 1919 reached a stage of 17.5 ft, from information by local residents.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 21-30)

2.0	1.9	2.7	65
2.1	3.1	2.9	114
2.2	6.2	3.3	247
2.3	13	4.0	560
2.5	35		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*142	57	37	10	12	13	55	433	42	16	4.0	4.0
2	120	54	42	10	12	13	70	378	41	15	3.7	*3.7
3	100	52	*45	10	12	13	90	360	39	12	3.7	3.5
4	87	49	42	11	12	13	200	318	38	12	*3.3	3.1
5	74	49	40	10	12	14	280	297	34	13	3.1	2.9
6	65	48	39	10	12	14	255	*285	32	*12	3.7	2.8
7	63	46	37	10	12	14	220	251	*30	11	4.0	3.1
8	57	48	28	10	12	14	285	236	28	9.6	3.5	3.5
9	54	45	20	10	12	15	330	314	28	9.6	3.5	4.3
10	52	43	14	10	12	15	280	369	28	13	3.3	4.0
11	48	42	14	10	12	16	240	335	26	22	3.1	3.7
12	45	41	15	10	12	17	202	322	25	16	3.1	3.5
13	46	38	15	10	12	21	222	270	22	11	3.1	3.1
14	45	42	15	*10	13	29	310	216	22	9.6	3.1	3.1
15	46	39	15	10	13	40	*396	188	25	9.0	3.1	3.1
16	46	39	14	10	13	55	414	168	24	7.7	3.1	2.9
17	43	39	14	10	13	88	352	158	25	7.2	3.1	2.8
18	43	38	13	11	*14	92	293	155	25	6.2	3.1	2.8
19	43	38	13	11	14	83	258	139	25	6.2	3.1	2.8
20	48	38	13	11	13	70	236	130	22	5.8	3.3	2.8
21	59	38	12	11	13	62	240	117	21	5.4	4.3	2.8
22	62	39	12	11	13	54	277	100	24	5.0	4.0	2.8
23	95	32	11	11	13	50	400	87	25	4.6	4.0	2.9
24	126	36	11	11	13	*47	476	78	24	4.3	4.3	2.8
25	117	39	11	10	13	45	433	69	20	4.3	4.3	2.6
26	100	49	11	10	13	46	391	63	18	4.0	4.0	2.3
27	85	54	10	11	13	48	356	57	17	4.3	4.3	2.3
28	72	54	10	11	13	49	339	52	17	4.0	5.0	2.3
29	67	43	10	11	13	49	369	49	15	3.7	5.4	2.3
30	62	33	10	11	----------	50	452	46	13	4.0	5.8	2.3
31	*59	----------	10	11	----------	52	----------	43	----------	4.3	4.3	----------
Total	2,171	1,302	603	323	366	1,201	8,721	6,083	775	271.8	116.7	90.9
Mean	70.0	43.4	19.5	10.4	12.6	38.7	291	196	25.8	8.77	3.76	3.03
Cfsm	0.107	0.066	0.030	0.016	0.019	0.059	0.446	0.300	0.040	0.013	0.0058	0.0046
In.	0.12	0.07	0.03	0.02	0.02	0.07	0.50	0.35	0.04	0.02	0.007	0.005
Ac-ft	4,310	2,580	1,200	641	726	2,380	17,300	12,070	1,540	539	231	180

Calendar year 1963: Max 1,580 Min 3.4 Mean 106 Cfsm 0.162 In. 2.20 Ac-ft 76,420
Water year 1963-64: Max 476 Min 2.3 Mean 60.2 Cfsm 0.092 In. 1.25 Ac-ft 43,700

Peak discharge (base, 100 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10-24	1400	2.96	133	4-24	1730	3.83	486
4- 9	0400	3.76	348	4-30	1800	3.81	461
4-16	0500	3.67	423	5-10	0900	3.66	382

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 23, Nov. 30 to Apr. 11.

5-3150. Redwood River at Marshall, Minn.

Location.--Lat 44°27'05", long 95°47'13", in SE¼NW¼ sec.4, T.111 N., R.41 W., on upstream side of highway bridge on Fourth Street in Marshall and 10 miles upstream from Threemile Creek.

Drainage area.--307 sq mi.

Records available.--March 1940 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Chain gage read twice daily. Datum of gage is 1,144.88 ft above mean sea level, datum of 1929.

Average discharge.--24 years, 47.8 cfs (34,610 acre-ft per year).

Extremes.--Maximum discharge during year, 138 cfs July 2; maximum gage height, 2.63 ft Mar. 13 (backwater from ice); minimum daily, 0.7 cfs June 25.
1940-64: Maximum discharge, 5,370 cfs June 17, 1957 (gage height, 10.14 ft); maximum gage height, 11.05 ft Apr. 6, 1951 (from floodmark); no flow at times.

Remarks.--Records good except those for periods of ice effect, which are fair, and those for periods of no gage-height record on diversion channel, which are poor. Water diverted at medium and high stages into diversion channel 3 miles above station, bypasses station and returns to river 1 mile below station. Diversion began Mar. 18, 1964. These records include flow in diversion channel. Unknown amount of natural diversion into Cottonwood River basin at extremely high stages.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	38	*17	8.5	6.9	a7.0	8.9	20	a72	8.6	39	2.1	1.8
2	*36	15	10	6.8	7.0	9.0	26	a72	8.6	*124	2.1	2.0
3	33	14	a11	6.7	7.0	9.1	35	68	8.6	119	2.3	1.4
4	33	14	*11	6.7	7.0	9.1	36	66	*11	99	2.0	*.9
5	28	15	12	6.7	7.0	9.0	37	65	8.6	108	*1.5	.9
6	24	14	12	6.6	7.0	9.0	43	a64	8.5	69	2.3	1.1
7	24	15	11	a6.6	7.0	9.1	50	64	8.7	55	2.3	1.8
8	28	17	4.0	6.6	7.1	a9.2	48	*69	8.6	49	1.5	1.8
9	20	17	1.9	a6.6	7.1	9.3	45	73	8.8	40	2.1	5.2
10	22	17	9.0	*6.6	7.1	9.7	42	75	9.0	34	2.0	3.1
11	28	17	9.0	6.5	7.2	11	a50	71	8.8	29	2.0	3.7
12	26	15	9.0	6.5	7.2	12	a64	66	8.8	29	1.6	2.8
13	22	15	9.0	6.5	7.2	13	92	61	8.7	25	1.5	2.0
14	19	15	8.8	6.5	7.3	15	86	57	8.7	25	1.8	1.3
15	19	17	a8.6	6.4	7.3	18	77	56	6.8	25	1.4	1.3
16	20	17	8.4	6.4	7.3	19	*72	53	1.9	19	1.8	1.0
17	22	17	8.3	6.5	7.3	18	66	51	.8	11	1.5	1.0
18	19	15	8.2	a6.5	7.4	18	62	51	.8	8.3	1.8	1.0
19	17	16	a8.0	a6.6	*7.5	a16	a59	51	.8	5.6	1.6	1.4
20	22	15	a8.0	6.6	a7.5	a16	60	51	1.0	4.4	3.7	1.5
21	37	16	7.8	6.7	7.5	a14	61	51	1.0	5.6	3.1	1.2
22	28	18	7.7	6.7	7.5	a14	62	47	1.0	5.6	5.2	1.6
23	24	17	7.7	6.7	7.5	13	60	33	.8	6.5	3.4	1.3
24	24	16	7.6	a6.8	7.5	13	65	29	.8	5.6	4.8	1.3
25	24	15	7.5	6.8	7.5	*14	69	29	.7	3.4	2.6	1.1
26	22	15	7.3	6.8	7.7	14	92	29	.8	3.1	2.1	1.3
27	21	15	7.2	6.8	8.0	15	89	29	.7	2.3	2.5	1.1
28	20	12	7.2	6.8	8.5	15	85	25	.8	2.8	2.5	1.0
29	20	12	7.1	6.9	a8.7	16	72	11	1.1	5.6	2.1	1.0
30	18	11	7.0	6.9	------	17	72	8.7	38	5.6	1.8	1.0
31	17	------	7.0	6.9	------	18	------	8.6	------	3.7	2.0	------
Total	755	461	256.8	206.6	213.9	410.4	1,797	1,556.3	181.8	967.1	71.0	48.9
Mean	24.4	15.4	8.32	6.66	7.38	13.2	59.9	50.2	6.06	31.2	2.29	1.63
Cfsm	0.079	0.050	0.027	0.022	0.024	0.043	0.195	0.164	0.020	0.102	0.0075	0.0053
In.	0.09	0.06	0.03	0.02	0.03	0.05	0.22	0.19	0.02	0.12	0.009	0.006
Ac-ft	1,500	918	511	410	424	814	3,560	3,090	361	1,920	141	97

Calendar year 1963: Max 597 Min 1.2 Mean 46.6 Cfsm 0.152 In. 2.04 Ac-ft 33,770
Water year 1963-64: Max 124 Min 0.7 Mean 18.9 Cfsm 0.062 In. 0.84 Ac-ft 13,750

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-discharge relation affected by ice Nov. 22, 23, Nov. 29 to Apr. 1.

5-3152. Prairie Ravine near Marshall, Minn.

Location.--Lat 44°29'45", long 95°47'55", NE¼ sec.20, T.112 N., R.41 W., on right bank just upstream from culvert on U. S. Highway 59 and 2.7 miles north of Marshall.

Records available.--November 1958 to September 1964 (discontinued).

Gage.--Water-stage recorder. Altitude of gage is 1,130 ft (from topographic map).

Average discharge.--5 years, 0.85 cfs.

Extremes.--Maximum discharge during year, 9.8 cfs Apr. 28 (gage height, 5.17 ft); no flow most of year.
1958-1964: Maximum discharge, 75 cfs Mar. 28, 1962 (gage height, 7.62 ft); maximum gage height, 8.78 ft Mar. 27, 1962 (backwater from ice); no flow for many days each year.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.2	*0.1	0.1				0	2.7	0.1	(*)		
2	*.2	.1	.1				0	2.4	.1			
3	.2	.1	.1				0	2.2	.1			
4	.2	.1	*.1				0	1.8	*0			
5	.2	.1	.1				0	1.8	0		(*)	
6	.2	.1	.1				0	1.8	0			
7	.2	.1	.1				0	1.5	0			
8	.2	.1	0				0	*1.7	0			
9	.2	.1	0				0	5.0	0			
10	.1	.1	0				0	2.9	0			
11	.1	.1	0				0	2.2	0			
12	.1	.1	0				.1	1.8	0			
13	0	.1	0				.3	1.4	0			
14	0	.1	0				.5	1.1	0			
15	0	.1	0				.7	.9	0			
16	0	.1	0				*1.1	1.1	0			
17	.1	.1	0				1.0	1.2	0			
18	.2	.1	0				1.0	1.1	0			
19	.2	.1	0				1.0	.7	0			
20	.2	.1	0				.9	.5	0			
21	.2	.1	0				.8	.4	0			
22	.2	.2	0				.7	.3	0			
23	.2	.2	0				.6	.1	0			
24	.2	.1	0				.6	.1	0			
25	.2	.1	0				.6	.1	0			
26	.2	.1	0				.7	.1	0			
27	.2	.1	0				.9	.1	0			
28	.2	.1	0				9.6	.1	0			
29	.2	.1	0				5.0	.1	0	(*)		
30	.2	.1	0		---		2.8	.1	0			
31	.2	---	0		---		---	.1	---			---
Total	5.0	3.2	0.7	0	0	0	28.9	37.4	0.3	0	0	0
Mean	0.16	0.11	0.02	0	0	0	0.96	1.21	0.01	0	0	0
Cfsm	-	-	-	-	-	-	-	-	-	-	-	-
In.	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1963: Max 58 Min 0 Mean 1.39 Cfsm - In. -
Water year 1963-64: Max 9.6 Min 0 Mean 0.21 Cfsm - In. -

* Discharge measurement or observation of no flow made on this day.
Note.--No gage-height record Oct. 9-17, Nov. 2 to Dec. 3, Dec. 5-8, Apr. 1-15, 17-27, May 23 to June 3. Stage-discharge relation affected by ice Dec. 4.

5-3165. Redwood River near Redwood Falls, Minn.

Location.--Lat 44°31'25", long 95°10'20", in SE¼NE¼ sec.9, T.112 N., R.36 W., on right bank 20 ft upstream from highway bridge, 3 miles west of town of Redwood Falls, and 8.5 miles upstream from mouth.

Drainage area.--697 sq mi.

Records available.--July 1909 to September 1911 (no winter records), October 1911 to September 1912, October 1912 to September 1914 and August 1930 to September 1935 (no winter records), October 1935 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 972.33 ft above mean sea level, datum of 1929. July 1909 to September 1914, chain gage at bridge 20 ft downstream at datum 0.22 ft lower. August 1930 to Mar. 25, 1940, chain gage and Mar. 26, 1940, to Oct. 25, 1949, wire-weight gage, at bridge 20 ft downstream at present datum.

Average discharge.--30 years (1911-12, 1935-64), 97.9 cfs (70,880 acre-feet per year).

Extremes.--Maximum discharge during year, 365 cfs Apr. 14 (gage height, 2.91 ft); maximum gage height, 3.02 ft Apr. 5 (backwater from ice); minimum discharge, 3.5 cfs Sept. 6 (gage height, 1.38 ft).
1909-14, 1930-64: Maximum discharge, 19,700 cfs June 18, 1957 (gage height, 15.92 ft, from floodmark); no flow for several days in January 1940 and for part of each day Aug. 19, 20, 1959.

Remarks.--Records good except those for period of ice effect, which are fair. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood and Cottonwood River basins during extreme floods.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.3	2.4	1.8	39
1.4	5.5	2.1	97
1.5	11	2.6	240
1.6	18	3.0	410

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*175	66	33	9.4	10	23	60	296	51	21	7.7	11
2	154	62	35	9.4	10	24	75	280	49	70	7.2	8.8
3	132	60	36	9.4	11	24	95	256	46	99	6.7	7.2
4	118	62	*37	9.4	12	24	140	248	44	125	*6.7	5.5
5	108	60	37	9.3	13	24	190	248	41	130	6.3	4.8
6	102	60	38	9.2	13	24	200	248	38	118	5.9	3.8
7	93	58	33	9.0	13	24	175	230	36	99	5.5	4.5
8	86	56	25	8.8	13	24	200	209	36	74	5.2	*6.3
9	82	56	14	8.8	14	25	225	*226	38	62	6.7	7.2
10	80	56	11	8.8	14	26	209	244	35	*53	8.2	9.4
11	76	53	11	8.7	14	30	190	252	34	48	6.3	15
12	74	51	11	8.7	15	33	166	244	30	43	5.9	17
13	70	49	11	8.7	16	40	213	223	28	35	5.5	13
14	68	48	11	8.7	17	50	348	197	28	32	4.8	11
15	66	49	11	*8.6	18	62	*292	181	*30	28	4.5	8.2
16	66	49	11	8.7	19	85	244	169	29	25	4.5	6.3
17	66	49	11	8.8	19	90	216	160	29	22	4.5	5.9
18	72	46	10	9.0	20	86	187	160	29	20	4.5	5.5
19	68	44	10	9.1	*20	75	184	157	29	19	4.2	5.2
20	72	46	10	9.2	20	68	169	142	25	15	4.2	10
21	78	46	10	9.2	20	62	175	130	23	13	5.2	8.8
22	97	48	10	9.1	20	56	184	115	23	13	6.3	7.7
23	113	30	10	9.0	20	52	197	104	23	10	6.7	7.7
24	111	32	10	9.0	20	50	213	93	23	8.8	7.2	8.2
25	106	36	10	8.8	20	*48	206	82	22	8.2	9.4	5.5
26	99	39	10	8.7	20	49	200	78	18	7.2	9.4	5.9
27	91	42	10	8.7	21	51	200	70	15	7.2	9.4	8.2
28	82	44	10	8.8	22	53	220	60	13	7.7	11	5.9
29	76	38	9.8	9.0	23	53	288	60	12	7.7	11	5.5
30	72	29	9.6	9.1	----------	53	296	58	11	8.2	14	5.2
31	* 72	----------	9.4	9.5	----------	54	----------	55	----------	8.2	14	----------
Total	2,825	1,464	514.8	278.6	487	1,442	5,957	5,275	888	1,237.2	218.6	234.2
Mean	91.1	48.8	16.6	8.99	16.8	46.5	199	170	29.6	39.9	7.05	7.81
Cfsm	0.131	0.070	0.024	0.013	0.024	0.067	0.286	0.244	0.042	0.057	0.010	0.011
In.	0.15	0.08	0.03	0.01	0.03	0.08	0.32	0.28	0.05	0.07	0.01	0.01
Ac-ft	5,600	2,900	1,020	553	966	2,860	11,820	10,460	1,760	2,450	434	465

Calendar year 1963: Max 1,360 Min 1.0 Mean 132 Cfsm 0.189 In. 2.57 Ac-ft 95,760
Water year 1963-64: Max 348 Min 3.8 Mean 56.9 Cfsm 0.082 In. 1.12 Ac-ft 41,290

Peak discharge (base, 150 cfs, revised)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-9	2200	2.60	240	5-1	0700	2.75	300
4-14	1400	2.91	365	5-11	1200	2.64	256

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 24 to Apr. 9.

5-3170. Cottonwood River near New Ulm, Minn.

Location.--Lat 44°17'40", long 94°26'40", in N½ sec.33, T.110 N., R.30 W., on left bank 600 ft upstream from highway bridge, 1.8 miles south of New Ulm, and 2 miles upstream from mouth.

Drainage area.--1,280 sq mi, approximately.

Records available.--July 1909 to December 1913, March 1931 to March 1938, August 1938 to September 1964 (winter records incomplete prior to 1936).

Gage.--Water-stage recorder. Datum of gage is 799.09 ft above mean sea level, adjustment of 1912. July 1, 1909, to Dec. 13, 1913, chain gage at site 2.7 miles upstream at different datum. Mar. 15, 1931, to Mar. 31, 1938, chain or wire-weight gage 2¼ miles upstream at datum 11.41 ft higher. Aug. 23, 1938, to June 25, 1948, staff gage at present site and datum.

Average discharge.--30 years (1911-13, 1935-37, 1938-64), 244 cfs (176,600 acre-ft per year).

Extremes.--Maximum discharge during year, 969 cfs May 14 (gage height, 4.64 ft); minimum, 16 cfs July 31.
1909-13, 1931-64: Maximum discharge, 14,200 cfs Mar. 30, 1962 (gage height, 15.88 ft); maximum gage height, 16.94 ft July 9, 1947 (from floodmark); minimum observed, 0.5 cfs Nov. 27, 1952 (gage height, 0.77 ft).

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Some regulation by dam at Cottonwood Lake and several other small lakes above station.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.1	22	2.0	134
1.3	36	2.5	247
1.5	55	3.0	397
1.7	83	4.0	745
		5.0	1,110

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	335	147	63	34	42	43	172	759	181	63	26	74
2	290	142	47	35	42	45	199	717	168	62	30	70
3	253	138	78	36	42	47	258	650	157	58	28	72
4	224	*134	99	36	43	47	455	612	153	53	27	68
5	204	134	111	36	43	47	448	598	147	116	26	68
6	188	129	101	36	43	47	479	762	84	145	29	67
7	*170	125	88	36	43	48	387	766	48	132	28	71
8	157	123	70	35	43	50	314	756	39	113	27	169
9	149	121	*44	35	42	52	242	731	28	114	28	167
10	142	118	41	35	42	53	242	728	41	120	*28	111
11	136	114	43	35	42	53	247	728	94	174	30	114
12	129	111	45	34	42	58	239	868	106	142	26	113
13	123	109	46	35	43	75	397	948	104	*113	25	*118
14	120	106	45	36	44	104	602	952	104	104	24	104
15	114	101	43	36	45	152	678	882	111	86	24	88
16	111	102	41	37	46	230	633	752	*127	74	24	76
17	120	101	40	*37	46	344	552	668	203	64	25	64
18	120	101	38	37	46	359	455	619	121	53	22	58
19	129	99	37	38	46	314	384	574	132	44	22	55
20	147	99	36	39	46	272	347	580	130	46	27	74
21	159	97	36	39	46	204	353	*524	120	42	41	68
22	166	96	35	39	46	211	381	465	111	42	48	71
23	214	101	34	38	46	179	431	421	102	44	44	74
24	247	72	35	38	*46	181	448	424	91	42	40	76
25	242	93	36	37	46	179	431	356	86	40	35	72
26	226	99	36	37	45	149	404	299	80	35	30	67
27	211	106	37	38	45	155	384	267	71	33	32	62
28	195	104	36	38	45	172	421	247	65	32	34	58
29	179	102	35	40	44	159	580	224	58	29	44	52
30	166	93	34	41	----------	*174	745	207	54	32	41	49
31	153	----------	34	41	----------	153	----------	192	----------	25	57	----------
Total	5,519	3,317	1,544	1,144	1,280	4,356	12,308	18,276	3,116	2,272	972	2,450
Mean	178	111	49.8	36.9	44.1	141	410	590	104	73.3	31.4	81.7
Cfsm	0.139	0.087	0.039	0.029	0.034	0.110	0.320	0.461	0.081	0.057	0.025	0.064
In.	0.16	0.10	0.04	0.03	0.04	0.13	0.36	0.53	0.09	0.07	0.03	0.07
Ac-ft	10,950	6,580	3,060	2,270	2,540	8,640	24,410	36,250	6,180	4,510	1,930	4,860

Calendar year 1963: Max 3,030 Min 11 Mean 245 Cfsm 0.191 In. 2.61 Ac-ft 177,600
Water year 1963-64: Max 952 Min 22 Mean 155 Cfsm 0.121 In. 1.65 Ac-ft 112,200

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10-22, Dec. 26 to Feb. 28, Mar. 2-4, 7-9, 12-16 (no gage-height record Dec. 31 to Jan. 16).

5-3180. East Branch Blue Earth River near Bricelyn, Minn.

Location.--Lat 43°37'50", long 93°47'25", in NE¼NE¼ sec.23, T.102 N., R.25 W., in center of span on downstream side of highway bridge, 2 miles upstream from Brush Creek, 3 miles downstream from South Walnut Lake, and 5 miles northeast of Bricelyn.

Drainage area.--132 sq mi.

Records available.--March 1951 to September 1964. Prior to October 1957, published as East Fork Blue Earth River near Bricelyn.

Gage.--Wire-weight gage read twice daily. Datum of gage is 1,131.86 ft above mean sea level, datum of 1929 (Minnesota State Highway Department bench mark).

Average discharge.--13 years, 30.9 cfs (22,370 acre-ft per year).

Extremes.--Maximum discharge during year, 128 cfs May 14 (gage height, 6.24 ft); no flow Oct. 1 to Apr. 3, July 8-9, July 28 to Sept. 6.
1951-64: Maximum discharge, 1,320 cfs Apr. 7, 1951 (gage height, 10.68 ft, from graph based on gage readings); no flow on many days.

Remarks.--Records good except those for period of no gage-height record, which are fair.

Rating table, water year 1963-64, (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 7-27)

3.8	0	4.3	3.2	5.0	38
3.9	0.4	4.4	4.8	5.5	72
4.0	.8	4.5	7.4	6.0	110
4.1	1.4	4.7	18	7.0	191
4.2	2.0				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							0	32	11	1.7		0
2							0	33	9.5	1.7		0
3							0	33	8.2	1.4		0
4							1.3	34	6.8	1.0		0
5							2.8	35	5.6	.5		0
6		(*)	(*)				4.2	46	5.4	.3		0
7							4.7	49	4.2	.1	(*)	2.8
8							4.5	52	3.9	0		.8
9	(*)						4.1	58	4.8	0		1.0
10							3.7	61	5.4	1.1		2.5
11							2.8	59	5.4	3.4		*7.8
12							3.7	68	6.4	5.6		14
13							15	98	6.8	6.8		16
14							37	118	6.4	*7.8		17
15							43	125	6.4	6.8		16
16				(*)			38	125	*5.6	6.1		13
17							32	123	4.6	5.1		9.5
18							30	118	3.9	3.7		7.8
19							29	110	3.6	2.4		5.6
20					(*)		24	*100	3.0	1.9		14
21							19	89	2.8	1.5		22
22							17	69	3.3	1.3		34
23							16	54	4.9	1.2		57
24							14	56	7.1	1.0		74
25							13	48	7.1	.6		84
26							10	38	6.1	.4		81
27							14	31	4.8	.1		76
28							17	26	3.9	0		68
29							22	21	2.9	0		60
30					---		28	17	2.1	0		51
31		---			---	(*)	---	14	---	0		---
Total	0	0	0	0	0	0	449.8	1,940	161.9	63.5	0	734.8
Mean	0	0	0	0	0	0	15.0	62.6	5.40	2.05	0	24.5
Cfsm	0	0	0	0	0	0	0.114	0.474	0.041	0.016	0	0.186
In.	0	0	0	0	0	0	0.13	0.55	0.05	0.02	0	0.21

Calendar year 1963: Max 208 Min 0 Mean 18.3 Cfsm 0.139 In. 1.88
Water year 1963-64: Max 125 Min 0 Mean 9.15 Cfsm 0.069 In. 0.96

* Discharge measurement or observation of no flow made on this day.
Note.--No gage-height record Apr. 1-18.

5-3200. Blue Earth River near Rapidan, Minn.

Location.--Lat 44°05'44", long 94°06'33", in SE¼SE¼ sec.6, T.107 N., R.27 W., on left bank 0.2 mile downstream from powerplant of Northern States Power Co., 2 miles west of Rapidan, 3½ miles downstream from Watonwan River, and 7⅞ miles upstream from LeSueur River.

Drainage area.--2,430 sq mi, approximately.

Records available.--July 1909 to November 1910 (no winter records), October 1939 to September 1945, July 1949 to September 1964. Published as "at Rapidan Mills" 1909-10.

Gage.--Water-stage recorder. Datum of gage is 808.80 ft above mean sea level, adjustment of 1912. July 20, 1909, to Apr. 28, 1910, chain gage at site a quarter mile upstream at different datum. Apr. 29 to Nov. 12, 1910, staff gage at site 800 ft upstream at different datum. Oct. 4 to Nov. 14, 1939, staff gage at present site and datum.

Average discharge.--21 years (1939-45, 1949-64), 744 cfs (538,600 acre-ft per year).

Extremes.--Maximum discharge during year, 5,240 cfs May 15 (gage height, 6.46 ft); minimum, 8.3 cfs Jan. 31 (gage height, 1.04 ft).
1909-10, 1939-45, 1949-64: Maximum discharge, 26,100 cfs Apr. 8, 1951 (gage height, 14.97 ft), from rating curve extended above 16,000 cfs by logarithmic plotting; minimum, 6.9 cfs Oct. 12, 1955 (gage height, 1.04 ft).

Remarks.--Records good. Flow regulated by Rapidan Reservoir (capacity, 2,980 acre-ft).

Rating table, water year 1963-64 (gage height, in feet, and discharge, in cubic feet per second)

1.1	13	2.4	495
1.2	24	3.0	910
1.4	64	4.0	1,840
1.6	120	5.0	3,100
2.0	278	7.0	6,220

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	453	293	55	21	53	16	161	1,520	1,220	315	70	155
2	453	233	84	80	23	82	277	1,520	1,200	315	70	99
3	447	90	139	70	76	111	*133	1,520	1,030	316	236	209
4	368	278	234	18	81	118	18	1,490	1,020	245	269	154
5	327	258	157	18	81	117	282	1,510	865	174	200	63
6	266	238	185	122	73	115	459	1,620	835	286	286	63
7	308	*236	114	76	64	36	483	2,730	719	257	213	178
8	*233	208	69	73	18	17	465	3,700	721	187	184	612
9	261	160	127	70	18	113	447	3,810	672	186	64	1,230
10	258	123	*49	68	93	75	402	3,580	680	186	178	1,600
11	258	274	99	18	100	124	364	3,300	689	188	*178	2,470
12	263	206	138	18	100	138	225	4,010	686	236	183	2,440
13	88	224	95	75	82	145	413	4,360	695	188	70	*2,290
14	263	158	57	80	74	146	1,070	*4,960	760	338	85	2,110
15	240	206	46	84	18	62	1,650	5,160	660	*468	124	1,980
16	153	177	60	*82	18	161	1,780	5,090	739	441	63	1,720
17	171	61	54	66	96	262	1,390	4,620	*596	244	102	1,620
18	200	161	52	18	100	257	1,240	3,940	612	241	157	1,350
19	171	189	48	18	96	251	1,080	3,620	551	143	155	1,230
20	113	209	45	80	92	255	1,060	3,270	479	222	99	1,240
21	304	228	22	80	86	228	1,050	2,870	478	222	157	1,570
22	287	207	55	57	18	21	952	2,570	472	226	65	2,170
23	328	61	62	55	18	258	1,150	2,260	470	225	69	3,000
24	368	62	48	64	65	149	1,050	2,240	470	184	179	3,070
25	355	189	49	28	*58	100	1,050	2,200	853	23	101	2,960
26	402	210	50	20	66	102	902	2,210	669	149	155	2,650
27	268	224	60	127	64	244	952	1,840	561	184	101	2,370
28	313	55	47	67	63	18	918	1,670	485	184	209	2,320
29	310	224	23	63	55	18	1,290	1,560	467	101	154	2,040
30	273	71	93	68	----------	149	1,580	1,410	413	69	62	1,910
31	292	---------	89	64	----------	146	----------	1,340	----------	102	211	----------
Total	8,794	5,513	2,505	1,848	1,849	4,034	24,293	87,500	20,767	6,845	4,449	46,873
Mean	284	184	80.8	59.6	63.8	130	810	2,823	692	221	144	1,562
Cfsm	0.117	0.076	0.033	0.025	0.026	0.053	0.333	1.16	0.285	0.091	0.059	0.643
In.	0.13	0.08	0.04	0.03	0.03	0.06	0.37	1.34	0.32	0.10	0.07	0.72
Ac-ft	17,440	10,930	4,970	3,670	3,670	8,000	48,180	173,600	41,190	13,580	8,820	92,970

Calendar year 1963: Max 10,500 Min 22 Mean 825 Cfsm 0.340 In. 4.61 Ac-ft 597,300
Water year 1963-64: Max 5,160 Min 16 Mean 588 Cfsm 0.242 In. 3.29 Ac-ft 427,000

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 15-20, 22-28, Jan. 2, 3, 9, 10, 13-17, 20, 21. No gage-height record Feb. 2-25.

5-3205. Le Sueur River near Rapidan, Minn.

Location.--Lat 44°06'40", long 94°02'28", in SW¼ sec.35, T.108 N., R.27 W., on right bank 600 ft downstream from highway bridge, 1.8 miles northeast of Rapidan, and 2.3 miles upstream from mouth.

Drainage area.--1,100 sq mi, approximately.

Records available.--October 1939 to September 1945, July 1949 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 775.76 ft above mean sea level, datum of 1929. Prior to Nov. 15, 1939, staff gage at same site and datum.

Average discharge.--21 years, 345 cfs (249,800 acre-ft per year).

Extremes.--Maximum discharge during year, 2,440 cfs Sept. 12 (gage height, 7.10 ft); minimum, 14 cfs Aug. 19 (gage height, 1.44 ft).
1939-45, 1949-64: Maximum discharge, 21,200 cfs May 22, 1960 (gage height, 22.72 ft, from floodmark); minimum daily, 1.6 cfs Feb. 9-25, 1959; minimum gage height, 1.79 ft Sept. 16-18, 1963.

Remarks.--Records good except for period of ice effect, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 1		Apr. 2 to Sept. 30			
1.9	48	1.4	12	3.5	352
2.1	68	1.6	25	4.0	535
2.5	119	2.0	58	5.0	980
3.0	214	2.5	119	6.0	1,560
		3.0	214	7.0	2,350

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	164	81	36	20	20	22	45	584	868	157	45	47
2	146	75	40	20	20	22	72	606	773	149	40	40
3	125	73	41	20	20	22	*75	598	678	135	36	42
4	113	72	42	20	20	23	78	602	575	119	34	36
5	104	68	41	20	20	23	101	638	495	106	33	31
6	97	*68	40	19	21	23	119	850	428	95	30	28
7	91	65	39	19	21	23	132	1,040	386	84	28	76
8	*96	63	39	19	21	23	139	1,170	355	74	25	590
9	80	61	43	19	21	24	137	1,270	328	71	24	1,090
10	75	60	*47	19	21	24	146	1,160	301	72	23	1,720
11	97	59	43	19	21	26	129	1,040	284	77	*22	2,220
12	96	58	38	18	21	27	127	1,230	267	146	24	*2,400
13	82	54	33	18	21	30	331	1,850	251	267	23	2,130
14	72	52	30	18	21	33	724	*1,840	236	376	22	1,750
15	65	50	28	18	21	38	786	1,810	221	*386	20	1,420
16	62	50	27	*18	21	46	737	1,640	210	349	18	1,180
17	60	50	26	18	21	49	652	1,520	*199	284	17	995
18	56	50	25	18	21	49	551	1,460	192	210	16	845
19	54	48	24	18	21	46	491	1,340	176	157	15	719
20	56	48	24	18	21	42	444	1,200	157	132	18	706
21	73	48	23	18	21	41	447	1,060	142	102	27	822
22	86	47	23	18	21	39	487	922	146	91	33	822
23	108	47	22	18	21	37	523	818	164	93	36	863
24	102	48	22	19	21	35	519	944	233	96	36	881
25	100	50	22	19	*21	34	487	904	346	102	34	872
26	133	51	21	19	21	34	444	1,160	346	93	31	827
27	122	49	21	19	21	36	447	1,280	301	82	28	746
28	106	47	21	19	21	36	483	1,280	248	71	35	678
29	96	45	21	19	22	37	527	1,110	203	56	39	611
30	88	41	21	19	----------	38	559	1,040	172	50	46	551
31	85	----------	20	19	----------	40	----------	953	----------	50	50	----------
Total	2,890	1,678	943	582	605	1,022	10,939	34,919	9,681	4,332	908	25,738
Mean	93.2	55.9	30.4	18.8	20.9	33.0	365	1,126	323	140	29.3	858
Cfsm	0.085	0.051	0.028	0.017	0.019	0.030	0.332	1.02	0.294	0.127	0.027	0.780
In.	0.10	0.06	0.03	0.02	0.02	0.03	0.37	1.18	0.33	0.15	0.03	0.87
Ac-ft	5,730	3,330	1,870	1,150	1,200	2,030	21,700	69,260	19,200	8,590	1,800	51,050

Calendar year 1963: Max 1,960 Min 19 Mean 206 Cfsm 0.187 In. 2.55 Ac-ft 149,100
Water year 1963-64: Max 1,850 Min 15 Mean 257 Cfsm 0.234 In. 3.19 Ac-ft 186,900

Peak discharge (base, 1,300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
5-13	1600	6.47	1,900	9-12	1415	7.10	2,440

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Apr. 1 (no gage-height record Feb. 6-14).

GPO 819-718-9

5-3250. Minnesota River at Mankato, Minn.

Location.--Lat 44°10'10", long 94°00'15", in sec.7, T.108 N., R.26 W., on left bank at downstream side of Main Street Bridge in Mankato, 1.8 miles downstream from Blue Earth River and at mile 106.4.

Drainage area.--14,900 sq mi, approximately.

Records available.--May 1903 to September 1964 (no winter records 1904, 1906-10, 1918-29). Monthly discharge only for some periods, published in WSP 1308. Published as "near Mankato" 1903-21.

Gage.--Water-stage recorder. Datum of gage is 747.92 ft above mean sea level, datum of 1929. Prior to Aug. 6, 1910, staff gage and Aug. 6, 1910, to Oct. 19, 1921, chain gage, at site 1.8 miles upstream at datum 6.4 ft higher. Mar. 15, 1922, to Nov. 30, 1924, chain gage at present site and datum.

Average discharge.--43 years (1905, 1910-17, 1929-64), 2,395 cfs (1,734,000 acre-ft per year).

Extremes.--Maximum discharge during year, 12,400 cfs May 15 (gage height, 12.30 ft); minimum 230 cfs Aug. 17, 18 (gage height, 1.00 ft).

1903-64: Maximum discharge, 66,600 cfs Apr. 9, 1951 (gage height, 26.20 ft, from floodmark); minimum observed, 26 cfs Aug. 4, 1934.

Maximum stage known, 29.9 ft Apr. 26, 1881, from floodmark, present site and datum (discharge, 90,000 cfs).

Remarks.--Records good except those for periods of ice effect, which are fair. Some diurnal fluctuation at low and medium stages caused by powerplants on Blue Earth River.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 2		Mar. 3 to Sept. 30			
1.5	400	1.0	230	5.0	3,180
2.0	605	1.2	265	7.0	5,480
3.0	1,230	1.6	369	9.0	7,910
4.0	2,010	2.0	525	11.0	10,500
5.0	3,040	3.0	1,240	13.0	13,500
		4.0	2,160		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,310	1,180	700	550	350	388	1,020	6,320	3,510	932	313	494
2	2,390	1,140	630	540	348	400	1,090	6,020	3,310	880	300	458
3	2,000	1,060	582	530	340	421	*1,240	6,330	3,080	835	378	489
4	1,770	981	590	520	337	447	1,340	6,220	2,800	865	384	510
5	1,670	1,030	600	510	330	543	1,490	6,360	2,520	812	375	447
6	1,520	994	600	490	329	474	2,520	6,730	2,380	798	414	357
7	1,420	*1,050	570	480	325	611	2,760	8,160	2,200	798	443	479
8	*1,400	1,190	510	465	320	451	2,800	9,450	2,060	798	375	1,598
9	1,260	1,160	479	455	320	407	2,700	10,100	1,700	720	300	2,760
10	1,170	1,150	524	440	325	474	2,560	9,730	1,780	769	337	3,800
11	1,100	1,130	550	430	330	424	2,500	8,870	1,880	850	*354	4,090
12	1,030	1,150	570	420	335	515	2,520	9,760	1,940	1,020	363	*5,380
13	962	1,080	600	410	345	692	3,250	11,400	1,880	1,190	310	5,040
14	942	870	620	400	355	842	4,240	12,400	1,860	*1,170	286	4,560
15	955	819	645	385	360	910	5,670	*12,300	1,780	1,570	276	4,060
16	942	838	655	380	365	1,060	6,270	11,700	1,680	1,460	279	3,520
17	851	844	665	*375	370	1,470	6,390	10,900	1,860	1,330	288	3,120
18	838	783	675	365	375	1,330	6,320	9,780	*1,860	1,160	288	2,760
19	851	789	*675	360	380	1,680	6,130	*9,060	1,610	1,020	318	2,500
20	838	832	680	355	380	1,720	6,040	8,460	1,610	872	316	2,480
21	890	795	675	352	380	1,470	5,950	7,750	1,520	741	318	2,780
22	962	819	670	350	379	1,360	5,880	7,090	1,490	650	343	3,180
23	1,040	825	665	348	375	1,290	5,710	6,150	1,450	657	303	4,050
24	1,080	743	660	342	372	1,270	5,840	5,030	1,460	637	378	4,350
25	1,180	754	655	340	*366	1,090	5,770	5,770	1,570	537	381	4,270
26	1,260	777	640	338	365	734	5,550	5,770	1,920	470	349	3,930
27	1,330	795	630	340	364	902	5,480	5,340	1,520	549	372	3,530
28	1,250	795	615	345	368	1,520	5,380	4,950	1,400	462	407	3,280
29	1,310	801	600	348	375	1,090	5,600	4,390	1,280	421	439	3,080
30	1,280	760	585	349	----------	790	6,150	4,090	1,120	375	414	2,860
31	1,230	---------	570	350	---------	1,230	----------	3,800	----------	357	494	----------
Total	39,031	27,934	19,085	12,662	10,263	28,005	126,160	240,180	58,030	25,705	10,895	84,212
Mean	1,259	931	616	408	354	903	4,205	7,748	1,934	829	351	2,807
Cfsm	0.084	0.062	0.041	0.027	0.024	0.061	0.282	0.520	0.139	0.056	0.024	0.188
In.	0.10	0.07	0.05	0.03	0.03	0.07	0.31	0.60	0.14	0.06	0.03	0.21
Ac-ft	77,420	55,410	37,850	25,110	20,360	55,550	250,200	476,400	115,100	50,990	21,610	167,000

Calendar year 1963: Max 15,400 Min 330 Mean 2,552 Cfsm 0.171 In. 2.33 Ac-ft 1,847,000
Water year 1963-64: Max 12,400 Min 276 Mean 1,864 Cfsm 0.125 In. 1.70 Ac-ft 1,353,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 30 to Dec. 2, Dec. 4-8, Dec. 11 to Mar. 2. Computed from twice-daily wire-weight gage readings Oct. 1 to July 31.

5-3300. Minnesota River near Carver, Minn.

Location.--Lat 44°43'28", long 93°37'58", in NE¼SW¼ sec.31, T.115 N., R.23 W., on left bank 2½ miles south of Carver and at mile 36 upstream from Mississippi River.

Drainage area.--16,200 sq mi, approximately.

Records available.--September 1934 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 690.00 ft above mean sea level, datum of 1929. Prior to Dec. 5, 1934, staff gage at same site and datum. Auxiliary chain gage 2¾ miles upstream at same datum read twice daily.

Average discharge.--30 years, 3,013 cfs (2,181,000 acre-ft per year).

Extremes.--Maximum discharge during year, 12,900 cfs May 18; maximum gage height, 16.15 ft May 18 (backwater from Mississippi River); minimum daily discharge, 385 cfs Jan. 1-3; minimum gage height, 3.42 ft Mar. 4.
1934-64: Maximum discharge, 64,100 cfs Apr. 11, 1951 (gage height, 27.71 ft); maximum gage height, 28.31 ft Apr. 16, 1952; minimum discharge, 79 cfs Nov. 17, 1955; minimum gage height, 2.66 ft Nov. 22, 1935.

Remarks.--Records good except those for periods of ice effect, which are fair.

Cooperation.--Auxiliary gage readings furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,450	1,510	1,020	385	495	510	1,230	6,070	4,320	1,630	674	910
2	2,380	1,480	1,030	*385	500	515	*1,270	6,350	4,150	1,560	652	850
3	2,280	1,440	960	385	495	510	1,190	6,420	3,900	1,430	619	839
4	2,190	1,380	905	390	495	510	1,280	6,330	3,700	1,360	575	806
5	2,060	1,280	880	390	490	520	1,400	6,280	2,830	1,310	630	784
6	1,920	1,290	855	395	495	520	1,610	6,500	2,670	1,280	685	795
7	1,820	1,300	835	400	495	520	2,090	7,620	2,540	1,210	674	762
8	1,710	*1,280	815	400	500	520	2,410	8,670	*2,440	1,260	674	795
9	1,650	1,240	800	405	500	525	2,520	9,320	2,460	1,310	696	1,490
10	*1,580	1,200	800	410	500	530	2,520	10,100	2,600	1,370	*652	2,640
11	1,500	1,170	798	425	500	540	2,470	10,500	2,520	1,420	586	4,370
12	1,440	1,140	790	440	500	550	2,430	10,400	2,390	1,450	564	5,040
13	1,380	1,180	780	455	500	560	2,540	10,200	2,220	1,510	608	5,430
14	1,340	1,170	760	465	505	580	2,910	11,400	2,150	1,540	597	5,250
15	1,230	1,150	750	475	510	615	4,560	12,200	2,120	1,590	575	*4,890
16	1,240	1,130	740	480	510	660	5,350	12,600	2,070	*1,660	520	4,520
17	1,240	1,110	730	485	510	725	5,990	12,900	2,050	1,740	502	4,120
18	1,190	1,090	*706	485	510	800	6,180	*12,700	2,070	1,680	502	3,800
19	1,160	1,060	700	485	505	920	6,150	12,000	2,040	1,520	493	3,370
20	1,160	1,040	680	*485	505	1,040	6,150	10,900	2,030	1,410	493	2,780
21	1,170	1,060	660	485	505	1,260	6,170	9,720	1,940	1,320	652	2,780
22	1,180	1,080	640	485	505	1,310	6,160	8,680	1,880	1,270	674	2,840
23	1,290	1,080	620	490	505	1,280	6,070	7,940	1,970	1,200	707	3,780
24	1,320	1,080	580	485	505	1,230	5,960	7,410	1,940	1,140	707	4,370
25	1,400	1,030	550	485	505	1,200	5,950	6,460	1,840	1,090	619	4,750
26	1,480	988	520	485	505	1,090	5,850	6,260	1,810	1,040	597	4,790
27	1,550	1,010	490	485	*505	1,030	5,860	5,870	2,010	940	751	4,500
28	1,660	1,050	470	485	505	1,080	5,630	5,630	1,910	870	751	4,180
29	1,620	1,050	430	485	510	1,180	5,570	5,280	1,770	880	817	3,940
30	1,600	1,020	410	490	----------	1,220	5,650	4,840	1,660	839	1,000	3,760
31	1,580	---------	390	495	----------	1,160	----------	4,540	----------	751	1,090	----------
Total	48,770	35,088	22,094	13,980	14,570	25,210	121,120	262,090	72,000	40,580	20,336	93,931
Mean	1,573	1,170	713	451	502	813	4,037	8,455	2,400	1,309	656	3,131
Cfsm	0.097	0.072	0.044	0.028	0.031	0.050	0.249	0.522	0.148	0.081	0.040	0.193
In.	0.11	0.08	0.05	0.03	0.03	0.06	0.28	0.60	0.17	0.09	0.05	0.22
Ac-ft	96,730	69,600	43,820	27,730	28,900	50,000	240,200	519,800	142,800	80,490	40,340	186,300

Calendar year 1963: Max 14,400 Min 390 Mean 2,760 Cfsm 0.170 In. 2.30 Ac-ft 1,998,000
Water year 1963-64: Max 12,900 Min 385 Mean 2,103 Cfsm 0.130 In. 1.77 Ac-ft 1,527,000

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 1-3, Dec. 5 to Mar. 30.

5-3309. Nine Mile Creek at Bloomington, Minn.

Location.--Lat 44°48'46", long 93°18'07", in NW¼ sec.21, T.27 N., R.24 W., on left bank between 105th and 106th street in Bloomington, Minn., 1.2 miles downstream from bridge on Old Shakopee Road and 2.1 miles upstream from mouth.

Records available.--January 1963 to September 1964.

Gage.--Water-stage recorder. Altitude of gage is 731 ft (from topographic map). Prior to May 16, 1963, staff gage 30 ft upstream at datum 0.81 ft higher.

Extremes.--Maximum discharge during year, 199 cfs Aug. 29 (gage height, 3.63 ft); minimum daily 1.6 cfs Dec. 31, Jan. 29, Mar. 15; minimum gage height, 1.47 ft July 6, 7, 8.
1963-64: Maximum discharge, that of Aug. 29, 1964; minimum daily, that of Dec. 31, Jan. 29, Mar. 15, 1964.

Remarks.--Records good.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.8	2.8	2.8	1.7	1.9	1.9	6.2	14	3.8	3.8	5.1	39
2	3.0	2.8	2.2	1.7	1.7	2.0	9.4	14	3.6	3.2	4.6	36
3	3.0	2.8	2.2	1.7	1.7	2.0	13	17	3.4	2.4	4.6	31
4	2.8	3.4	2.1	1.8	2.1	2.1	16	12	3.2	2.2	4.1	16
5	2.5	3.0	2.1	1.7	2.1	2.1	24	11	3.2	2.0	3.8	7.6
6	2.1	3.4	*2.6	1.7	1.8	2.0	35	37	2.7	2.1	4.3	5.1
7	*3.0	3.4	3.0	1.9	1.8	2.1	37	38	3.8	2.2	3.6	14
8	3.4	2.8	2.8	*1.7	1.7	2.0	11	34	3.2	2.1	2.5	30
9	3.2	2.8	2.4	1.7	1.8	2.2	9.9	33	3.0	12	3.4	38
10	3.4	3.2	2.5	1.7	1.8	2.3	8.9	29	3.0	15	4.1	42
11	3.2	3.2	2.5	1.7	1.8	2.2	9.9	24	4.0	22	4.3	*41
12	2.7	3.0	2.5	1.8	1.9	4.1	13	31	3.6	25	4.8	39
13	2.7	2.8	2.4	1.7	1.9	2.1	38	29	2.7	26	5.1	34
14	3.2	2.5	2.1	1.7	1.9	1.7	41	22	2.8	22	5.3	26
15	3.2	2.8	2.0	1.7	1.8	1.6	40	16	2.8	15	4.8	16
16	3.8	2.8	1.8	1.7	1.9	*3.3	29	15	*2.7	9.9	4.1	10
17	4.1	2.7	1.9	1.9	*1.9	2.9	*19	12	3.2	7.6	4.1	11
18	3.8	*3.4	1.9	1.7	1.9	4.3	14	12	5.2	6.2	3.8	14
19	3.4	3.2	1.9	1.7	1.8	5.6	12	9.9	4.6	5.1	4.3	11
20	2.8	3.2	1.9	1.8	1.7	5.1	12	9.9	6.3	8.0	5.1	27
21	6.9	3.2	2.2	1.9	1.8	4.3	28	13	5.3	6.5	7.9	24
22	6.5	5.9	1.8	1.8	1.8	4.6	28	8.9	5.5	6.5	17	25
23	6.5	3.8	1.7	1.7	1.8	5.3	28	11	20	*6.2	9.4	*33
24	8.7	4.6	1.7	1.7	1.8	5.1	22	10	19	5.3	11	34
25	6.8	4.3	1.8	1.7	1.8	5.6	16	13	19	4.6	8.4	27
26	6.2	4.3	1.7	1.7	1.8	5.6	11	*15	15	3.8	6.5	22
27	5.1	3.8	1.7	1.7	1.8	5.6	10	8.4	8.0	4.1	10	16
28	4.1	3.8	1.7	1.7	1.9	5.6	15	7.6	5.1	3.6	14	12
29	3.0	3.0	1.7	1.6	2.0	5.6	12	5.6	4.6	3.4	31	8.9
30	3.2	3.0	1.9	1.8	----------	5.6	16	4.6	6.6	4.8	38	9.4
31	2.8	----------	1.6	1.9	----------	5.6	----------	4.3	----------	5.3	38	----------
Total	122.9	99.7	65.1	53.9	53.4	112.1	584.3	521.2	178.9	247.9	277.0	699.0
Mean	3.96	3.32	2.10	1.74	1.84	3.62	19.5	16.8	5.96	8.00	8.94	23.3
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1963: Max 53 Min 1.6 Mean 9.05 Ac-ft -
Water year 1963-64: Max 42 Min 1.6 Mean 8.48 Ac-ft -

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Jan. 13, 27.

5-3310. Mississippi River at St. Paul, Minn.

Location.--Lat 44°56'40", long 93°05'20", in SE¼NE¼ sec.6, T.28 N., R.22 W., on left bank in St. Paul, 300 ft upstream from Robert Street Bridge, 6 miles downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.

Drainage area.--36,800 sq mi, approximately.

Records available.--March 1892 to September 1964 (prior to 1901, fragmentary during some winters). Records prior to March 1892, published in the 19th Annual Report, Part 4, have been found to be unreliable and should not be used. Monthly discharge only for some periods, published in WSP 1308. Gage-height records (winter records incomplete) collected at same site since 1866 are contained in reports of U. S. Weather Bureau, War Department and Mississippi River Commission.

Gage.--Water-stage recorder. Datum of gage is 684.16 ft above mean sea level, adjustment of 1912. Prior to Mar. 18, 1925, staff or chain gage at several sites within 300 ft of present site at same datum. Mar. 18, 1925, to Mar. 10, 1933, water-stage recorder and Mar. 11, 1933, to Sept. 14, 1939, staff gage, at present site and datum. Since September 1938, auxiliary water-stage recorder 5.4 miles downstream.

Average discharge.--66 years (1894-95, 1896-97, 1900-1964), 9,799 cfs (adjusted for diversion).

Extremes.--Maximum discharge during year, 33,400 cfs May 15 (gage height, 8.31 ft); minimum daily, 2,170 cfs Aug. 20.

1892-1964: Maximum discharge, 125,000 cfs Apr. 16, 1952 (gage height, 22.02 ft); minimum daily, 632 cfs Aug. 26, 1934.

Maximum stage know since at least 1870, that of Apr. 16, 1952. Flood of Apr. 29, 1881, reached a stage of 19.7 ft (discharge, 107,000 cfs), determined by Corps of Engineers.

Remarks.--Records good. Slight regulation except during extreme floods by reservoirs on headwaters and by powerplants. Beginning July 20, 1938, sewage from Minneapolis and St. Paul, which formerly entered above station, was diverted to a sewage-disposal plant, thence to river below station. Figures of daily discharge do not include this diversion.

Cooperation.--Records of Mississippi River at Twin City lock and dam computed and furnished by Ford Motor Co. Gage-height record at South St. Paul furnished by Corps of Engineers. Diversion through sewage-disposal plant furnished by Minneapolis-St. Paul Sanitary District.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,860	4,270	4,000	2,580	3,030	3,000	5,170	19,100	11,400	10,900	3,340	7,040
2	5,710	4,230	3,210	2,690	3,140	2,850	4,170	19,300	9,970	10,200	3,190	*8,750
3	5,780	4,470	3,460	2,910	2,840	2,980	4,410	19,700	8,990	8,830	3,300	7,660
4	5,420	4,150	3,910	2,920	3,190	2,980	4,770	20,200	8,530	8,000	3,990	6,980
5	5,040	4,320	3,500	2,980	3,040	2,940	5,950	20,000	8,160	7,690	3,470	6,730
6	5,020	3,780	3,580	2,970	3,030	3,060	7,050	21,300	7,040	7,220	3,400	6,590
7	4,900	3,620	3,840	2,940	3,220	2,990	6,830	22,300	7,570	7,190	2,930	7,540
8	4,310	3,990	4,440	3,030	3,190	3,030	7,330	24,900	7,160	6,820	2,790	6,760
9	4,620	4,120	3,400	2,990	3,180	3,030	8,180	27,000	5,510	7,040	2,420	9,400
10	4,390	3,970	3,360	2,980	3,200	3,320	8,760	28,600	5,590	6,510	2,890	11,700
11	4,400	3,680	3,180	2,940	3,020	3,300	9,920	29,800	6,470	7,010	2,900	14,000
12	3,700	*3,770	3,160	3,060	2,940	3,050	10,000	31,400	6,100	6,840	2,600	15,000
13	3,770	3,900	2,530	2,860	2,940	3,930	11,900	32,400	5,790	6,520	2,820	16,200
14	4,050	4,090	2,370	3,330	3,100	3,840	12,600	32,800	5,500	6,230	2,710	16,000
15	3,840	3,920	2,510	3,140	3,120	3,670	16,200	33,200	6,260	6,030	2,880	16,200
16	3,970	3,800	2,930	3,100	3,230	3,690	18,200	33,000	6,390	5,930	2,320	15,600
17	*3,790	3,440	3,220	2,960	3,120	3,870	20,200	32,400	*5,760	5,630	2,440	14,900
18	3,560	2,590	3,040	2,970	2,810	5,080	22,400	31,600	5,990	5,790	2,290	14,600
19	3,820	3,970	3,100	3,010	3,230	5,760	22,200	30,200	6,010	5,620	2,490	13,500
20	3,420	3,970	3,440	2,970	3,070	4,660	22,700	28,900	5,840	*5,370	2,170	13,600
21	4,030	4,060	2,850	3,010	3,090	5,220	23,200	27,100	6,370	4,460	2,470	12,200
22	3,840	3,940	2,970	3,160	3,020	5,500	*22,400	*25,500	6,660	4,400	3,320	12,400
23	4,170	3,840	2,970	3,370	3,060	6,320	22,000	23,800	9,240	4,290	2,780	12,600
24	4,660	4,290	2,770	3,440	2,890	4,900	22,900	22,000	8,780	4,200	3,260	12,500
25	4,840	3,980	2,940	3,280	3,060	4,050	22,900	20,100	10,400	4,060	3,320	13,600
26	4,740	4,080	2,760	2,950	3,060	3,980	22,900	17,900	10,800	3,790	3,500	13,200
27	4,890	3,740	3,010	2,910	3,040	4,240	22,500	16,700	11,700	3,720	3,580	12,600
28	4,530	4,550	2,910	2,970	3,090	4,200	20,800	14,400	11,900	3,720	3,900	12,800
29	4,880	5,050	2,970	3,070	3,200	3,960	20,200	13,700	12,200	3,300	4,320	*12,300
30	4,960	4,580	3,010	3,040	----------	4,710	19,000	12,000	10,800	3,510	4,450	12,500
31	4,750	----------	2,790	3,200	----------	4,300	----------	10,600	----------	3,200	5,940	----------
Total	139,660	121,160	98,130	93,730	89,150	122,410	447,740	741,900	238,880	184,020	98,180	355,450
Mean	4,505	4,039	3,165	3,024	3,074	3,949	14,920	23,930	7,963	5,936	3,167	11,850
(ƒ)	+302	+274	+258	+248	+272	+286	+296	+312	+323	+363	+363	+341
Mean ≠	4,807	4,313	3,423	3,272	3,346	4,235	15,216	24,242	8,286	6,299	3,530	12,191
Cfsm ≠	0.131	0.117	0.093	0.089	0.091	0.115	0.413	0.659	0.225	0.171	0.096	0.331
In.≠	0.15	0.13	0.11	0.10	0.10	0.13	0.46	0.76	0.25	0.20	0.11	0.37

Calendar year 1963: Max 31,300 Min 2,370 Mean 8,546 Mean≠ 8,844 Cfsm≠ 0.240 In.≠ 3.26
Water year 1963-64: Max 33,200 Min 2,170 Mean 7,460 Mean≠ 7,763 Cfsm≠ 0.211 In.≠ 2.87

* Discharge measurement made on this day.
ƒ Diversion, equivalent in cubic feet per second, through sewage-disposal plant.
≠ Adjusted for diversion.
Note.--Stage-fall-discharge relation affected by ice or indefinite slope Oct. 1 to Mar. 15, June 1 to Aug. 31.

5-3362. Glaisby Brook near Kettle River, Minn.

Location.--Lat 46°27'19", long 92°51'34", in SE¼NW¼ sec.22, T.46 N., R.20 W., on left bank 20 ft upstream from bridge No. 2468 on State Highways 27 and 73, 1.0 mile upstream from mouth, and 2.4 miles south of Kettle River.

Records available.--October 1959 to September 1964.

Gage.--Water-stage recorder. Altitude of gage is 1,105 ft (from topographic map).

Average discharge.--5 years, 12.4 cfs.

Extremes.--Maximum discharge during year, 478 cfs May 7 (gage height, 5.57 ft); minimum daily, 0.1 cfs July 24, 25, 26; minimum gage height, 1.99 July 24, 26.
1959-64: Maximum discharge, 628 cfs May 23, 1962 (gage height, 6.17 ft); minimum, 0.1 cfs Aug. 3, 1960, July 9, 1961, Aug. 8, Sept. 1, 1963, July 24, 25, 26, 1964.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.0	.1	2.4	5.1	3.5	76
2.1	.6	2.5	8.5	4.0	141
2.2	1.4	2.7	19	5.0	338
2.3	2.8	3.0	36	6.0	585

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.5	1.0	2.4	0.4	0.3	0.3	0.8	49	6.8	6.4	3.1	18
2	.5	1.0	2.2	.5	.3	.4	5.3	52	*5.8	6.8	1.6	17
3	.4	1.0	*2.0	.5	.4	.4	7.1	49	4.8	4.8	*.8	*14
4	.4	1.0	2.0	.5	.4	.4	4.0	*52	4.2	4.0	.5	9.0
5	.4	1.0	1.9	.5	.4	.4	3.1	84	3.7	2.9	.3	8.2
6	.5	1.0	1.7	.5	.4	.4	3.3	*227	3.3	2.8	.3	9.8
7	.5	1.0	1.7	.5	.4	.4	4.0	428	3.3	2.3	.2	165
8	.6	1.0	2.0	.5	.4	.4	4.5	303	3.1	1.9	.2	294
9	.7	1.0	2.0	.5	.3	.3	8.0	174	4.5	2.3	.2	190
10	.7	1.2	1.6	.5	.3	.3	15	117	5.8	2.1	.2	102
11	.7	1.1	1.4	.4	.3	.4	21	84	4.5	1.5	.2	71
12	.7	1.0	1.3	.4	.4	.6	27	86	3.7	1.4	.2	54
13	.7	.9	1.3	.3	.4	1.1	35	86	2.8	*1.1	.2	46
14	.7	.9	1.1	*.3	.4	2.6	46	76	2.4	.9	.2	55
15	.7	1.0	1.0	.3	.4	2.3	60	62	2.3	.8	.2	70
16	.8	1.0	.9	.3	.4	1.7	69	51	2.0	.6	.2	65
17	.9	1.0	.8	.4	*.4	.8	68	43	2.6	.4	.2	53
18	.9	1.0	.8	.3	.4	.6	61	40	2.8	.3	.2	42
19	.8	1.1	.8	.3	.4	.7	53	34	3.1	.2	.2	37
20	.8	1.0	.7	.3	.3	.6	46	29	2.8	.2	.2	35
21	1.6	1.0	.6	.3	.3	.5	*60	24	2.3	.2	.8	33
22	2.6	1.1	.6	.3	.3	.7	97	20	2.3	.2	1.1	32
23	1.5	2.0	.6	.3	.3	.8	109	26	25	.2	.9	42
24	1.6	2.8	.6	.3	.3	.9	87	41	52	.1	2.6	54
25	1.6	2.9	.5	.3	.3	.8	70	28	63	.1	3.7	57
26	1.6	2.8	.5	.3	.3	*.8	58	21	52	.1	2.9	49
27	1.4	2.7	.5	.3	.3	.7	50	17	35	.2	2.9	41
28	*1.2	2.7	.5	.3	.3	.6	46	14	20	.2	16	34
29	1.1	2.6	.4	.3	.3	.6	44	12	12	.2	17	29
30	1.1	2.5	.4	.3	----------	.6	48	10	7.8	.2	26	26
31	1.1	----------	.4	.3	----------	.5	----------	7.4	----------	.2	23	----------
Total	29.3	43.3	35.2	11.5	10.1	22.6	1,210.1	2,346.4	345.7	45.6	106.3	1,752.0
Mean	0.95	1.44	1.14	0.37	0.35	0.73	40.3	75.7	11.5	1.47	3.43	58.4
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1963: Max 109 Min 0.1 Mean 8.1 Ac-ft -
Water year 1963-64: Max 428 Min 0.1 Mean 16.3 Ac-ft -

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Dec. 2, Apr. 9-16.

5-3385. Snake River near Pine City, Minn.

Location.--Lat 45°50'30", long 92°56'00", in SE¼NW¼ sec.26, T.39 N., R.21 W., on left bank at site of former powerplant and dam, half a mile downstream from Cross Lake and 1½ miles northeast of Pine City.

Drainage area.--958 sq mi.

Records available.--June 1913 to September 1917, July 1951 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 919.00 ft above mean sea level, datum of 1929. June 25, 1913, to Sept. 30, 1917, staff gage at site 500 ft downstream at different datum. July 1 to Oct. 28, 1951, staff gage at present site and datum.

Average discharge.--17 years, 526 cfs.

Extremes.--Maximum discharge during year, 6,820 cfs May 11 (gage height, 7.86 ft); minimum daily, 68 cfs Feb. 4-20; minimum gage height, 2.89 ft Jan. 10.
1913-17, 1951-64: Maximum discharge, 7,730 cfs May 28, 1962; maximum gage height, 8.30 ft Apr. 12, 13, 1952; minimum discharge, 12 cfs Nov. 29, 30, 1960; minimum gage height, 2.65 ft Jan. 15, 1955.
A discharge measurement of 12,500 cfs was made May 9, 1950.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method May 9-31)

Oct. 1 to Apr. 3		Apr. 4 to Sept. 30			
3.0	70	3.0	56	5.0	1,870
3.2	144	3.2	133	6.0	3,290
3.4	246	3.5	301	7.0	5,160
		4.0	729	8.0	7,440

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	116	104	148	75	69	70	210	1,260	308	456	129	264
2	116	94	150	74	69	71	218	1,180	276	408	124	289
3	104	94	154	73	69	71	222	1,100	251	349	124	*295
4	97	94	155	73	68	71	228	1,100	228	321	129	289
5	97	94	155	72	68	72	239	1,150	222	295	153	264
6	94	97	154	72	68	72	289	1,610	205	289	163	239
7	97	97	153	72	68	73	328	2,220	205	*276	153	228
8	94	94	150	71	68	74	362	3,150	194	251	133	217
9	84	97	148	70	68	75	431	4,690	205	258	120	239
10	84	101	*144	70	68	76	517	5,980	211	328	120	328
11	80	101	140	70	68	77	649	6,680	217	500	138	369
12	77	*97	136	70	68	80	834	6,660	222	679	124	369
13	80	94	130	70	68	83	994	6,070	222	750	112	355
14	77	90	123	70	*68	88	1,210	5,360	217	709	103	315
15	77	87	118	*70	68	93	1,420	4,690	200	639	99	282
16	77	90	114	70	68	100	1,700	4,050	189	582	99	289
17	80	90	109	70	68	110	1,920	3,380	189	526	90	295
18	80	90	105	70	68	120	2,020	2,840	189	473	83	289
19	84	90	102	70	68	130	2,040	2,400	194	431	76	282
20	80	94	98	70	68	140	2,010	2,040	183	385	73	282
21	84	94	95	70	69	147	1,930	1,750	178	349	107	276
22	97	100	93	70	69	153	1,830	1,490	173	295	116	270
23	104	110	91	70	69	163	1,780	1,260	205	264	120	289
24	108	118	89	70	69	168	1,830	1,090	245	239	129	295
25	116	128	87	70	69	173	1,910	*919	362	222	143	289
26	120	136	85	70	69	*180	1,900	803	517	194	143	335
27	120	145	83	70	69	182	1,920	679	601	*183	168	349
28	116	150	82	70	69	184	*1,720	563	591	189	222	308
29	112	152	80	70	70	187	1,540	473	535	173	217	282
30	108	150	78	70	---	190	1,390	408	500	148	228	276
31	108	---	76	70	---	205	---	349	---	138	233	---
Total	2,968	3,172	3,625	2,192	1,985	3,678	35,591	77,394	8,234	11,299	4,171	8,748
Mean	95.7	106	117	70.7	68.4	119	1,186	2,497	274	364	135	292
Cfsm	0.100	0.111	0.122	0.074	0.071	0.124	1.24	2.61	0.286	0.380	0.141	0.305
In.	0.11	0.12	0.14	0.09	0.08	0.14	1.38	3.00	0.32	0.44	0.16	0.34

Calendar year 1963: Max 2,880 Min 44 Mean 357 Cfsm 0.373 In. 5.05
Water year 1963-64: Max 6,680 Min 68 Mean 446 Cfsm 0.466 In. 6.32

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 22 to Dec. 9, Dec. 11 to Apr. 3.

5-3400. Sunrise River near Stacy, Minn.

Location.--Lat 45°24'30", long 92°55'55", in NW¼NW¼ sec.26, T.34 N., R.21 W., on right bank on upstream side of highway bridge, 2½ miles northeast of Stacy, 2½ miles upstream from Minnesota Game and Fish dam and 3 miles downstream from West Branch Sunrise River.

Drainage area.--167 sq mi.

Records available.--January 1949 to September 1964.

Gage.--Water-stage recorder. Altitude of gage is 865 ft (from topographic map) revised. Prior to Nov. 10, 1949, chain gage at same site and datum.

Average discharge.--15 years, 63.6 cfs.

Extremes.--Maximum discharge during year, 290 cfs May 11 or 12 (gage height, 6.72 ft); minimum daily, 4.6 cfs July 27; minimum gage height, 2.65 ft Nov. 15.
1949-64: Maximum discharge, 806 cfs Apr. 12, 1952 (gage height, 7.88 ft); minimum observed, 3.6 cfs July 17, 1949 (gage height, 1.98 ft).

Remarks.--Records fair. Subject to backwater from Minnesota Game and Fish dam approximately 2½ miles downstream after May 11, 1964. At high stages a small part of flow discharges into the Rum River and Coon Creek basins from West Arm of Coon Lake and South Coon Lake, respectively.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*26	18	20	14	14	15	30	71	42	14	8.4	16
2	26	18	20	14	14	15	*28	75	38	13	7.8	*17
3	25	18	20	14	14	15	27	73	36	12	7.5	20
4	25	18	21	14	14	15	25	73	33	12	6.9	21
5	24	18	22	14	15	14	26	86	30	12	6.0	21
6	24	*18	23	14	15	14	33	120	28	12	5.7	22
7	23	18	24	14	14	14	40	150	25	*12	5.7	23
8	23	17	24	14	14	15	35	185	22	13	5.4	34
9	22	18	24	14	14	15	36	210	21	14	5.1	35
10	21	17	24	14	14	15	37	240	19	15	5.7	37
11	21	17	*24	14	14	16	40	285	18	17	8.1	36
12	20	16	23	14	14	16	45	275	17	17	8.4	34
13	20	17	22	14	14	16	59	230	16	17	*8.1	31
14	20	16	21	14	*14	17	84	195	15	16	7.8	29
15	19	16	21	*14	14	18	84	179	15	15	7.8	26
16	18	16	20	14	14	18	76	171	14	14	7.8	26
17	18	16	19	14	14	19	72	162	14	12	7.8	27
18	18	16	19	14	14	20	65	152	14	12	7.2	28
19	18	16	18	14	15	22	60	140	14	11	6.6	28
20	18	17	18	15	15	23	58	*127	14	10	6.6	29
21	20	18	17	15	14	24	64	110	14	9.8	8.1	30
22	22	27	17	15	14	25	76	90	15	9.1	8.1	27
23	21	29	17	15	14	27	72	80	17	8.1	7.8	26
24	21	26	16	15	14	29	70	82	21	7.2	8.1	28
25	21	24	16	15	14	31	70	*75	24	6.0	8.1	25
26	20	23	16	15	14	33	65	68	22	5.1	7.5	23
27	19	23	16	14	14	35	60	61	19	*4.6	6.6	21
28	19	23	16	14	15	36	60	56	18	8.4	15	20
29	18	21	15	14	15	36	58	51	16	9.8	17	19
30	18	20	15	14	---	36	57	47	15	*9.8	20	18
31	18	---	15	14	---	33	---	43	---	9.4	18	---
Total	646	575	603	441	412	677	1,612	3,962	626	357.3	264.7	777
Mean	20.8	19.2	19.5	14.2	14.2	21.8	53.7	128	20.9	11.5	8.54	25.9
Cfsm	0.125	0.115	0.117	0.085	0.085	0.131	0.322	0.766	0.125	0.069	0.051	0.155
In.	0.14	0.13	0.13	0.10	0.09	0.15	0.36	0.88	0.14	0.08	0.06	0.17

Calendar year 1963: Max 251 Min 12 Mean 48.3 Cfsm 0.289 In. 3.92
Water year 1963-64: Max 285 Min 4.6 Mean 29.9 Cfsm 0.179 In. 2.43

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 24, Nov. 30 to Apr. 1, Apr. 3. No gage-height record May 5-14, June 8 to July 6.

5-3405. St. Croix River at St. Croix Falls, Wis.

Location.--Lat 45°24'30", long 92°38'45", in NW¼ sec.30, T.34 N., R.18 W., on left bank 1,800 ft downstream from powerplant of Northern States Power Co., in St. Croix Falls, and at mile 52.2.

Drainage area.--5,930 sq mi, approximately.

Records available.--January 1902 to September 1964 in reports of Geological Survey. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Croix Falls."

Gage.--Water-stage recorder. Datum of gage is 690.47 ft above mean sea level, adjustment of 1912. Prior to July 1905, gage heights and discharge measurements were used to determine flow. July 1905 to February 1940, records were computed from power generation at the St. Croix Falls powerplant 1,800 ft upstream.

Average discharge.--62 years (1902-64), 4,012 cfs.

Extremes.--Maximum discharge during year, 27,700 cfs May 9 (gage height, 13.05 ft); minimum, 128 cfs Jan. 7, Feb. 11-13, 24, 25, 27 (gage height, 0.92 ft); minimum daily, 1,000 cfs Jan. 29.
1902-64: Maximum discharge, 54,900 cfs May 8, 1950 (gage height, 25.19 ft); minimum daily, 75 cfs July 17, 1910.

Remarks.--Records good. Flow regulated by powerplant upstream.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.8	1,080	7.0	14,100
2.4	2,270	9.0	18,600
3.5	3,800	11.0	23,100
5.0	9,500	13.0	27,600

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,220	1,750	1,190	1,560	1,440	1,520	1,550	7,450	3,760	3,220	1,500	3,500
2	2,020	1,630	1,340	1,740	1,570	1,490	2,280	7,400	3,620	2,690	1,610	2,910
3	2,110	1,740	1,190	1,570	1,700	1,510	1,950	7,450	3,300	2,110	1,540	2,930
4	1,780	1,870	1,340	1,500	1,350	1,550	2,650	7,580	3,130	2,360	1,770	2,900
5	1,740	1,550	1,620	1,660	1,590	1,650	2,940	7,800	2,660	2,300	1,770	2,540
6	1,800	1,510	2,430	1,570	1,680	1,640	3,350	11,600	2,560	2,080	*1,640	2,380
7	1,900	1,580	2,340	1,460	1,530	1,730	2,920	16,700	2,610	2,060	1,640	2,890
8	1,740	1,650	2,460	1,740	1,450	1,490	3,310	22,500	2,690	1,990	1,440	2,590
9	1,810	1,580	1,960	1,650	1,500	1,790	3,440	27,000	2,500	1,870	1,440	4,270
10	1,710	1,660	1,730	1,680	1,840	1,730	3,940	26,300	2,560	2,000	1,430	5,710
11	1,660	1,710	1,850	1,580	1,400	1,640	4,310	24,400	2,730	1,950	1,450	5,800
12	1,770	1,630	1,800	1,440	1,360	1,720	4,560	22,700	2,630	2,120	1,430	5,180
13	1,740	1,600	1,810	1,600	1,560	1,750	5,640	21,700	2,280	2,200	1,570	4,530
14	1,860	1,470	1,930	*1,360	1,590	1,980	6,680	*21,100	2,420	2,240	1,560	4,230
15	1,810	1,710	1,650	1,580	1,260	2,490	7,910	19,300	2,230	2,230	1,540	3,660
16	1,740	1,650	1,580	1,630	1,650	2,330	9,040	16,800	2,410	2,140	1,490	3,800
17	1,720	1,550	1,650	1,590	1,530	2,340	9,470	14,300	2,230	1,760	1,420	3,770
18	1,650	1,680	1,540	1,440	1,400	2,200	9,610	12,900	2,080	2,140	1,420	3,330
19	1,780	1,750	1,810	1,500	1,650	2,610	9,510	11,900	2,010	1,870	1,420	3,300
20	1,690	1,630	1,460	1,670	1,650	1,890	8,670	10,900	2,380	1,730	1,490	3,100
21	1,760	1,600	1,830	1,460	1,440	1,970	8,360	9,990	2,300	1,730	1,620	3,160
22	1,680	1,860	1,430	1,610	1,480	1,730	8,770	8,800	1,890	1,720	1,720	3,260
23	1,890	1,970	1,810	1,620	1,360	2,260	10,600	7,800	2,230	1,800	1,650	3,470
24	2,030	2,200	1,430	1,730	1,810	1,740	11,800	7,270	2,340	1,720	1,820	3,490
25	1,760	2,400	1,720	1,470	1,300	2,210	11,600	7,560	3,490	1,720	1,810	3,320
26	1,980	2,180	1,660	1,310	1,400	2,010	10,400	6,830	4,050	1,570	2,150	4,120
27	1,840	2,640	1,800	1,990	1,580	2,170	9,100	5,200	4,200	1,610	2,320	4,060
28	1,780	2,420	1,590	1,630	1,330	1,670	8,590	6,470	3,680	1,440	2,660	4,000
29	1,880	2,250	1,600	1,000	1,510	1,820	7,920	5,190	3,660	1,480	2,650	3,630
30	1,670	2,060	1,680	1,490	---------	2,200	7,640	4,700	3,090	1,490	2,880	3,740
31	2,220	----------	1,500	1,630	---------	1,580	----------	4,390	----------	1,500	3,100	----------
Total	56,740	54,480	52,730	48,460	43,910	58,410	198,510	391,980	83,720	60,840	54,950	109,570
Mean	1,830	1,816	1,701	1,563	1,514	1,884	6,617	12,640	2,791	1,963	1,773	3,652
Cfsm	0.309	0.306	0.287	0.264	0.255	0.318	1.12	2.13	0.471	0.331	0.299	0.616
In.	0.36	0.34	0.33	0.30	0.28	0.37	1.24	2.46	0.53	0.38	0.34	0.69

Calendar year 1963: Max 7,660 Min 562 Mean 2,756 Cfsm 0.465 In. 6.30
Water year 1963-64: Max 27,000 Min 1,000 Mean 3,318 Cfsm 0.560 In. 7.62

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 29-31, Jan. 10-15, 29, Feb. 22, 25-27, Mar. 5, 7. No gage-height record Dec. 5-18, Sept. 27-30.

5-3445. Mississippi River at Prescott, Wis.

Location.--Lat 44°44'45", long 92°48'00", in sec.9, T.26 N., R.20 W., on left bank at Prescott, 200 ft downstream from St. Croix River, 300 ft south of Chicago, Burlington & Quincy Railroad bridge, 800 ft south of bridge on U. S. Highway 10, and at mile 811.4 upstream from Ohio River.

Drainage area.--44,800 sq mi, approximately.

Records available.--June 1928 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 600.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Aug. 2, 1932, staff gage at railroad bridge 300 ft upstream at following datums: June 3, 1928, to Sept. 30, 1929, 69.27 ft higher; Oct. 1, 1929, to Sept. 30, 1930, 67.68 ft higher; Oct. 1, 1930, to Aug. 1, 1932, 69.28 ft higher. Aug. 2, 1932, to Oct. 30, 1938, water-stage recorder at present site at datum 69.28 ft higher. Auxiliary water-stage recorder 10.7 miles downstream from base gage.

Average discharge.--36 years, 14,680 cfs.

Extremes.--Maximum discharge during year, 57,600 cfs May 13 (gage height, 81.96 ft); minimum daily, 3,010 cfs Nov. 12, 13; minimum gage height, 74.42 ft Sept. 5.
1928-64: Maximum discharge, 155,000 cfs Apr. 16-18, 1952 (gage height, 89.03 ft); minimum daily, 1,380 cfs July 13, 1940; minimum gage height, 65.08 ft Aug. 29, 1934, present datum.

Remarks.--Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9,220	5,810	7,200	5,300	5,000	4,900	9,160	30,000	18,300	15,000	6,700	11,600
2	9,030	7,980	6,500	5,200	5,000	5,200	8,620	29,100	17,200	13,200	6,560	14,300
3	10,100	8,030	6,400	5,300	5,100	5,300	8,230	28,400	14,700	11,600	6,020	*15,100
4	9,940	6,160	5,200	5,300	5,100	5,700	8,840	28,700	12,700	9,520	5,690	12,600
5	9,100	7,070	5,100	5,400	5,300	5,200	10,200	29,000	12,600	9,320	7,120	9,370
6	8,650	6,430	5,300	5,300	5,100	5,800	a16,200	30,600	12,000	11,100	7,210	9,440
7	7,600	7,650	5,500	5,300	6,400	5,700	13,500	33,300	11,700	9,740	5,690	9,940
8	7,290	7,290	6,800	5,300	5,600	5,700	13,500	37,300	11,400	8,860	6,090	12,700
9	8,120	5,340	8,500	5,400	5,600	5,700	14,900	44,000	11,400	9,010	6,900	13,600
10	7,700	5,810	6,500	5,300	5,300	4,200	16,500	50,500	9,630	9,160	6,320	17,800
11	6,610	5,060	6,000	5,200	4,600	4,200	16,300	54,200	9,060	10,500	3,260	20,100
12	7,520	3,010	5,500	5,100	4,600	5,300	17,000	56,500	10,000	10,600	4,360	22,000
13	7,560	*3,010	4,700	5,200	5,400	7,000	18,200	57,000	10,500	8,860	5,620	22,700
14	7,290	5,680	4,700	5,100	5,300	8,600	a26,200	56,300	10,100	8,290	6,090	23,400
15	*7,380	7,110	4,500	5,100	5,500	8,500	a24,300	56,400	9,380	8,960	6,710	22,200
16	7,160	7,240	4,800	5,200	5,400	7,100	a28,500	55,700	9,770	9,000	6,300	21,800
17	6,190	5,920	4,800	5,000	5,200	7,300	28,700	53,700	10,100	8,940	5,360	20,700
18	5,810	6,880	5,200	5,200	5,100	7,200	31,400	51,200	*10,500	8,270	5,590	19,700
19	6,120	7,650	4,900	5,100	5,300	8,900	32,900	49,000	10,200	8,610	5,760	19,500
20	7,460	7,470	5,100	5,100	5,300	9,380	33,200	46,300	8,950	8,950	6,270	19,600
21	8,230	7,380	5,500	4,400	5,200	8,320	33,600	43,500	8,840	*8,040	6,220	18,000
22	6,890	7,470	5,300	4,900	5,100	8,750	33,800	41,000	9,370	7,210	8,090	16,400
23	8,230	7,120	5,200	5,100	5,500	9,960	*33,400	38,500	10,300	7,080	8,490	16,800
24	8,800	7,560	5,700	5,100	5,200	7,810	33,300	36,600	11,600	6,640	6,500	17,900
25	10,400	7,700	5,300	5,300	5,100	7,720	34,400	33,000	12,200	7,000	6,120	19,000
26	9,220	7,900	5,600	5,100	5,200	7,170	35,400	31,600	14,500	6,780	7,790	19,200
27	8,330	6,900	5,800	5,100	5,000	7,490	35,300	*28,000	15,900	6,840	8,460	19,300
28	6,610	7,900	5,500	5,100	5,000	6,940	34,800	24,600	17,400	5,950	9,150	*18,100
29	7,200	7,200	5,400	5,100	5,000	5,690	33,400	23,600	17,400	5,950	10,000	17,300
30	8,090	7,200	5,300	5,100	---	7,300	31,400	21,600	16,500	7,200	10,800	17,100
31	6,850	---	5,400	5,100	---	7,280	---	19,200	---	7,480	9,590	---
Total	244,700	200,930	173,200	159,800	151,500	211,310	715,150	1,218,400	364,200	273,660	210,830	517,250
Mean	7,894	6,698	5,587	5,155	5,224	6,816	23,840	39,300	12,140	8,828	6,801	17,240
Cfsm	0.176	0.150	0.125	0.115	0.117	0.152	0.532	0.877	0.271	0.197	0.152	0.385
In.	0.20	0.17	0.14	0.13	0.13	0.18	0.59	1.01	0.30	0.23	0.18	0.43

Calendar year 1963: Max 41,000 Min 3,010 Mean 12,700 Cfsm 0.283 In. 3.85
Water year 1963-64: Max 57,000 Min 3,010 Mean 12,130 Cfsm 0.271 In. 3.69

* Discharge measurement made on this day.
a No gage-height record.
Note.--Stage-fall-discharge relation affected by ice Nov. 26 to Mar. 19.

5-3552. Cannon River at Welch, Minn.

Location.--Lat 44°33'50", long 92°43'55", in NW¼SW¼ sec.27, T.113 N., R.16 W., on right bank 0.3 mile downstream from highway bridge at Welch and 1.8 miles upstream from Belle Creek.

Drainage area.--1,320 sq mi, approximately.

Records available.--June 1909 to January 1914 (no winter records 1909-11), November 1930 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 699.16 ft above mean sea level, datum of 1929. Prior to Nov. 11, 1930, chain gage on highway bridge at site 0.3 mile upstream at datum 3.00 ft lower. Nov. 11, 1930, to Oct. 11, 1938, water-stage recorder at site 0.3 mile upstream at present datum.

Average discharge.--35 years (1911-13, 1931-64), 455 cfs.

Extremes.--Maximum discharge during year, 1,660 cfs Sept. 9 (gage height, 4.50 ft); minimum, 43 cfs Nov. 4 (gage height, 1.23 ft).

1909-14, 1930-64: Maximum discharge, 15,800 cfs Apr. 2, 1952 (gage height, 12.00 ft), from rating curve extended above 9,100 cfs by logarithmic plotting; maximum gage height, 12.04 ft Mar. 23, 1936 (site then in use); minimum discharge, 2.5 cfs Jan. 3, 1950 (gage height, 0.06 ft, backwater from ice).

Maximum stage known, 17.1 ft, present datum, in April 1888, from floodmark at mill about 2,400 ft upstream.

Remarks.--Records good except those for period of ice effect, which are fair. Diurnal fluctuation caused by powerplants above station.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 11		Mar. 12 to Sept. 30			
1.4	66	1.3	62	2.5	406
1.6	100	1.5	95	3.0	666
1.8	142	1.7	136	4.0	1,310
2.0	192	2.0	217	5.0	2,030
2.5	395				

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	138	130	77	88	115	62	152	167	277	144	80	138
2	141	121	174	195	70	124	158	160	255	123	73	132
3	127	76	269	225	140	172	156	93	234	114	129	159
4	*126	119	211	150	140	200	127	188	226	76	124	127
5	109	131	213	70	135	222	84	276	188	73	116	87
6	74	126	*251	150	132	221	152	309	149	110	110	76
7	108	130	193	158	130	161	168	333	86	117	100	139
8	110	114	81	154	110	71	161	378	194	114	73	784
9	115	86	189	*145	63	137	159	407	150	116	72	755
10	112	66	224	135	160	180	155	170	188	121	102	1,390
11	114	99	227	135	164	181	128	220	198	217	107	1,100
12	72	122	244	70	159	372	84	363	218	220	105	848
13	66	124	220	150	159	688	201	438	*135	285	101	822
14	121	112	200	150	160	471	292	436	85	319	100	524
15	115	129	79	146	95	197	251	*515	153	224	76	448
16	109	91	150	148	67	189	203	496	161	165	73	479
17	107	69	240	130	*134	179	*253	461	162	164	102	458
18	118	121	305	90	169	157	229	344	165	88	100	429
19	110	*113	320	66	167	160	92	455	158	78	97	381
20	76	133	210	142	164	*179	131	390	133	151	105	295
21	149	129	165	150	167	170	149	310	83	162	125	*318
22	159	179	76	140	132	86	154	255	159	138	132	472
23	158	165	170	135	65	178	144	200	245	131	83	522
24	159	86	185	135	164	165	127	242	149	129	182	484
25	155	147	70	95	168	158	85	325	121	*84	177	441
26	140	184	205	70	173	158	81	343	116	75	138	343
27	80	203	230	140	148	156	135	388	110	135	134	240
28	125	160	165	150	117	126	163	304	79	132	*167	299
29	135	141	70	145	101	77	165	312	111	121	90	344
30	130	141	195	145	---	149	167	269	119	122	76	342
31	132	---	235	134	---	153	---	207	---	116	143	---
Total	3,690	3,747	5,843	4,136	3,868	5,899	4,706	9,754	4,807	4,364	3,392	13,376
Mean	119	125	188	133	133	190	157	315	160	141	109	446
Cfsm	0.090	0.095	0.142	0.101	0.101	0.144	0.119	0.239	0.121	0.107	0.083	0.338
In.	0.10	0.11	0.16	0.12	0.11	0.17	0.13	0.27	0.14	0.12	0.10	0.38

Calendar year 1963: Max 1,020 Min 66 Mean 228 Cfsm 0.173 In. 2.35
Water year 1963-64: Max 1,390 Min 62 Mean 185 Cfsm 0.140 In. 1.91

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 13 to Feb. 15.

5-3730. South Fork Zumbro River near Rochester, Minn.

Location.--Lat 44°04'00", long 92°27'55", in SE¼ sec.14, T.107 N., R.14 W., on left bank 30 ft upstream from ford, a quarter of a mile downstream from sewage plant, 1.6 miles north of Rochester, 2 miles downstream from Cascade Creek, and 2½ miles downstream from Silver Lake Dam.

Drainage area.--304 sq mi.

Records available.--January 1952 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 949.56 ft (revised) above mean sea level, datum of 1929.

Average discharge.--12 years, 106 cfs.

Extremes.--Maximum discharge during year, 998 cfs Sept. 7 (gage height, 6.67 ft); minimum, 16 cfs Aug. 5, 8, 16; minimum gage height, 1.62 ft Aug. 5, 8.

1952-64: Maximum discharge, 18,000 cfs Mar. 29, 1962 (gage height, 18.46 ft); minimum, 8.4 cfs Dec. 7, 1955.

Previous maximum stage known since at least 1908, about 17.5 ft July 21, 1951, from information by sewage plant superintendent.

Remarks.--Records good. Slight regulation at times from Silver Lake and at very low flows from sewage-plant effluent.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	34	37	46	26	28	25	40	150	33	26	19	23
2	33	36	44	29	25	27	71	148	34	24	17	24
3	*32	34	43	30	27	28	62	119	35	23	18	109
4	32	36	43	30	28	34	51	110	34	20	18	29
5	31	36	*46	28	29	30	46	98	33	20	18	24
6	30	35	46	30	28	30	60	95	31	21	19	199
7	31	34	44	30	27	30	75	83	28	22	18	159
8	31	*34	44	*30	27	27	59	87	31	22	17	340
9	31	34	43	27	25	29	53	74	30	22	18	245
10	31	32	40	26	26	30	50	66	28	22	20	136
11	31	32	41	26	27	31	48	64	34	26	21	83
12	31	34	40	24	26	79	46	82	*33	22	19	72
13	30	34	38	26	27	281	89	86	30	22	19	63
14	31	34	34	26	*26	128	105	*93	28	22	18	58
15	32	35	30	26	27	72	90	84	31	21	17	50
16	34	34	31	26	24	64	*74	74	29	21	16	44
17	34	33	31	27	26	51	62	78	28	20	19	42
18	35	34	30	27	26	45	54	75	31	20	18	*44
19	34	34	29	25	26	46	51	67	28	19	19	39
20	34	39	28	27	24	46	53	71	27	19	35	85
21	44	35	27	28	24	42	82	80	24	21	37	52
22	44	107	26	29	24	38	172	70	28	20	24	50
23	39	68	27	28	24	40	112	63	42	19	20	60
24	78	46	28	30	25	*38	89	57	28	*18	22	50
25	63	46	28	26	25	38	76	52	27	18	22	43
26	46	46	30	25	24	35	74	48	25	17	22	42
27	41	46	30	26	24	35	70	46	24	18	*22	38
28	40	45	29	24	26	35	79	41	22	22	25	40
29	38	46	26	24	26	35	103	38	23	19	24	39
30	37	46	27	26	----------	34	133	36	24	19	22	38
31	40	----------	27	28	----------	36	----------	32	----------	20	22	----------
Total	1,152	1,222	1,076	840	751	1,539	2,229	2,367	883	645	645	2,320
Mean	37.2	40.7	34.7	27.1	25.9	49.6	74.3	76.4	29.4	20.8	20.8	77.3
Cfsm	0.122	0.134	0.114	0.089	0.085	0.163	0.244	0.251	0.097	0.068	0.068	0.254
In.	0.14	0.15	0.13	0.10	0.09	0.19	0.27	0.29	0.11	0.08	0.08	0.28

Calendar year 1963: Max 1,660 Min 26 Mean 81.9 Cfsm 0.269 In. 3.65
Water year 1963-64: Max 340 Min 16 Mean 42.8 Cfsm 0.141 In. 1.91

Peak discharge (base, 1,000 cfs).--No peak above base.

* Discharge measurement made on this day.

5-3740. Zumbro River at Zumbro Falls, Minn.

Location.--Lat 44°17'12", long 92°25'56", in sec.36, T.110 N., R.14 W., on left bank in Zumbro Falls, 1,000 ft downstream from Spring Creek, 0.7 mile upstream from bridge on U. S. Highway 63, and 6.3 miles downstream from North Fork.

Drainage area.--1,130 sq mi, approximately.

Records available.--June 1909 to September 1917, April to November 1929, March 1930 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder (digital since May 28). Datum of gage is 811.26 ft above mean sea level, datum of 1929. Prior to Nov. 11, 1933, chain gage on bridge 800 ft downstream at same datum.

Average discharge.--42 years (1909-17, 1930-64), 468 cfs.

Extremes.--Maximum discharge during year, 1,580 cfs Mar. 13 (gage height, 9.29 ft); minimum, 34 cfs Feb. 23 (gage height, 6.06 ft), result of freezeup.
1909-17, 1929-64: Maximum discharge, 35,900 cfs July 22, 1951 (gage height, 30.80 ft, from floodmark); minimum, 27 cfs Jan. 12, 1935; minimum gage height, that of Feb. 23.
Flood of April 1888 reached stage of about 30.5 ft at present site or 29.7 ft original site. Flood in 1859 is known to have exceeded that of 1888 (gage height, not determined).

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 12		Mar. 13 to Sept. 30	
6.2	47	6.3	59
6.4	75	6.5	95
6.7	140	7.0	245
7.0	227	7.5	464
7.5	449	8.0	734
		9.0	1,380

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	135	141	101	81	110	72	184	594	152	114	95	127
2	133	129	124	81	80	102	214	313	100	119	83	126
3	*128	83	166	89	92	158	178	152	91	114	97	221
4	139	95	189	145	130	141	95	389	122	89	114	151
5	146	181	*100	86	110	139	93	556	127	85	79	93
6	79	184	191	96	135	130	161	335	93	83	77	85
7	73	186	159	150	135	149	276	264	87	167	75	95
8	120	*181	94	*115	100	73	236	555	179	87	75	795
9	113	141	120	140	76	79	221	312	186	83	75	1,100
10	138	84	214	153	110	147	320	138	127	85	75	1,150
11	155	96	204	148	150	162	189	336	127	95	75	990
12	143	187	218	76	98	361	109	401	*227	95	73	384
13	77	167	215	78	96	914	235	529	149	97	73	172
14	86	172	204	155	*94	701	347	*588	91	199	87	142
15	151	175	110	140	100	576	396	599	132	149	91	125
16	152	157	100	135	71	562	*443	276	138	196	73	115
17	155	88	94	160	78	322	385	164	93	119	72	217
18	150	106	92	130	118	234	233	263	124	109	70	150
19	142	206	200	88	128	236	117	332	176	89	70	107
20	81	211	210	84	117	328	301	335	100	89	73	111
21	91	210	200	200	113	213	597	397	87	87	223	120
22	184	260	76	205	98	107	576	394	124	87	100	117
23	181	169	74	205	60	271	831	242	138	119	83	122
24	230	103	190	80	90	*273	831	130	146	*130	132	*313
25	322	120	130	62	112	295	308	249	146	95	141	309
26	205	168	103	63	111	223	149	272	196	85	85	263
27	94	208	166	64	115	414	392	122	95	112	*75	120
28	191	151	137	150	101	186	524	227	85	89	124	109
29	204	230	79	110	96	100	430	170	114	81	83	160
30	197	205	82	125	---	100	558	107	158	114	72	165
31	179	---	121	120	---	178	---	97	---	158	112	---
Total	4,574	4,794	4,463	3,714	3,024	7,946	9,929	9,838	3,910	3,420	2,832	8,254
Mean	148	160	144	120	104	256	331	317	130	110	91.4	275
Cfsm	0.131	0.142	0.127	0.106	0.092	0.227	0.293	0.281	0.115	0.097	0.081	0.243
In.	0.15	0.16	0.15	0.12	0.10	0.26	0.33	0.32	0.13	0.11	0.09	0.27

Calendar year 1963: Max 4,580 Min 73 Mean 283 Cfsm 0.250 In. 3.41
Water year 1963-64: Max 1,150 Min 60 Mean 182 Cfsm 0.161 In. 2.19

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 15-25, Jan. 6-17, Jan. 21 to Feb. 16.

5-3765. South Fork Whitewater River near Altura, Minn.

Location.--Lat 44°04'10", long 91°58'49", in SE¼ sec.14, T.107 N., R.10 W., on left bank 500 ft upstream from highway bridge, 1.4 miles upstream from small tributary entering from the west, 2 miles west of Altura, and 2.4 miles upstream from Keefer Creek.

Drainage area.--76.8 sq mi.

Records available.--October 1939 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 761.80 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Average discharge.--25 years, 26.9 cfs.

Extremes.--Maximum discharge during year, 136 cfs Mar. 12 (gage height, 2.11 ft); minimum, 6.9 cfs Feb. 27 (gage height, 0.76 ft).
1939-64: Maximum discharge, 5,460 cfs Aug. 31, 1947 (gage height, 10.61 ft); minimum, 3.8 cfs Mar. 24, 1940; minimum gage height, 0.74 ft Jan. 20, 1951.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 8 to June 29)

0.8	7.5	1.2	20
.9	9.2	1.3	28
1.0	12	1.5	46
1.1	15	2.0	111

Discharge, in cubic feet per second, water year October 1963to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11	13	12	11	11	10	12	12	13	11	9.0	9.9
2	*11	13	12	11	11	10	17	12	13	11	9.0	9.6
3	12	13	12	11	11	11	18	12	13	11	8.8	12
4	12	13	*12	11	11	11	14	12	13	11	8.8	11
5	12	13	12	11	11	10	13	12	12	11	8.8	11
6	12	13	12	10	11	11	14	12	12	11	8.7	11
7	14	*13	12	*10	11	11	20	12	12	10	8.8	11
8	14	13	12	10	10	11	14	12	12	10	8.8	19
9	14	12	12	10	10	11	13	13	12	11	9.2	12
10	14	12	12	10	10	11	13	12	12	11	9.2	12
11	14	12	12	10	10	11	13	12	*13	11	9.2	12
12	14	12	12	10	11	42	13	12	13	11	9.2	11
13	14	12	11	10	*11	65	14	*12	12	11	9.2	11
14	14	12	11	10	11	30	13	12	12	11	9.0	11
15	14	12	11	10	11	14	*12	13	12	10	9.0	11
16	14	12	10	11	11	13	12	18	12	10	8.8	11
17	14	12	10	11	11	12	12	14	12	*10	8.8	11
18	14	12	10	11	11	*11	12	13	12	9.9	8.8	*12
19	14	12	10	11	11	11	12	13	12	9.6	8.8	12
20	14	12	10	11	10	11	12	12	12	9.6	9.2	12
21	14	12	10	11	10	11	13	12	12	9.4	9.6	12
22	14	14	10	11	10	11	12	12	12	9.2	9.6	11
23	14	14	10	11	10	11	12	12	12	9.2	9.2	12
24	14	14	10	11	10	11	12	13	12	9.2	9.0	12
25	14	13	10	11	10	12	12	13	12	9.2	9.0	12
26	14	12	10	11	9.4	13	12	13	11	9.2	*8.8	12
27	13	12	10	10	11	12	12	13	11	9.2	9.0	12
28	13	12	10	10	11	12	12	13	11	9.4	9.2	12
29	13	12	11	10	10	12	12	13	11	9.0	9.4	12
30	13	12	11	11	---	12	12	13	11	9.2	9.6	11
31	13	---	11	11	---	11	---	13	---	9.2	9.4	---
Total	415	375	340	328	306.4	455	394	392	361	312.5	280.9	350.5
Mean	13.4	12.5	11.0	10.6	10.6	14.7	13.1	12.6	12.0	10.1	9.06	11.7
Cfsm	0.174	0.163	0.143	0.138	0.138	0.191	0.171	0.164	0.156	0.132	0.118	0.152
In.	0.20	0.18	0.16	0.16	0.15	0.22	0.19	0.19	0.17	0.15	0.14	0.17

Calendar year 1963: Max 546 Min 10 Mean 19.9 Cfsm 0.259 In. 3.52
Water year 1963-64: Max 65 Min 8.7 Mean 11.8 Cfsm 0.154 In. 2.08

Peak discharge (base, 200 cfs).--No peak above the base.

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 14 to Jan. 18, Jan. 27-30, Feb. 9, 10.

5-3785. Mississippi River at Winona, Minn.

Location.--Lat 44°03'20", long 91°38'15", in sec.23, T.107 N., R.7 W., on right bank at Winona pumping station in Winona, 9½ miles upstream from Trempealeau River and at mile 725.7 upstream from the Ohio River.

Drainage area.--59,200 sq mi, approximately.

Records available.--June 1928 to September 1964. Gage-height records collected in this vicinity since 1878 are contained in reports of Mississippi River Commission.

Gage.--Water-stage recorder. Datum of gage is 639.64 ft above mean sea level, datum of 1929. June 10, 1928, to Apr. 15, 1931, staff gage at site 800 ft upstream. Prior to Oct. 1, 1929, at datum 0.20 ft higher and Oct. 1, 1929, to Apr. 15, 1931, at datum 0.12 ft lower. Apr. 16, 1931, to Nov. 12, 1934, staff gage at present site and datum. Since Mar. 31, 1937, auxiliary water-stage recorder 2.7 miles upstream at tailwater of navigation dam 5A.

Average discharge.--36 years, 24,120 cfs.

Extremes.--Maximum discharge during year, 65,700 cfs May 18 (gage height, 9.02 ft); minimum daily, 6,190 cfs Aug. 17, 18; minimum gage height, 4.77 ft Mar. 16.
1928-64: Maximum discharge, 190,000 cfs Apr. 20, 1952 (gage height, 17.91 ft); minimum, 2,250 cfs Dec. 29, 1933 (gage height, -1.18 ft); minimum gage height, -3.38 ft Aug. 31, 1934.

Remarks.--Records good except those below 15,000 cfs, which are fair. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

Cooperation.--Gage-height record at dam 5A furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	13,700	10,600	13,000	11,100	10,100	9,700	15,200	45,800	30,600	22,200	9,750	15,000
2	14,700	11,300	13,000	10,900	10,100	10,100	15,100	44,200	25,800	19,800	9,840	21,200
3	14,700	10,200	10,200	11,200	10,100	10,200	15,000	43,600	24,800	18,200	8,220	19,500
4	14,200	10,200	11,600	11,200	10,100	11,100	14,900	43,400	19,300	16,500	7,370	*25,700
5	13,000	10,300	11,500	11,200	10,100	10,500	15,900	42,200	18,000	14,600	9,110	17,800
6	11,900	9,120	11,600	11,200	11,100	10,800	18,100	40,800	17,700	14,500	8,340	16,000
7	10,800	9,710	11,500	11,100	11,800	10,900	19,800	41,300	18,800	14,300	8,300	17,100
8	12,000	9,680	11,600	10,600	11,700	11,200	22,000	44,000	18,600	12,300	7,430	27,100
9	12,100	9,570	11,800	9,800	11,700	12,100	23,100	44,800	18,200	11,300	8,340	28,700
10	10,900	8,880	12,000	10,100	11,100	12,000	22,400	46,000	16,600	12,000	8,370	30,200
11	10,200	8,800	12,000	10,200	10,000	11,900	24,100	49,500	16,700	13,800	8,150	31,100
12	11,700	9,430	10,500	10,200	10,200	12,000	26,700	53,800	15,500	17,000	7,280	28,200
13	10,700	9,710	9,700	10,200	10,200	15,400	26,100	58,500	15,600	14,000	7,280	33,000
14	10,700	*9,340	9,600	10,200	11,200	19,200	28,300	60,200	16,700	13,200	6,300	28,100
15	9,540	10,000	9,600	10,200	11,100	24,900	32,600	62,900	15,900	13,200	7,260	30,300
16	*10,100	8,620	9,600	10,100	11,000	21,000	31,700	64,600	16,900	11,900	7,220	30,200
17	10,700	9,360	9,600	9,500	10,500	15,600	33,200	65,100	16,300	12,500	6,190	28,700
18	10,800	9,440	9,600	9,600	10,100	15,100	37,100	65,600	14,100	13,400	6,190	29,300
19	9,370	9,280	9,600	10,500	10,200	15,200	41,700	64,400	*15,000	10,400	6,220	29,200
20	9,970	9,880	9,500	10,400	10,300	17,400	41,500	63,100	14,900	11,100	7,240	27,700
21	11,200	11,000	9,500	10,100	10,300	16,700	41,900	61,200	15,700	10,400	8,220	27,700
22	10,600	13,500	9,500	10,000	10,400	17,800	44,100	59,700	14,300	*12,800	7,460	23,500
23	11,800	13,400	9,500	10,000	10,300	17,500	46,800	57,600	13,900	14,300	9,990	22,300
24	11,800	13,000	9,600	10,000	10,300	14,100	*47,000	56,600	14,500	9,780	10,600	24,600
25	13,700	12,400	9,600	10,100	10,200	14,200	46,800	*54,500	15,500	11,200	9,990	25,600
26	17,100	12,300	9,600	10,100	10,100	14,600	47,000	50,900	16,400	11,000	12,100	26,400
27	16,900	12,300	9,700	10,100	10,100	16,200	48,300	48,500	18,300	8,900	11,500	26,200
28	13,700	12,500	9,800	10,000	9,900	14,100	49,300	44,000	20,700	10,400	13,300	26,500
29	12,600	12,600	9,800	9,800	10,000	13,100	49,200	41,700	20,500	9,810	13,900	24,800
30	9,510	13,000	9,800	9,800	---	14,300	48,200	38,100	19,800	9,780	12,800	*25,400
31	13,400	---	10,000	10,000	---	14,700	---	33,800	---	11,100	17,200	---
Total	374,090	319,420	323,500	319,500	304,300	443,600	973,100	1,590,400	535,600	405,670	281,460	767,100
Mean	12,070	10,650	10,440	10,310	10,490	14,310	32,440	51,300	17,850	13,090	9,079	25,570
Cfsm	0.204	0.180	0.176	0.174	0.177	0.242	0.548	0.867	0.302	0.221	0.153	0.432
In.	0.24	0.20	0.20	0.20	0.19	0.28	0.61	1.00	0.34	0.25	0.18	0.48

Calendar year 1963: Max 51,300 Min 7,460 Mean 19,500 Cfsm 0.329 In. 4.49
Water year 1963-64: Max 65,600 Min 6,190 Mean 18,140 Cfsm 0.306 In. 4.17

* Discharge measurement made on this day.
Note.--Fall-stage-discharge relation affected by ice Nov. 22 to Mar. 13.

5-3836. North Branch Root River tributary near Stewartville, Minn.

Location.--Lat 43°51'20", long 92°26'50", near center of sec.36, T.105 N., R.14 W., on right bank just upstream from culvert on State Highway 30, 2 miles upstream from mouth and 2 miles east of Stewartville.

Drainage area.--0.73 sq mi.

Records available.--March 1959 to September 1964 (discontinued).

Gage.--Water-stage recorder. Altitude of gage is 1,205 ft (from topographic map).

Average discharge.--5 years, 0.20 cfs.

Extremes.--Maximum discharge during year, 0.2 cfs Apr. 28; (gage height, 4.74 ft); no flow for many days.
1959-64: Maximum discharge, 328 cfs July 2, 1960 (gage height, 13.47 ft); no flow most of period.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							0	0.1				
2			(*)				0	0				
3	(*)						0	0				
4							0	0				
5							0	0				
6							0	0				
7		(*)					0	0				
8				(*)			0	0				
9							0	0				(*)
10							0	0				
11							0	0				
12							0	0	(*)			
13							0	0				
14							*0	**0				
15							0	0		(*)		
16						(*)	0	0				
17							0	0				
18							0	0				(*)
19							0	0				
20							0	0				
21							0	0				
22							0	0				
23							0	0				
24							0	0				
25							0	0			(*)	
26							0	0				
27							0	0				
28							0	0				
29							0.1	0				
30					---		.1	0				
31		---			---		---	0	---			---
Total	0	0	0	0	0	0	0.2	0.1	0	0	0	0
Mean	0	0	0	0	0	0	0.007	0.003	0	0	0	0
Cfsm	0	0	0	0	0	0	0.0096	0.0041	0	0	0	0
In.	0	0	0	0	0	0	0.01	0.005	0	0	0	0

Calendar year 1963: Max 3.5 Min 0 Mean 0.03 Cfsm 0.041 In. 0.56
Water year 1963-64: Max 0.1 Min 0 Mean 0.0008 Cfsm 0.0011 In. 0.02

Peak discharge (base, 30 cfs).--No peak above the base.

* Discharge measurement or observation of no flow made on this day.
** Field estimate made on this day.

5-3840. Root River near Lanesboro, Minn.

Location.--Lat 43°44'58", long 91°58'43", in sec.1, T.103 N., R.10 W., on left bank half a mile upstream from highway bridge, 1¼ miles upstream from South Branch, and 2½ miles northeast of Lanesboro.

Drainage area.--615 sq mi.

Records available.--February to November 1910, February 1911 to September 1914, July 1915 to September 1917, August 1940 to September 1964 Published as North Branch Root River near Lanesboro, 1910-17

Gage.--Water-stage recorder. Datum of gage is 791.84 ft above mean sea level, adjustment of 1912. Prior to Oct. 1, 1917, chain gage at site half a mile downstream at datum about 1.5 ft higher.

Average discharge.--29 years (1911-14, 1915-17, 1940-64), 314 cfs.

Extremes.--Maximum discharge during year, 409 cfs July 29 (gage height, 2.58 ft); maximum gage height, 3.20 ft Mar. 13 (backwater from ice); minimum discharge, 62 cfs July 27 (gage height, 1.32 ft).
1910-17, 1940-64: Maximum discharge, 22,100 cfs Mar. 29, 1962 (gage height, 16.11 ft); minimum, 29 cfs Aug. 27, 1949 (gage height, 1.08 ft).

Remarks.--Records good except those for periods of ice effect, which are fair. Diurnal fluctuation at times during medium and low flow caused by powerplant above station.

Rating tables, water year 1963-64, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 3		Apr. 4 to Sept. 30	
1.5	90	1.3	60
1.7	119	1.5	85
2.0	197	2.0	205
		2.5	375

Discharge, in cubic feet per second, water year October 1963to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*102	101	100	98	90	87	100	179	98	78	135	69
2	98	101	78	99	91	88	230	189	96	79	112	70
3	97	100	*71	101	92	88	310	189	96	75	94	72
4	96	*100	76	103	92	88	236	179	94	72	82	73
5	95	100	80	104	93	88	195	169	92	70	78	70
6	95	100	82	*104	93	88	197	156	92	70	73	78
7	94	100	84	104	94	87	252	166	92	72	72	82
8	94	100	86	103	94	87	197	184	92	70	68	121
9	94	100	88	102	94	87	172	159	*89	70	69	202
10	94	99	90	99	94	88	166	144	89	70	72	211
11	94	99	91	97	94	89	154	137	92	72	69	184
12	93	97	92	95	*94	90	147	*130	98	75	68	162
13	93	97	93	93	94	189	154	140	96	76	68	137
14	95	97	93	92	93	252	*164	140	94	75	68	123
15	95	97	93	92	92	206	184	135	94	72	68	112
16	96	97	93	93	92	164	184	149	89	*70	67	103
17	97	99	92	94	92	*146	172	169	87	70	66	*98
18	100	99	92	94	92	112	154	166	89	69	66	98
19	102	99	92	94	92	106	142	172	89	68	67	96
20	102	100	91	94	92	104	137	164	85	67	68	100
21	101	100	91	94	91	105	144	149	84	67	89	103
22	101	116	91	94	90	105	142	137	85	67	87	103
23	102	146	91	93	90	102	142	128	92	67	87	103
24	112	169	91	92	88	99	144	130	87	66	82	100
25	119	146	91	91	87	93	142	123	84	64	*79	96
26	111	129	91	91	86	87	135	118	82	63	76	92
27	105	119	92	90	86	88	135	112	81	63	73	89
28	102	116	93	90	86	89	130	107	78	66	72	85
29	100	112	94	90	86	90	132	105	78	266	73	84
30	100	111	95	90	---	89	152	103	76	227	73	85
31	101	---	97	90	---	91	---	100	---	164	70	---
Total	3,080	3,246	2,774	2,960	2,644	3,372	5,045	4,528	2,670	2,620	2,391	3,201
Mean	99.4	108	89.5	95.5	91.2	109	168	146	89.0	84.5	77.1	107
Cfsm	0.162	0.176	0.146	0.155	0.148	0.177	0.273	0.237	0.145	0.137	0.125	0.174
In.	0.19	0.20	0.17	0.18	0.16	0.20	0.31	0.27	0.16	0.16	0.14	0.19

Calendar year1963: Max 4,990 Min 71 Mean 202 Cfsm 0.328 In. 4.47
Water year1963-64: Max 310 Min 63 Mean 105 Cfsm 0.171 In. 2.33

Peak discharge (base, 3,500 cfs).--No peak above base.

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 1 to Mar. 15, Mar. 19-21, Mar. 24 to Apr. 3.

GPO 819-718-10

5-3845. Rush Creek near Rushford, Minn.

Location.--Lat 43°50'00", long 91°46'40", on line between secs.3 and 10, T.104 N., R.8 W., on downstream side near center of span of highway bridge, 1½ miles northwest of Rushford and 3 miles upstream from mouth.

Drainage area.--129 sq mi.

Records available.--August 1942 to September 1964.

Gage.--Chain gage read twice daily. Datum of gage is 735.00 ft above mean sea level, adjustment of 1912. Prior to June 14, 1950, water-stage recorder at site 100 ft upstream; at datum 5 ft higher, Aug. 5, 1942, to Oct. 27, 1945; at datum 3 ft higher, Oct. 28, 1945, to Aug. 3, 1949; at present datum thereafter.

Average discharge.--22 years, 53.2 cfs.

Extremes.--Maximum discharge during year, 53 cfs Mar. 12 (gage height, 2.48 ft); minimum daily, 31 cfs July 11-27, Aug 31; minimum gage height, 1.88 ft Aug. 31.
1942-64: Maximum discharge, 11,600 cfs Mar. 26, 1950 (gage height, 13.54 ft, from floodmark), from rating curve extended above 1,400 cfs on basis of contracted-opening measurements at gage heights 11.0 and 13.5 ft; minimum, 17 cfs May 22, 1959; minimum gage height, 1.84 ft Sept. 24, 29, 1962.
Flood of June 28, 29, 1942, reached a discharge of 11,000 cfs (by slope-area measurement of peak flow).

Remarks.--Records fair.

Rating table, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used May 2-22, July 11-20)

1.8	29
2.0	35
2.2	41
2.5	54

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	36	36	38	35	33	35	36	38	34	33	33	32
2	*36	36	38	35	33	35	38	38	33	34	33	32
3	36	36	*38	35	33	35	40	40	33	34	33	32
4	36	36	37	35	33	36	37	41	33	34	33	32
5	36	36	37	35	33	35	38	42	33	34	32	32
6	36	*36	37	*35	33	36	40	43	33	35	32	33
7	36	36	37	35	33	35	38	44	34	34	33	32
8	36	36	37	34	33	35	36	48	33	33	33	38
9	36	36	37	34	33	35	36	49	33	32	33	33
10	36	36	37	34	33	35	36	47	*33	32	33	38
11	36	36	37	34	33	35	36	47	34	31	32	35
12	36	36	37	33	*33	42	36	*48	34	31	32	35
13	36	36	37	33	33	50	37	50	33	31	32	35
14	36	36	37	34	33	41	*36	49	34	31	32	35
15	36	36	37	34	33	36	36	48	34	31	32	35
16	36	36	37	34	33	35	36	49	34	*31	32	34
17	37	36	36	34	33	*35	36	46	34	31	32	*34
18	37	36	36	34	33	35	36	46	34	31	32	34
19	36	36	36	35	34	35	36	43	34	31	32	34
20	36	37	36	35	34	35	35	41	33	31	32	36
21	36	37	35	35	34	35	37	39	33	31	34	35
22	36	41	35	35	34	35	36	38	34	31	33	35
23	36	39	36	35	34	35	36	37	34	31	33	35
24	36	38	36	35	34	35	36	38	33	31	33	35
25	38	38	36	35	34	35	35	36	33	31	33	35
26	37	38	36	35	34	36	35	35	33	31	*32	35
27	37	38	36	35	35	35	36	34	33	31	32	35
28	37	38	36	34	35	36	36	34	33	34	32	35
29	36	38	36	34	35	35	36	34	34	33	32	35
30	36	38	36	34	----------	36	37	34	33	33	32	35
31	37	---------	36	33	----------	36	----------	33	----------	34	31	----------
Total	1,124	1,104	1,133	1,067	971	1,120	1,095	1,289	1,003	996	1,005	1,031
Mean	36.3	36.8	36.5	34.4	33.5	36.1	36.5	41.6	33.4	32.1	32.4	34.4
Cfsm	0.281	0.285	0.283	0.267	0.260	0.280	0.283	0.322	0.259	0.249	0.251	0.267
In.	0.32	0.32	0.33	0.31	0.28	0.32	0.32	0.37	0.29	0.29	0.29	0.30

Calendar year 1963: Max 597 Min 33 Mean 43.9 Cfsm 0.340 In. 4.62
Water year 1963-64: Max 50 Min 31 Mean 35.3 Cfsm 0.274 In. 3.74

*Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 13 to Feb. 27.

5-3850. Root River near Houston, Minn.

Location.--Lat 43°46'05", long 91°35'11", in sec.32, T.104 N., R.6 W., on right bank 1 mile west of Houston and 2½ miles upstream from South Fork.

Drainage area.--1,270 sq mi, approximately.

Records available.--May 1909 to September 1917, May to November 1929, March 1930 to September 1964. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 671.86 ft above mean sea level, datum of 1929. May 28, 1909, to Sept. 30, 1917, staff gage at site 1½ miles downstream at different datum. May 4, 1929, to Sept. 27, 1933, chain gage at present site and datum.

Average discharge.--42 years (1909-17, 1930-64), 639 cfs.

Extremes.--Maximum discharge during year, 1,110 cfs Apr. 3 (gage height, 3.27 ft); minimum, 219 cfs July 7, 8, 9 (gage height, 1.40 ft).
1909-17, 1929-64: Maximum discharge, 37,000 cfs Apr. 1, 1952 (gage height, 13.90 ft); maximum gage height, 15.10 ft Mar. 27, 1961; minimum discharge, 65 cfs Dec. 26, 1933, Feb. 25, 1935.

Remarks.--Records fair. Slight diurnal fluctuation at low flows caused by powerplants above station.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 22 to Dec. 1)

Oct. 1 to Mar. 1		Mar. 2 to Sept. 30			
1.5	274	1.4	219	2.5	651
1.6	294	1.6	269	3.0	940
2.0	414	2.0	414		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	318	286	300	250	252	338	285	344	315	237	336	240
2	*311	286	290	250	255	332	366	366	312	235	312	237
3	313	284	280	251	260	325	868	378	312	233	288	256
4	311	284	*277	250	265	322	678	382	312	233	272	256
5	311	286	270	250	267	318	509	382	312	230	261	247
6	311	*286	272	240	268	312	463	359	312	228	253	245
7	302	284	272	*238	275	312	467	336	310	224	245	253
8	311	284	270	238	285	298	495	449	305	226	240	322
9	307	284	268	238	291	298	427	722	300	224	233	308
10	309	282	260	238	300	298	398	513	*288	226	235	458
11	307	280	260	238	307	295	382	427	275	224	235	398
12	307	282	260	238	315	304	363	382	279	226	235	355
13	307	280	258	239	*325	394	370	*414	288	228	230	326
14	304	280	258	239	330	626	363	406	282	228	230	304
15	307	282	255	239	330	546	*366	406	275	228	230	288
16	304	282	255	240	328	436	370	445	272	*228	230	279
17	311	282	252	242	328	390	370	700	264	228	230	*272
18	315	278	251	245	328	*351	355	537	261	230	235	269
19	307	282	251	248	327	329	336	487	258	230	235	269
20	307	286	250	250	327	329	322	454	256	230	240	272
21	298	284	250	250	325	318	344	423	256	230	266	272
22	298	334	250	250	325	304	329	402	256	233	275	275
23	292	328	250	250	325	298	315	386	261	233	269	269
24	288	328	249	248	325	291	318	394	261	233	266	269
25	320	331	250	242	325	288	322	378	261	237	258	266
26	331	323	252	240	326	291	318	366	256	240	*256	264
27	309	313	250	240	327	272	326	347	253	235	247	256
28	296	307	248	240	330	279	329	340	245	235	242	256
29	290	302	249	242	334	282	318	329	242	233	242	250
30	292	300	248	246	---	279	326	325	240	291	245	253
31	288	---	250	250	---	272	---	315	---	355	242	---
Total	9,482	8,810	8,055	7,559	8,905	10,327	11,798	12,894	8,319	7,331	7,813	8,484
Mean	306	294	260	244	307	333	393	416	277	236	252	283
Cfsm	0.241	0.231	0.205	0.192	0.242	0.262	0.309	0.328	0.218	0.186	0.198	0.223
In.	0.28	0.26	0.24	0.22	0.26	0.30	0.35	0.38	0.24	0.21	0.23	0.25

Calendar year 1963: Max 9,500 Min 248 Mean 482 Cfsm 0.380 In. 5.17
Water year 1963-64: Max 868 Min 224 Mean 300 Cfsm 0.236 In. 3.22

Peak discharge (base, 5,000 cfs).--No peak above base.

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 2 to Mar. 1. No gage-height record June 5-9, Aug. 10-20.

5-3855. South Fork Root River near Houston, Minn.

Location.--Lat 43°44', long 91°34', in NE¼SW¼ sec.9, T.103 N., R.6 W., on left bank 50 ft downstream from bridge on State Highway 76, half a mile upstream from Badger Creek and 1½ miles south of Houston.

Drainage area.--275 sq mi.

Records available.--January 1953 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 680.41 ft above mean sea level, datum of 1929.

Average discharge.--11 years, 119 cfs.

Extremes.--Maximum discharge during year, 1,250 cfs Apr. 3 (gage height, 9.01 ft); minimum daily, 54 cfs Jan. 7-14; minimum gage height, 1.80 ft July 15.
1953-64: Maximum discharge, 8,420 cfs Mar. 29, 1962 (gage height, 13.35 ft); maximum gage height, 13.74 ft Mar. 26, 1961 (backwater from ice); minimum discharge, 11 cfs Nov. 28, 1961 (gage height, 1.47 ft).

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair.

Rating tables, water year 1963-64, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 11-18)

Oct. 1 to Apr. 3		Apr. 4 to Sept. 30	
2.0	73	1.8	66
2.5	134	2.0	86
3.0	196	2.5	136
5.0	467	3.0	196
7.0	796		

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	80	84	88	58	63	80	89	101	87	77	73	70
2	*80	84	86	57	64	81	147	99	87	77	72	70
3	80	85	85	56	65	83	680	95	86	76	70	71
4	80	85	*91	55	66	85	189	97	85	75	70	72
5	81	85	90	55	67	122	136	95	84	76	69	71
6	80	*85	93	55	68	103	133	92	84	77	69	71
7	80	84	89	*54	69	91	158	91	84	76	69	75
8	80	84	83	54	70	85	127	99	84	76	69	81
9	80	84	84	54	71	83	110	115	83	75	70	78
10	80	83	84	54	72	80	103	101	*80	75	73	119
11	80	81	84	54	73	81	98	96	82	75	72	98
12	81	81	84	54	74	101	98	96	89	76	74	81
13	81	83	83	54	*75	317	99	*109	85	76	74	77
14	81	79	82	54	75	213	95	105	83	78	73	76
15	80	79	81	55	75	120	*92	102	83	70	72	75
16	80	79	80	56	76	98	90	108	82	*71	72	73
17	84	79	79	58	76	*93	89	136	82	70	71	*74
18	86	79	78	59	76	93	88	111	82	93	70	75
19	85	80	75	60	76	91	88	103	81	88	71	78
20	81	80	72	60	77	91	89	98	79	74	72	77
21	83	80	71	61	77	90	97	96	78	73	82	78
22	83	93	70	61	77	89	94	94	81	71	79	76
23	81	115	69	61	78	89	91	93	90	70	76	76
24	81	110	67	60	78	87	90	106	81	71	75	76
25	97	107	66	60	79	89	91	98	80	82	78	76
26	89	104	64	60	79	92	86	96	78	73	*74	76
27	86	100	63	60	79	92	95	87	77	72	72	76
28	84	96	62	60	79	89	95	88	76	72	70	76
29	84	92	61	61	81	89	94	89	76	72	70	76
30	85	90	60	62	------	89	96	88	77	72	72	76
31	84	------	59	62	------	87	------	88	------	73	70	------
Total	2,557	2,630	2,383	1,784	2,135	3,173	3,727	3,072	2,466	2,332	2,243	2,324
Mean	82.5	87.7	76.9	57.5	73.6	102	124	99.1	82.2	75.2	72.4	77.5
Cfsm	0.300	0.319	0.280	0.209	0.268	0.371	0.451	0.360	0.299	0.273	0.263	0.282
In.	0.35	0.36	0.32	0.24	0.29	0.43	0.50	0.42	0.33	0.32	0.30	0.31

Calendar year 1963 Max 2,440 Min 59 Mean 117 Cfsm 0.425 In. 5.80
Water year 1963-64 Max 680 Min 54 Mean 84.2 Cfsm 0.306 In. 4.17

Peak discharge (base, 900 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-3	0900	9.01	1,250				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 9 to Feb. 28. No gage-height record Nov. 14 to Dec. 3.

5-4570. Cedar River near Austin, Minn.

Location.--Lat 43°38'10", long 92°58'20", in NE¼SE¼ sec.15, T.102 N., R.18 W., on left bank 200 ft upstream from abandoned powerhouse, 500 ft downstream from highway bridge, 1.1 miles downstream from Turtle Creek, and 1.1 miles south of Austin.

Drainage area.--425 sq mi.

Records available.--May 1909 to September 1914, October 1944 to September 1964.

Gage.--Water-stage recorder. Datum of gage is 1,162.10 ft above mean sea level, datum of 1929. May 1909 to April 1912 staff gage in tailwater of powerplant 200 ft downstream at datum 3.1 ft lower. May 1912 to September 1914 chain gage on highway bridge 500 ft downstream at datum 1.1 ft lower.

Average discharge.--25 years, 165 cfs.

Extremes.--Maximum discharge during year, 543 cfs May 15; maximum gage height, 4.17 ft July 9; minimum discharge, 27 cfs Aug. 9; minimum gage height, 2.12 ft Mar. 5.
1909-14, 1944-64: Maximum discharge, 9,530 cfs Mar. 29, 1962; maximum gage height, 17.81 ft Mar. 26, 1950; no flow for several days in 1911.

Remarks.--Records good except those for periods of ice effect or backwater from aquatic growth, which are fair.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*60	52	48	43	48	48	79	184	85	65	35	42
2	55	50	*48	45	46	52	110	169	83	63	33	43
3	54	46	51	47	50	55	112	155	79	62	34	50
4	54	*50	51	47	52	57	90	169	77	54	34	50
5	54	48	51	47	52	51	94	149	75	50	34	43
6	52	47	51	*48	52	55	193	138	72	56	32	48
7	55	46	51	48	48	52	199	133	75	56	34	59
8	55	45	51	48	48	55	127	125	79	52	31	196
9	55	46	48	47	47	55	98	112	*81	100	29	184
10	55	45	47	46	48	55	88	96	70	57	31	196
11	55	43	48	45	48	55	81	*96	*65	55	36	136
12	54	43	51	47	*48	60	83	125	79	47	33	105
13	52	43	48	46	48	79	133	166	68	46	32	88
14	52	42	45	44	47	92	*172	175	63	36	32	85
15	56	42	51	44	46	77	138	202	70	*48	31	81
16	56	43	50	46	45	*75	117	369	67	45	31	*81
17	55	41	46	47	46	62	103	239	70	46	34	81
18	55	40	43	46	48	59	90	196	74	44	34	83
19	50	43	43	46	48	59	81	161	74	42	34	83
20	50	45	43	48	47	60	88	122	63	44	36	112
21	56	45	46	50	46	56	214	103	60	41	44	108
22	56	98	47	52	45	52	297	96	83	43	37	122
23	54	72	46	50	45	54	211	96	105	40	34	120
24	52	60	45	52	47	56	155	125	77	41	35	112
25	52	57	43	47	45	54	122	136	72	37	*36	105
26	50	56	44	46	44	56	108	249	70	36	35	105
27	47	55	45	51	45	57	122	255	62	38	37	100
28	47	54	46	46	45	59	149	164	58	37	65	98
29	48	51	49	46	46	60	199	130	63	35	47	96
30	47	51	51	47	---	62	193	108	65	34	46	98
31	54	---	45	48	---	68	---	94	---	34	43	---
Total	1,647	1,499	1,472	1,460	1,370	1,847	4,046	4,837	2,184	1,484	1,119	2,910
Mean	53.1	50.0	47.5	47.1	47.2	59.6	135	156	72.8	47.9	36.1	97.0
Cfsm	0.125	0.118	0.112	0.111	0.111	0.140	0.318	0.367	0.171	0.113	0.085	0.228
In.	0.14	0.13	0.13	0.13	0.12	0.16	0.35	0.42	0.19	0.13	0.10	0.25

Calendar year 1963: Max 2,190 Min 40 Mean 107 Cfsm 0.252 In. 3.40
Water year 1963-64: Max 369 Min 29 Mean 70.7 Cfsm 0.166 In. 2.25

Peak discharge (base, 1,400 cfs).--No peak above the base.

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 15-17, 21-23, 29, 30, Jan. 12,13,27. Backwater from aquatic growth Oct. 1 to Dec. 14, Dec. 18-20, 24-28, Dec. 31 to Jan. 11, Jan. 14-26, May 4 to Sept. 30.

5-4760. West Fork Des Moines River at Jackson, Minn.

Location.--Lat 43°37'10", long 94°59'10", in SE¼SW¼ sec.24, T.102 N., R.35 W., on right bank in Jackson, 200 ft downstream from dam at powerplant.

Drainage area.--1,220 sq mi, approximately.

Records available.--May 1909 to December 1913, August 1930 to September 1964 (winter records incomplete prior to 1936). Published as Des Moines River at Jackson, 1909-13, as Des Moines River near Jackson, 1930-35, and as West Fork Des Moines River near Jackson, 1936-44.

Gage.--Water-stage recorder. Datum of gage is 1,287.75 ft above mean sea level, datum of 1929. May 31, 1909, to Dec. 20, 1913, staff gage at site 0.6 mile downstream at datum 0.99 ft lower. Aug. 22, 1930, to Sept. 30, 1944, chain gage at site 7 miles upstream at datum 17.10 ft higher. Oct. 1, 1944, to Oct. 26, 1949, wire-weight gage at site 600 ft upstream at datum 10.64 ft higher.

Average discharge.--29 years (1935-64), 261 cfs.

Extremes.--Maximum discharge during year, 1,130 cfs May 6 (gage height, 7.33 ft); minimum, 11 cfs Aug. 14 (gage height, 2.97 ft).
1909-13, 1930-64: Maximum discharge, 8,360 cfs June 8, 1953 (gage height, 17.43 ft, from floodmark), from rating curve extended above 3,500 cfs on basis of contracted-opening measurement of peak flow; no flow at times.

Remarks.--Records good except those for periods of ice effect, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes.

Discharge, in cubic feet per second, water year October 1963 to September 1964

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	249	120	32	14	20	24	72	383	295	78	34	30
2	234	111	41	14	22	26	126	396	274	68	29	28
3	207	110	56	16	22	30	177	388	254	59	20	34
4	*194	111	71	17	23	30	148	405	236	58	18	41
5	182	*111	65	21	25	28	170	405	217	52	14	39
6	168	113	*66	23	27	29	234	805	*200	52	22	32
7	154	106	66	23	29	28	244	703	194	55	*18	78
8	141	105	40	23	28	28	196	645	184	53	16	216
9	130	105	26	22	29	28	191	573	184	*51	16	367
10	122	100	39	22	29	27	177	603	187	46	14	*339
11	120	97	45	20	28	28	180	573	177	53	16	289
12	113	96	47	18	27	32	182	712	154	50	26	266
13	106	92	38	17	29	43	284	*1,050	150	61	16	207
14	103	81	35	17	29	56	236	1,090	141	58	12	187
15	103	81	32	17	30	82	297	960	136	50	18	166
16	106	90	29	*17	30	84	249	890	130	42	20	148
17	157	92	26	17	28	76	232	886	132	37	18	138
18	175	88	26	18	30	68	203	934	136	35	16	130
19	177	84	24	19	29	86	187	954	136	32	12	153
20	175	84	22	20	*26	78	182	902	126	33	31	441
21	170	84	20	20	25	76	191	829	111	26	32	416
22	173	82	19	21	25	78	217	737	108	29	45	407
23	184	76	18	23	24	77	224	700	108	33	54	370
24	187	48	18	24	23	59	207	752	108	29	40	349
25	180	60	19	24	22	46	198	606	102	34	36	331
26	166	74	20	23	21	61	198	549	91	29	32	279
27	152	81	20	20	21	67	295	486	84	26	30	254
28	141	78	19	18	21	64	383	424	76	24	38	232
29	130	70	18	17	21	58	410	388	69	20	43	215
30	122	45	16	18	------	52	483	360	63	24	33	207
31	124	------	14	19	------	*59	------	313	------	43	38	------
Total	4,845	2,675	1,027	602	743	1,608	6,773	20,401	4,563	1,340	807	6,389
Mean	156	89.2	33.1	19.4	25.6	51.9	226	658	152	43.2	26.0	213
Cfsm	0.128	0.073	0.027	0.016	0.021	0.043	0.185	0.539	0.125	0.035	0.021	0.175
In.	0.15	0.08	0.03	0.02	0.02	0.05	0.21	0.62	0.14	0.04	0.02	0.19

Calendar year 1963: Max 1,640 Min 2.0 Mean 253 Cfsm 0.207 In. 2.80
Water year 1963-64: Max 1,090 Min 12 Mean 141 Cfsm 0.116 In. 1.57

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
5- 6	1000	7.33	1,130	6-24	0130	6.45	864
5-14	0100	7.32	1,130				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 25, 26, Nov. 30 to Mar. 31.

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or floodflow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations and the second is a table of annual maximum stage and discharge at crest-stage stations. Discharge measurements made at miscellaneous sites for both low flow and high flow are given in a third table.

Low-flow partial-record stations

Measuring of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. Most of these measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will give a picture of the low-flow potentiality of the stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same, site.

Discharge measurements made at low-flow partial-record stations during water year 1964

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
		Crow Wing River basin				
5-2427	Little Sand Lake Outlet near Dorset, Minn.	NE¼ sec.36, T.141 N., R.34 W., ½ mile below Little Sand Lake and 3 miles northeast of Dorset.	a74	1930-41≠ 1942, 1956-64	10-25-63	14.8
					11-22-63	14.0
					12-18-63	12.2
					1-25-64	17.6
					2-17-64	18.6
					3-23-64	22.3
					5-28-64	33.2
					7-16-64	30.5
					8- 8-64	22.0
					9-25-64	25.0

a Approximately
≠ Operated as a continuous-record gaging station.

Crest-stage partial-record stations

The following table contains annual maximum discharges for crest-stage stations. A crest-stage gage is a device which will register the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from discharge measurements made by indirect measurements of peak flow or by current meter. The date of the maximum discharge is not always certain but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. Only the maximum discharge for each water year is given. Information on some lower floods may have been obtained but is not published herein. The years given in the period of record represent water years for which the annual maximum has been determined.

Annual maximum discharge at crest-stage partial-record stations

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Streams tributary to Lake Superior					
4-0113.7	South Branch Devils Track River near Grand Marais, Minn.	NW¼ sec.9, T.61 N., R.1 E., at culvert on County Highway 12, 1½ miles above mouth, and 2½ miles north of Grand Marais.	-	1961-64	5-6-64	19.06	260
4-0114	South Branch Devils Track River tributary near Grand Marais, Minn.	NE¼ sec.9, T.61 N., R.1 E., at culvert on County Highway 12, a quarter mile above mouth, and 2½ miles north of Grand Marais.	-	1961-64	4-20-61 10-11-61 4-7-63 5-23-64	9.82 9.45 a9.67 9.42	3.1 1.6 1.3 1.5
4-0131	Lake Superior tributary near Taconite Harbor, Minn.	SW¼SE¼ sec.20, T.58 N., R.5 W., at culvert on U. S. Highway 61, 0.2 mile above mouth, and 3.7 miles southwest of Taconite Harbor.	1.56	1964	5-23-64	11.63	167
4-0132	Caribou River near Little Marais, Minn.	NW¼SE¼ sec.36, T.58 N., R.6 W., at culvert on U.S. Highway 61, 0.2 mile above mouth and 5.2 miles northeast of Little Marais.	22.8	1961-64	4-28-64	16.74	1,340
4-0151.5	Crow Creek near Silver Creek, Minn.	SW¼SW¼ sec.23, T.54 N., R.10 W., at culvert on County Highway 3, 2.3 miles northeast of Silver Creek, and 4.0 miles above mouth.	1.07	1960-64	5-23-64	9.30	(≠)
4-0152	Encampment River tributary at Silver Creek, Minn.	NE¼SE¼ sec.33, T.54 N., R.10 W., at culvert on County Highway 3, 0.3 mile north of Silver Creek and 1.4 miles above mouth.	.96	1960-64	9-7-64	7.50	41
4-0153	Little Stewart River near Two Harbors, Minn.	SE¼NE¼ sec.24, T.53 N., R.11 W., at culvert on county highway, 2.0 miles above mouth, and 2.7 miles north of Two Harbors.	5.54	1960-64	9-7-64	12.03	218
4-0153.6	Lake Superior tributary at French River, Minn.	SW¼SE¼ sec.18, T.51 N., R.12 W., at culvert on U.S. Highway 61, 0.35 mile above mouth, and 0.7 mile west of French River.	1.44	1964	9-7-64	28.25	337
4-0153.7	Talmadge River at Duluth, Minn.	SE¼NE¼ sec.24, T.51 N., R.13 W., at culvert on U.S. Highway 61, 0.6 mile above mouth, and 0.5 mile northeast of Duluth city limits.	-	1964	9-7-64	17.54	609
4-0154	Miller Creek at Duluth, Minn.	SE¼NE¼ sec.13, T.50 N., R.15 W., at culvert on U.S. Highway 53, 0.2 mile northwest of Duluth city limits.	4.92	1960-64	9-7-64	17.95	343
4-0177	McKinley Lake tributary at McKinley, Minn.	SW¼NE¼ sec.18, T.58 N., R.16 W., at culvert on State Highway 135 at west edge of McKinley.	-	1960-64	6-23-64	8.03	11
4-0187	Mud Hen Creek tributary near Central Lakes, Minn.	SW¼NW¼ sec.14, T.56 N., R.17 W., at culvert on U.S. Highway 53, 0.3 mile above mouth and 3.2 miles north of Central Lakes.	-	1960-64	6-23-64	7.90	(≠)
4-0188	East Two River tributary at Virginia, Minn.	NE¼NE¼ sec.12, T.58 N., R.18 W., at culvert on U.S. Highway 169, 0.2 mile west of Virginia city limits, and 1.1 miles above mouth.	4.26	1959-64	5-7-64	7.87	81
4-0241	Rock Creek near Blackhoof, Minn.	SW¼SE¼ sec.21, T.47 N., R.16 W., at culvert on State Highway 23, 4.0 miles above mouth, and 4.4 miles east of Blackhoof.	-	1961-64	4-2-63 9-7-64	a12.68 19.44	85 698
4-0241.1	Rock Creek tributary near Blackhoof, Minn.	NE¼SE¼ sec.21, T.47 N., R.16 W., at culvert on State Highway 23, 0.1 mile above mouth, and 4.5 miles east of Blackhoof.	-	1961-64	4-20-61 5-23-62 4-2-63 9-7-64	9.44 9.82 a9.42 13.23	12 15 5.8 27
4-0242	South Fork Nemadji River near Holyoke, Minn.	E½SE¼ sec.6, T.46 N., R.16 W., at culvert on State Highway 23, 2.0 miles northwest of Holyoke, and 4¼ miles above Net River.	-	1961-64	5-14-61 6-10-63 9-7-64	11.44 9.84 14.40	b458 b190 1,120

≠ Discharge not determined.
a Backwater from ice.
b Revised

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Red River of the North basin					
5-0476	West Branch Mustinka River near Graceville, Minn.	NW¼NW¼ sec.22, T.125 N., R.46 W., at culverts on county highway, 4.1 miles north of Graceville.	-	1964	4-13-64	8.25	(≠)
5-0477	West Branch Mustinka River tributary near Graceville, Minn.	NE¼NW¼ sec.28, T.125 N., R.45 W., at culvert on county highway, 0.6 mile northeast of Graceville.	-	1964	4-13-64	8.76	(≠)
5-0608	Buffalo River near Callaway, Minn.	SW¼SW¼ sec.17, T.141 N., R.41 W., at culvert on U.S. Highway 59, 2.7 miles north of Callaway.	49.9	1960-64	4-13-64	a13.73	237
5-0612	Whisky Creek at Barnesville, Minn.	NE¼NW¼ sec.29, T.137 N., R.45 W., at culvert on State Highway 34, 0.7 mile above Blue Eagle Lake, and 1.0 mile northeast of Barnesville.	25.3	1961-64	4-15-64	4.83	117
5-0614	Hay Creek above Downer, Minn.	NW¼NW¼ sec.30, T.138 N., R.45 W., at culvert on county road, 3.1 miles east of Downer.	5.81	1961-64	4-15-64	6.90	(≠)
5-0622.8	Wild Rice River tributary near Bagley, Minn.	SW¼NW¼ sec.21, T.146 N., R.37 W., at culvert on State Highway 92, 5.0 miles south of Bagley.	3.34	1961-64	5-5-64	c8.32	36
5-0624.7	Marsh River tributary near Mahnomen, Minn.	SE¼SW¼ sec.36, T.145 N., R.43 W., at culvert on State Highway 31, a quarter mile above mouth, and 5¼ miles west of Mahnomen.	6.57	1961-64	4-17-64	a12.52	140
5-0627	Wild Rice River tributary near Twin Valley, Minn.	SW¼SE¼ sec.12, T.144 N., R.45 W., at culvert on State Highway 31, 1½ miles above mouth, and 4¼ miles northwest of Twin Valley.	2.25	1961-64	4-21-64	c11.25	23
5-0628	Coon Creek near Twin Valley, Minn.	NE¼NE¼ sec.26, T.144 N., R.45 W., at bridge on County Highway 28, 1.1 miles above mouth, and 4.0 miles west of Twin Valley.	32.1	1962-64	6-19-64	11.83	565
5-0632	South Branch Wild Rice River near Ogema, Minn.	SE¼SE¼ sec.11, T.142 N., R.42 W., at culvert on county highway, 2 miles northwest of Ogema.	6.50	1963-64	4-17-64	8.87	83
5-0736	South Branch Battle River at Northome, Minn.	NE¼ sec.25, T.151 N., R.29 W., at culvert on U.S. Highway 71, three-quarters of a mile west of Northome, and 3 miles above Battle Lake.	3.19	1960-64	4-13-64	a13.92	24
5-0737.5	South Branch Cormorant River tributary near Blackduck, Minn.	NW¼NW¼ sec.32, T.150 N., R.30 W., at culvert on County Highway 304, 3 miles above mouth, and 3¼ miles north of Blackduck.	4.45	1960-64	4-13-64	a12.59	20
5-0738	Perry Creek near Shooks, Minn.	NW¼SW¼ sec.30, T.151 N., R.30 W., at culvert on State Highway 72, 5 miles west of Shooks.	2.41	1960-64	6-23-64	5.93	13
5-0766	Red Lake River tributary near Thief River Falls, Minn.	SW¼SE¼ sec.8, T.153 N., R.43 W., at culvert on County Highway 7, 0.5 mile above mouth, and 3.1 miles south of Thief River Falls.	-	1962-64	9-26-64	d7.39	(≠)
5-0781	Lost River at Gonvick, Minn.	NE¼NE¼ sec.16, T.149 N., R.38 W., at culvert on county highway, a half mile south of Gonvick, and 3 miles below Pine Lake.	30.9	1960-64	4-21-64	a7.54	110
5-0781.8	Lost River tributary near Clearbrook, Minn.	NW¼ sec.13, T.148 N., R.38 W., at culvert on county highway, 3½ miles south of Clearbrook.	1.79	1960-64	4-21-64	c8.04	16
5-0782	Lost River tributary at Clearbrook, Minn.	SW¼NW¼ sec.29, T.149 N., R.37 W., at culvert on county highway at north edge of Clearbrook, and three-quarters of a mile above mouth.	3.05	1960-64	4-13-64	9.89	45
5-0784	Clearwater River tributary near Plummer, Minn.	SE¼SE¼ sec.22, T.151 N., R.43 W., at culvert on county highway, 1¼ miles above mouth, and 5½ miles southwest of Plummer.	1.17	1961-64	7-10-64	8.33	96
		Lake of the Woods basin					
5-1287	Pike River tributary near Wahlsten, Minn.	SW¼SW¼ sec.32, T.61 N., R.15 W., at culvert on State Highway 135, 1.2 miles south of Wahlsten, and 2.7 miles above mouth.	-	1961-64	6-23-64	6.71	39

≠ Discharge not determined.
a Backwater from ice.
c Affected by shifting control.
d Backwater from aquatic growth.

GPO 819-718-11

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Lake of the Woods basin--continued					
5-1297.1	South Branch Little Fork River near Britt, Minn.	NW¼NE¼ sec.28, T.60 N., R.18 W., at culvert adjacent to U.S. Highway 53, 0.6 mile below Sand Lake, and 5.9 miles west of Britt.	-	1961-64	5-6-64	7.63	29
5-1303	Boriin Creek near Chisholm, Minn.	SE¼SE¼ sec.9, T.59 N., R.20 W., at culvert on State Highway 73, 1.2 miles above mouth, and 7.8 miles north of Chisholm.	13.7	1959-64	5-6-64	12.21	146
		Split Hand Creek basin					
5-2150	Smith Creek near Hill City, Minn.	SE¼NW¼ sec.13, T.53 N., R.26 W., at culvert on U.S. Highway 169, 6½ miles north of Hill City.	5.06	1961-64	5-6-64	6.28	(≠)
		Swan River basin					
5-2167	O'Brien Creek near Nashwauk, Minn.	NE¼NE¼ sec.33, T.57 N., R.22 W., at culvert on U.S. Highway 169, 1.5 miles east of Nashwauk, and 3.0 miles above Welcome Creek.	-	1959-64	6-24-64	8.80	98
5-2168.3	Hay Creek near Pengilly, Minn.	SW¼NE¼ sec.26, T.56 N., R.22 W., at culvert on Duluth, Missabe and Iron Range railroad, 1.9 miles above Hay Lake, and 5.0 miles southeast of Pengilly.	-	1964	6-23-64	8.80	95
5-2169.8	Swan River tributary at Warba, Minn.	NW¼ sec.34, T.54 N., R.23 W., at culvert on U.S. Highway 2, three-quarters of a mile above mouth, and 1 mile southeast of Warba.	2.36	1961-64	4-21-61 5-23-62 4-2-63 4-21-64	c5.63 6.80 a6.87 6.21	27 77 39 52
		Bluff Creek basin					
5-2177	Bluff Creek near Jacobson, Minn.	SW¼NW¼ sec.8, T.52 N., R.23 W., at culvert on State Highway 34, 1¼ miles west of Jacobson.	2.95	1961-64	6-23-64	7.72	(≠)
		Crow Wing River basin					
5-2441	Kitten Creek near Sebeka, Minn.	SE¼SE¼ sec.15, T.137 N., R.35 W., at culvert on county highway, 3¾ miles above mouth, and 3¾ miles north of Sebeka.	9.34	1961-64	5-6-64	10.52	(≠)
5-2442	Cat River near Nimrod, Minn.	SW¼SW¼ sec.36, T.137 N., R.34 W., at bridge on State Highway 227, 2½ miles west of Nimrod, and 3 miles above mouth.	44.3	1961-64	5-6-64	6.38	(≠)
		Platte River basin					
5-2678	Big Mink Creek tributary near Lastrup, Minn.	NW¼SW¼ sec.14, T.41 N., R.30 W., at culvert on State Highway 25, 1.4 miles above mouth, and 2.1 miles west of Lastrup.	-	1961-64	4-13-64	8.57	(≠)
5-2679	Hillman Creek near Pierz, Minn.	NE¼SE¼ sec.9, T.40 N., R.30 W., at bridge on county highway, 1.1 miles above mouth, and 1.5 miles east of Pierz.	52.6	1964	5-7-64	14.55	2,040
		Sauk River basin					
5-2703	Sauk River tributary at Spring Hill, Minn.	NE¼ sec.27, T.124 N., R.33 W., at culvert on State Highway 4, 1 mile east of Spring Hill, and 1¼ miles above mouth.	6.42	1960-64	4-6-64	a10.08	(≠)
5-2703.1	Sauk River tributary near St. Martin, Minn.	SE¼ sec.19, T.124 N., R.32 W., at culvert on county highway, 4½ miles northwest of St. Martin.	0.23	1960 1962-64	5-6-64	7.10	7.4
		Johnson Creek basin					
5-2718	Johnson Creek tributary at Luxemburg, Minn.	NW¼NE¼ sec.30, T.123 N., R.28 W., at culverts on State Highway 15, 0.8 mile south of Luxemburg.	2.77	1964	8-29-64	7.24	(≠)
5-2720	Johnson Creek tributary near St. Augusta, Minn.	NE¼SE¼ sec.21, T.123 N., R.28 W., at culverts on county highway, 0.7 mile above mouth, and 3.1 miles southwest of St. Augusta.	-	1964	5-6-64	6.45	(≠)

≠ Discharge not determined.
a Backwater from ice.
c Affected by shifting control.

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Johnson Creek basin--continued					
5-2723	Johnson Creek near St. Augusta, Minn.	NW¼SW¼ sec.13, T.123 N., R.28 W., at bridge on County Highway 7, 3.3 miles above mouth, and 1.0 mile south of St. Augusta.	-	1964	4-13-64	12.85	(≠)
		Otsego Creek basin					
5-2737	Otsego Creek near Otsego, Minn.	SW¼NE¼ sec.13, T.121 N., R.24 W., at culvert on County Highway 39, 1.3 miles above mouth, and 1.9 miles west of Otsego.	-	1964	4-6-64	a4.39	(≠)
		Elk River basin					
5-2742	Stony Brook tributary near Foley, Minn.	NW¼ sec.2, T.36 N., R.29 W., at culvert on State Highway 25, a quarter mile above mouth, and 1½ miles south of Foley.	3.11	1960-64	5-6-64	8.96	59
		Crow River basin					
5-2761	North Fork Crow River tributary near Paynesville, Minn.	NW¼ sec.12, T.122 N., R.33 W., at culvert on county highway, 1 mile above mouth and 3 miles west of Paynesville.	0.58	1960-64	4-6-64	a16.82	6.7
5-2783.5	Fountain Creek near Montrose, Minn.	NE¼NW¼ sec.22, T.118 N., R.26 W., at culvert on County Highway 30, 3.3 miles southwest of Montrose.	-	1962-64	5-6-64	5.46	(≠)
5-2787	Otter Creek near Lester Prairie, Minn.	SE¼SE¼ sec.28, T.117 N., R.27 W., at culvert on State Highway 7, 2.1 miles northwest of Lester Prairie, and 4.4 miles above mouth.	-	1961-64	5-18-61 5-22-62 5-8-64	6.08 8.66 5.75	e46 b348 33
5-2787.5	Otter Creek tributary near Lester Prairie, Minn.	SE¼SE¼ sec.33, T.117 N., R.27 W., at culvert on County Highway 63, 1.7 miles northwest of Lester Prairie, and 3.3 miles above mouth.	-	1962-64	5-6-64	8.28	26
5-2788.5	Buffalo Creek tributary near Brownton, Minn.	NE¼SE¼ sec.13, T.115 N., R.30 W., at culvert on State Highway 15, 0.6 mile above mouth, and 2.6 miles northwest of Brownton.	-	1961-64	-	f	<12
5-2790.3	South Fork Crow River tributary near Mayer, Minn.	NW¼NE¼ sec.36, T.117 N., R.26 W., at culvert on State Highway 7, 0.7 mile above mouth, and 1.4 miles north of Mayer.	-	1962-64	-	f	<20
5-2803	School Lake Creek tributary near St. Michael, Minn.	NW¼SE¼ sec.15, T.120 N., R.24 W., at culvert on county highway, 0.2 mile above mouth, and 1.5 miles southwest of St. Michael.	-	1964	5-6-64	7.34	(≠)
		Rum River basin					
5-2841	Mille Lacs Lake tributary near Wealthwood, Minn.	NW¼NE¼ sec.25, T.45 N., R.27 W., at culvert on State Highway 18, 0.2 mile above mouth, and 2.0 miles west of Wealthwood.	-	1961-64	5-6-64	8.47	9.4
5-2846	Robinson Brook near Onamia, Minn.	NE¼SE¼ sec.11, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 6¾ miles south of Onamia.	7.21	1960-64	7-16-60 5-6-64	14.36 15.17	b36 96
5-2846.2	Rum River tributary near Onamia, Minn.	E½ sec.14, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 7¾ miles south of Onamia.	1.84	1960-64	5-6-64	8.87	65
5-2849.2	Stanchfield Creek tributary near Day, Minn.	NW¼SE¼ sec.13, T.37 N., R.25 W., at culvert on County Highway 60, 0.5 mile above mouth, and 1.5 miles southwest of Day.	-	1961-64	5-14-61 5-23-62 5-28-63 5-8-64	6.38 8.50 6.80 5.95	13 70 22 26
		Minnesota River basin					
5-2991	Lazarus Creek tributary near Canby, Minn.	N½ sec.6, T.114 N., R.45 W., at culvert on State Highway 68, 3 miles west of Canby, and 3¼ miles above mouth.	3.4	1960-64	4-13-64	10.75	(≠)

≠ Discharge not determined.
< Less than.
a Backwater from ice.
b Revised.
e Corrected.
f Peak stage did not reach bottom of gage.

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Minnesota River basin--continued					
5-3012	Minnesota River tributary near Montevideo, Minn.	SW¼SE¼ sec.16, T.117 N., R.41 W., at culvert on U.S. Highway 212, 1 mile above mouth, and 3¾ miles west of Montevideo.	0.54	1960-64	4-12-64	a8.20	(✓)
5-3029.7	Lake Emily tributary near Starbuck, Minn.	NW¼ sec.27, T.124 N., R.39 W., at culvert on State Highway 29, 6½ miles south of Starbuck.	.13	1962-64	4-5-64	a7.26	(✓)
5-3034.5	Hassel Creek near Clontarf, Minn.	NW¼SE¼ sec.4, T.122 N., R.39 W., at culvert on State Highway 29, a quarter mile above Lake Hassel, and 5¾ miles east of Clontarf.	4.03	1962-64	10-20-63	9.70	(✓)
5-3052	Spring Creek near Montevideo, Minn.	SW¼SW¼ sec.32, T.118 N., R.40 W., at culvert on State Highway 29, 1¼ miles above mouth, and 2¼ miles north of Montevideo.	16.3	1959-64	4-12-64	13.51	54
5-3112	North Branch Yellow Medicine River near Ivanhoe, Minn.	NW¼ sec.2, T.111 N., R.46 W., at culvert on State Highway 19, 5¼ miles west of Ivanhoe.	15.2	1960-64	4-21-64	12.60	(✓)
5-3112.5	North Branch Yellow Medicine River tributary near Wilno, Minn.	SE¼NE¼ sec.33, T.113 N., R.45 W., at culvert on U.S. Highway 75, 1½ miles above mouth, and 4½ miles northwest of Wilno.	.33	1960-64	4-13-64	8.71	20
5-3113	North Branch Yellow Medicine River tributary near Porter, Minn.	E½ sec.16, T.113 N., R.45 W., at culvert on U.S. Highway 75, 6¼ miles southwest of Porter.	1.46	1960-64	4-13-64	a14.78	(✓)
5-3138	Chetomba Creek tributary near Blomkest, Minn.	SW¼SW¼ sec.35, T.118 N., R.35 W., at culvert on U.S. Highway 71, 2⅜ miles northwest of Blomkest.	.79	1959-64	4-13-64	7.79	(✓)
5-3149	Redwood River at Ruthton, Minn.	NW¼NW¼ sec.11, T.108 N., R.44 W., at culvert on State Highway 23, 0.1 mile northeast of Ruthton.	5.90	1959-64	4-13-64	13.75	126
5-3165.5	West Fork Beaver Creek near Olivia, Minn.	SW¼SW¼ sec.14, T.116 N., R.35 W., at culvert on U.S. Highway 71, 5½ miles northwest of Olivia.	9.71	1959-64	4-13-64	5.90	61
5-3167	Spring Creek near Sleepy Eye, Minn.	NE¼SE¼ sec.24, T.111 N., R.33 W., at culvert on county highway, 3¾ miles above mouth, and 7½ miles north of Sleepy Eye.	30.0	1959-64	4-13-64	9.61	66
5-3168	Cottonwood River tributary near Balaton, Minn.	NW¼NW¼ sec.19, T.109 N., R.42 W., at culvert on U.S. Highway 14, 4¼ miles west of Balaton.	.50	1959-64	4-13-64	5.84	35
5-3168.5	Meadow Creek tributary near Marshall, Minn.	E½ sec.34, T.111 N., R.41 W., at culvert on U.S. Highway 59, 1¼ miles above mouth, and 4½ miles south of Marshall.	-	1961-64	6-30-64	14.02	(✓)
5-3169	Dry Creek near Jeffers, Minn.	NE¼NE¼ sec.31, T.108 N., R.36 W., at culvert on County Highway 10, 4½ miles north of Jeffers.	3.24	1961-64	7-10-64	4.83	37
5-3178.5	Foster Creek near Alden, Minn.	NE¼NE¼ sec.9, T.102 N., R.23 W., at culvert on U.S. Highway 16, 1.2 miles southwest of Alden.	-	1959-64	9-20-64	4.42	(✓)
5-3181	East Branch Blue Earth River tributary near Blue Earth, Minn.	W½SE¼ sec.24, T.102 N., R.27 W., at culvert on County Highway 13, a quarter mile above mouth, and 4¾ miles east of Blue Earth.	-	1960-64	4-13-64	3.79	58
5-3183	North Fork Watonwan River near Delft, Minn.	E½ sec.11, T.106 N., R.36 W., at culvert on U.S. Highway 71, 1¾ miles northwest of Delft.	13.1	1960-64	4-13-64	14.48	27
5-3202	LeSueur River tributary near Mankato, Minn.	SE¼SW¼ sec.28, T.108 N., R.26 W., at culvert on State Highway 22, 0.2 mile above mouth, and 1.5 miles southeast of Mankato Airport.	.073	1959-64	-	f	<1
5-3203	Cobb River tributary near Mapleton, Minn.	SW¼NE¼ sec.4, T.106 N., R.26 W., at culvert on State Highway 22, 1.0 mile above mouth, and 6.3 miles north of Mapleton.	7.25	1959-64	4-13-64	14.99	92
5-3204	Maple River tributary near Mapleton, Minn.	SW¼ sec.1, T.105 N., R.27 W., at culvert on State Highway 30, 1 mile above mouth, and 3¼ miles west of Mapleton.	5.75	1959-64	9-7-64	15.64	44
5-3204.4	Maple River tributary near Amboy, Minn.	NW¼ sec.19, T.105 N., R.27 W., at culvert on State Highway 30, 1½ miles east of Amboy.	13.8	1959-64	9-7-64	c13.59	100
5-3251	Minnesota River tributary near North Mankato, Minn.	SW¼SW¼ sec.13, T.109 N., R.27 W., at culvert on county road, 200 ft above U.S. Highway 169, 0.4 mile above mouth, and 4.2 miles north of North Mankato.	-	1961-64	9-7-64	4.13	(✓)

✓ Discharge not determined.
< Less than.
a Backwater from ice.
c Affected by shifting control.
f Peak stage did not reach bottom of gage.

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Minnesota River basin--continued					
5-3301.5	Sand Creek tributary near Montgomery, Minn.	NE¼ sec.18, T.111 N., R.22 W., at culvert on State Highway 21, 3½ miles east of Montgomery.	0.29	1961-64	3-25-61 5-12-62 7-18-63 9-8-64	8.21 8.68 8.11 8.75	16 25 14 27
5-3302	Rice Lake tributary near Montgomery, Minn.	N½ sec.13, T.111 N., R.23 W., at culvert on State Highway 21, 1¼ miles above Rice Lake, and 2½ miles east of Montgomery.	2.49	1960-64	9-8-64	6.12	18
5-3303	Sand Creek near New Prague, Minn.	NE¼NW¼ sec.1, T.112 N., R.23 W., at culvert on State Highways 13 and 19, 1.9 miles east of New Prague.	65	1960-64	9-10-64	9.14	64
5-3305.5	Raven Stream tributary near New Prague, Minn.	NW¼ sec.28, T.113 N., R.23 W., at culvert on county road, 1.6 miles above mouth, and 2.3 miles northwest of New Prague.	23	1960-64	6-7-64	10.38	112
5-3306	Sand Creek tributary near Jordan, Minn.	NW¼NE¼ sec.5, T.113 N., R.23 W., at culvert on State Highway 21, 0.8 mile above mouth, and 2.8 miles south of Jordan.	2.62	1960-64	-	f	(≠)
		St. Croix River basin					
5-3363	Moose River tributary at Moose Lake, Minn.	SE¼NE¼ sec.19, T.46 N., R.19 W., at culvert on State Highway 27, 0.9 mile above mouth, and 1.2 miles west of Moose Lake.	-	1960-64	4-24-60 5-15-61 6-10-63 9-7-64	7.81 8.60 7.54 9.87	b27 b64 b17 118
5-3365.5	Wolf Creek tributary near Sandstone, Minn.	NE¼SE¼ sec.33, T.43 N., R.20 W., at culvert on U.S. Highway 61, 0.2 mile above mouth, and 2.2 miles north of Sandstone.	-	1960-64	5-6-64	16.24	51
5-3366	Kettle River tributary at Sandstone, Minn.	SE¼SE¼ sec.4, T.42 N., R.20 W., at culvert on U.S. Highway 61 at Sandstone, and 0.2 mile above mouth.	-	1960-64	5-6-64	7.48	(≠)
5-3382	Mission Creek near Hinckley, Minn.	SW¼SW¼ sec.25, T.41 N., R.21 W., at culvert on U.S. Highway 61, 1.2 miles south of Hinckley.	-	1960-64	5-6-64	13.63	52
		Vermillion River basin					
5-3459	Vermillion River tributary near Hastings, Minn.	NE¼SE¼ sec.35, T.115 N., R.18 W., at culvert on county highway, 2.0 miles above mouth, and 4.1 miles west of Hastings.	-	1960-64	3-13-64	a15.59	(≠)
		Cannon River basin					
5-3527	Turtle Creek tributary near Pratt, Minn.	NW¼ sec.8, T.106 N., R.19 W., at culvert on U.S. Highway 218, 1 mile above mouth, and 1½ miles southeast of Pratt.	-	1960-64	4-21-64	g15.04	7.3
5-3528	Turtle Creek tributary near Steele Center, Minn.	NW¼NW¼ sec.11, T.106 N., R.20 W., at culvert on township road, 1½ miles above mouth and 1½ miles northeast of Steele Center.	-	1960-64	7-19-63 9-7-64	4.64 6.18	27 79
5-3551	Little Cannon River tributary near Kenyon, Minn.	SE¼ sec.9, T.110 N., R.18 W., at culvert on State Highway 56, a quarter mile above mouth, and 5 miles north of Kenyon.	2.02	1960-64	9-9-64	12.04	74
5-3551.5	Pine Creek near Cannon Falls, Minn.	NE¼NE¼ sec.6, T.112 N., R.17 W., at culvert on State Highway 20, 2.0 miles above mouth, and 2.1 miles north of Cannon Falls.	-	1960-64	9-9-64	c1.14	6.3
5-3551.8	Cannon River tributary near Miesville, Minn.	SW¼SW¼ sec.9, T.113 N., R.17 W., at culvert on State Highway 50, 2.9 miles west of Miesville.	-	1960-64	3-13-64	a14.25	(≠)
5-3552.3	Cannon River tributary near Welch, Minn.	SW¼SW¼ sec.11, T.113 N., R.16 W., at culvert on U.S. Highway 61, 1.2 miles above mouth, and 2.7 miles northeast of Welch.	-	1960-64	5-25-64	10.15	49
		Zumbro River basin					
5-3733.5	Zumbro River tributary near South Troy, Minn.	SE¼NE¼ sec.6, T.108 N., R.13 W., at culvert on county road, 0.8 mile above mouth, and 1.3 miles south of South Troy.	.16	1962-64	3-13-64	a7.21	(≠)

≠ Discharge not determined.
a Backwater from ice.
b Revised.
c Affected by shifting control.
f Peak stage did not reach bottom of gage.
g Backwater from debris.

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Zumbro River basin--continued					
5-3737	North Fork Zumbro River tributary near Wanamingo, Minn.	SE¼SE¼ sec.32, T.110 N., R.17 W., at culvert on County Highway 1, 3¾ miles above mouth, and 4¼ miles southwest of Wanamingo.	9.36	1960-64	-	f	<100
5-3739	Trout Brook tributary near Goodhue, Minn.	SE¼ sec.4, T.110 N., R.15 W., at culvert on State Highway 58, three-quarter mile above mouth, and 3 miles south of Goodhue.	.41	1960-64	4-21-64	5.76	(≠)
		East Indian Creek basin					
5-3758	East Indian Creek tributary No. 1 near Weaver, Minn.	NW¼SE¼ sec.23, T.109 N., R.10 W., at culvert on County Highway 14, 0.3 mile above mouth, and 2.5 miles northwest of Weaver.	.21	1962-64	5-29-62 3-16-63 10-25-63	9.25 a7.98 9.67	25 3.2 31
		Garvin Brook basin					
5-3783	Straight Valley Creek near Rollingstone, Minn.	SE¼NE¼ sec.12, T.107 N., R.9 W., at bridge on county highway, 0.2 mile above mouth, and 1.5 miles southwest of Rollingstone.	5.16	1959-64	9-7-64	-	h60
		Gilmore Creek basin					
5-3790	Gilmore Creek at Winona, Minn.	N½ sec.29, T.107 N., R.7 W., about 1500 ft above bridge carrying U.S. Highway 14 at west edge of Winona and 2¼ miles above mouth.	8.95	1939-63≠ 1964	11-22-63	1.07	114
		Root River basin					
5-3837	Mill Creek tributary near Chatfield, Minn.	SW¼NW¼ sec.14, T.105 N., R.12 W., at culvert on county highway, 0.8 mile above mouth, and 4.5 miles northwest of Chatfield.	2.36	1959-64	9-7-64	12.08	(≠)
5-3837.2	Mill Creek near Chatfield, Minn.	SE¼NW¼ sec.23, T.105 N., R.12 W., at bridge on county highway, 3.4 miles northwest of Chatfield, and 4.8 miles above mouth.	22.4	1962-64	3-12-64	a10.06	(≠)
5-3838.5	Bear Creek near Grand Meadow, Minn.	NE¼SE¼ sec.14, T.103 N., R.15 W., at bridge on county highway, 1½ miles northwest of Grand Meadow, and 4 miles above North Fork Bear Creek.	13.6	1962-64	7-28-64	15.64	206
5-3841	Trout Creek tributary near Lanesboro, Minn.	SW¼ sec.6, T.102 N., R.9 W., at culvert on county highway, three-quarter mile above mouth, and 4 miles south of Lanesboro.	4.08	1959-64	5-8-64	15.01	267
5-3841.5	Root River tributary near Whalan, Minn.	SW¼ sec.17, T.103 N., R.9 W., at culvert on private road, 1¼ miles southwest of Whalan.	.30	1959-64	5-8-64	4.69	4.2
5-3842	Whalan Creek near Whalan, Minn.	SE¼ sec.21, T.103 N., R.9 W., at bridge on county highway, 1¾ miles southeast of Whalan, and 2¼ miles above mouth.	7.85	1959-64	5-8-64	20.14	1,430
5-3843	Big Springs Creek near Arendahl, Minn.	NE¼SE¼ sec.7, T.104 N., R.9 W., at culvert on State Highway 250, 2.0 miles west of Arendahl.	.14	1959-64	4-13-64	7.68	2.0
5-3844	Pine Creek near Arendahl, Minn.	SE¼NE¼ sec.3, T.104 N., R.9 W., at bridge on County Highway 25, 1.3 miles northeast of Arendahl, and 4.9 miles above Hemingway Creek.	28.1	1959-64	-	f	<80
		Iowa River basin					
5-4570.8	Rose Creek tributary near Dexter, Minn.	SE¼SW¼ sec.22, T.103 N., R.16 W., at culvert on county highway, 1¾ miles above mouth, and 2¾ miles southwest of Dexter.	1.20	1962-64	5-16-64	7.10	(≠)
5-4589.5	Shell Rock River tributary near Albert Lea, Minn.	SW¼SE¼ sec.25, T.103 N., R.22 W., at culvert on State Highway 13, 0.4 mile above mouth, and 2.4 miles northwest of Albert Lea city limits.	-	1960-64	-	f	<3

≠ Discharge not determined.
≠ Operated as a continuous-record gaging station.
< Less than.
a Backwater from ice.
f Peak stage did not reach bottom of gage.
h Estimated; gage height unknown.

Annual maximum discharge at crest-stage partial-record stations--continued.

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
		Des Moines River basin					
5-4747.5	Beaver Creek tributary near Slayton, Minn.	NW¼NW¼ sec.17, T.106 N., R.41 W., at culvert on State Highway 30, 2¼ miles west of Slayton, and 2¾ miles above mouth.	2.67	1961-64	4-13-64	16.80	(✗)
5-4747.6	Beaver Creek tributary above Slayton, Minn.	NE¼NE¼ sec.17, T.106 N., R.41 W., at culvert on State Highway 30, three-quarters of a mile above mouth, and 1½ miles west of Slayton.	.97	1961-64	5-3-64	17.13	(✗)
5-4754	Warren Lake tributary near Windom, Minn.	SE¼NE¼ sec.14, T.105 N., R.36 W., at culvert on U.S. Highway 71, a quarter mile above Warren Lake, and 2.4 miles north of Windom.	1.38	1960-64	9-8-64	4.46	18
5-4758	West Fork Des Moines River tributary near Jackson, Minn.	NW¼SE¼ sec.27, T.103 N., R.35 W., at culvert on county highway, three-quarters of a mile above mouth, and 5½ miles north of Jackson.	1.42	1960-64	5-24-64	13.51	16
5-4759	West Fork Des Moines River tributary near Lakefield, Minn.	SE¼SE¼ sec.32, T.103 N., R.35 W., at culvert on County Highway 19, 1½ miles above mouth, and 5¾ miles east of Lakefield.	4.52	1960-64	5-6-64	5.52	49
5-4760.1	Nelson Creek at Jackson, Minn.	NW¼NW¼ sec.25, T.102 N., R.35 W., at flume spillway, at intersection of U.S. Highways 16 and 71 at south edge of Jackson.	6.8	1964	5-6-64	13.22	(✗)
5-4761	Story Brook near Petersburg, Minn.	SW¼NW¼ sec.24, T.101 N., R.35 W., at bridge on U.S. Highway 71, 3 miles above mouth, and 4 miles west of Petersburg.	-	1960-64	5-7-64	10.25	716
5-4769	East Fork Des Moines River tributary near Dunnell, Minn.	SW¼NW¼ sec.2, T.101 N., R.33 W., at bridge on State Highway 4, a half mile above mouth, and 1½ miles north of Dunnell.	7.88	1960-64	5-7-64	c10.89	86
		Big Sioux River basin					
6-4829.5	Mound Creek near Hardwick, Minn.	SE¼SE¼ sec.15, T.104 N., R.45 W., at culvert on county highway, 2¾ miles northwest of Hardwick.	2.77	1959-64	4-27-64	7.38	20
6-4829.6	Mound Creek tributary at Hardwick, Minn.	SE¼ sec.34, T.104 N., R.45 W., at culvert on U.S. Highway 75, half a mile above mouth, and 1 mile southwest of Hardwick.	.23	1959-64	9-7-64	7.42	(✗)
6-4830.5	Rock River tributary near Luverne, Minn.	NE¼ sec.10, T.101 N., R.45 W., at culvert on U.S. Highway 75, 5.8 miles south of Luverne.	-	1959-64	7-11-64	13.23	(✗)
6-4831.5	Kanaranzi Creek tributary near Adrian, Minn.	E½ sec.16, T.102 N., R.42 W., at culvert on private road, a quarter mile above mouth, and 3 miles east of Adrian.	.76	1959-64	4-27-64	7.76	11
6-4832	North Branch Kanaranzi Creek tributary near Lismore, Minn.	SW¼SW¼ sec.31, T.104 N., R.42 W., at culvert on county highway adjacent to State Highway 91, 60 ft above mouth and 1¼ miles northeast of Lismore.	.12	1959-64	7-2-64	17.59	49
		Little Sioux River basin					
6-6035.2	Little Sioux River tributary near Spafford, Minn.	NW¼NE¼ sec.27, T.102 N., R.38 W., at culvert on U.S. Highway 16, 0.4 mile west of Spafford, and a half mile above mouth.	4.06	1959-64	5-6-64	6.26	10
6-6035.3	Little Sioux River near Spafford, Minn.	NE¼NE¼ sec.34, T.102 N., R.37 W., at bridge on county highway, 1.6 miles below Jackson County ditch No. 11, and 5.8 miles east of Spafford.	-	1962-64	5-23-64	6.80	(✗)

✗ Discharge not determined.
c Affected by shifting control.

Measurements at miscellaneous sites

Measurements of streamflow at points other than gaging stations or partial-record stations are given in the following table. Those that are measurements of base flow are designated by an asterisk (*).

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Red River of the North basin						
Mustinka River	Bois de Sioux River	On line between secs.11 and 14, T.128 N., R.43 W., about 6.7 miles southwest of town of Elbow Lake, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	10.4 *.53 *.23 *.10
Twelve Mile Creek	Mustinka River	On line between secs.27 and 28, T.126 N., R.45 W., ½ mile above West Fork, 5 miles east and 1½ miles south of Dumont, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	8.96 0 0 0
West Fork Twelve Mile Creek	Twelve Mile Creek	On line between secs.28 and 33, T.126 N., R.45 W., 1 mile above mouth, 4 miles east and 2 miles south of Dumont, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	5.47 0 0 0
Twelve Mile Creek	Mustinka River	On line between secs.30 and 31, T.127 N., R.45 W., 0.1 mile above mouth, 5¼ miles east and 2 miles south of Wheaton, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	23.0 0 0 0
West Branch Mustinka River	Mustinka River	On line between secs.30 and 31, T.127 N., R.45 W., ¼ mile above mouth of Twelve Mile Creek, 5¼ miles east and 2 miles south of Wheaton, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	6.69 0 0 0
Mustinka River	Bois de Sioux River	SW¼ sec.8, T.127 N., R.46 W., on U. S. Highway 75, 1.2 miles north of Wheaton, Minn., 8 miles above mouth.	834	1916,17 1919-24≠ 1931-58≠	4-20-64 5-26-64 7- 7-64 8-19-64	95.1 *1.68 *.43 0
Drainage Ditch	Rabbit River	On line between secs.7 and 12, T.130 N., R.45 and 46 W., ¼ mile above Rabbit River and ½ mile southeast of Campbell, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	4.35 0 0 0
South Fork Rabbit River	Rabbit River	On line between secs.18 and 19, T.130 N., R.45 W., 2 miles above mouth and 2.2 miles southeast of Campbell, Minn.	-	-	4-20-64 5-26-64 7- 7-64 8-19-64	7.58 0 0 0
Rabbit River	Bois de Sioux River	SE¼SE¼ sec.2, T.130 N., R.46 W., at Campbell, Minn., 1 mile below South Fork.	266	1942-51≠	4-20-64 5-26-64 7- 7-64 8-19-64	21.6 *.13 0 0
Otter Tail River	Red River of the North	NW¼NE¼ sec.1, T.136 N., R.39 W., at outlet of Little Pine Lake 2.2 miles northeast of Perham, Minn.	-	1933	4-21-64 5-27-64 7- 8-64 8-20-64	305 *195 *115 *53.8
Toad River	Otter Tail River	S½NW¼ sec.29, T.137 N., R.38 W., at County Highway 13, 1 mile above Pine Lake, and 4½ miles northeast of Perham, Minn.	-	-	4-21-64 5-27-64 7- 8-64 8-20-64	220 *29.2 *17.9 *4.84
Whiskey Creek	Red River of the North	On line between secs.13 and 24, T.134 N., R.48 W., at County Highway 20, 1.7 miles southeast of Kent, Minn.	-	-	4-23-64 5-25-64 7- 6-64 8-18-64	28.8 0 *.18 0
Wolverton Creek	Red River of the North	On line between secs.21 and 22, T.137 N., R.48 W., ¼ mile northeast of Comstock, Minn.	-	-	4-23-64 5-25-64 7- 6-64 8-18-64	16.5 0 0 0
Deerhorn Creek	South Branch Buffalo River	On line between secs.23 and 26, T.137 N., R.47 W., 3 miles above mouth, at County Highway 2, 7.4 miles west of Barnsville, Minn.	-	-	4-23-64 5-25-64 7- 6-64 8-19-64	102 *5.46 *4.79 *2.75

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Red River of the North basin--continued				
Stony Creek	South Branch Buffalo River	On line between secs.22 and 27, T.138 N., R.47 W., at County Highway 65, 3 miles southeast of Sabin, Minn.	-	-	4-23-64	275
					5-28-64	*3.82
					7- 6-64	*.57
					8-19-64	0
Wild Rice River	Red River of the North	On line between secs.8 and 9, T.145 N., R.39 W., at County Highway 4, 1 mile below Lambert Lake Creek and 5½ miles northwest of town of Roy Lake, Minn.	-	-	4-22-64	438
					5-28-64	*103
					7- 9-64	95.8
White Earth Creek	Wild Rice River	On line between secs.6 and 1, T.144 N., R.41 and 42 W., at County highway bridge about 1 mile above Wild Rice River and 1½ miles east of Mahnomen, Minn.	-	-	4-22-64	153
					5-28-64	*80.1
					7- 9-64	29.6
Wild Rice River	Red River of the North	On line between secs.1 and 12, T.144 N., R.42 W., at County Highway 25, ¼ mile below White Earth Creek and ½ mile east of Mahnomen, Minn.	-	-	4-22-64	729
					5-28-64	*220
					7- 9-64	134
Marsh Creek	Wild Rice River	On line between secs.6 and 31, T.144 and 145 N., R.42 W., at State Highway 31, 3.6 miles west of Mahnomen, Minn.	-	-	4-22-64	159
					5-28-64	*6.20
					7- 9-64	27.9
Wild Rice River Tributary	Wild Rice River	SW¼ sec.16, T.144 N., R.44 W., at footbridge in park at Heiberg, ¼ mile above mouth, and 1½ miles northwest of Twin Valley, Minn.	-	-	4-22-64	121
					5-28-64	*.59
					7- 9-64	.45
					8-18-64	a.1
South Branch Wild Rice River	Wild Rice River	On line between secs.28 and 33, T.142 N., R.42 W., 3½ miles southwest of Ogema, Minn.	-	-	4-22-64	65.0
					6- 3-64	2.06
					7- 9-64	1.57
South Branch Wild Rice River	Wild Rice River	On line between secs.8 and 9, T.142 N., R.45 W., at bridge on County Road 63, 5½ miles northeast of Felton, Minn.	-	1959-63	10- 3-63	*3.14
					10-30-63	*4.66
					4- 7-64	194
					4-14-64	72.2
					4-22-64	537
					4-27-64	113
					5-28-64	*10.7
					7- 6-64	*9.68
					7-28-64	*3.98
					9- 3-64	*3.10
					9-28-64	18.3
State Ditch No. 45	Wild Rice River	On line between secs.15 and 16, T.141 N., R.46 W., at culvert on State Highway 9, 3 miles south of Felton, Minn.	-	1959-63	10- 3-63	*1.24
					10-30-63	*1.83
					4- 7-64	11.7
					4-14-64	49.4
					4-22-64	60.0
					4-27-64	17.7
					5-28-64	*2.44
					7- 6-64	*2.89
					7-28-64	*2.90
					9- 3-64	*2.34
					9-28-64	3.34
Sand Hill River	Red River of the North	At intersection of secs.15, 16, 21 and 22, T.147 N., R.44 W., 1 mile northeast of Fertile, Minn.	-	-	4-23-64	219
					5-26-64	*23.0
					7- 9-64	27.2
					8-18-64	*9.57
Tamarack River	Upper Red Lake	Sec.8, T.154 N., R.30 W., at Waskish, Minn.	-	1961	4-29-64	442
					7- 1-64	*295
					8-19-64	*3.11
Shotley Brook	Upper Red Lake	On line between secs.11 and 14, T.153 N., R.31 W., at County Highway 23, 2 miles above mouth and 3.2 miles northeast of Shotley, Minn.	-	-	4-29-64	78.4
					5-26-64	*13.2
					7- 2-64	*18.5
					8-20-64	0
South Branch Battle River	Battle River	E½ sec.31, T.152 N., R.30 W., at State Highway 72, 3.4 miles west of Kelliher, Minn.	-	-	4-29-64	59.1
					5-26-64	*7.09
					7- 2-64	*12.9
					8-20-64	*2.22
Cormorant River	Blackduck River	On line between secs.7 and 12, T.152 N., R.30 and 31 W., at State Highway 72, ¼ mile below an unnamed tributary entering from the south, and 5½ miles northwest of Shooks, Minn.	-	-	4-29-64	36.3
					5-26-64	*4.02
					7- 2-64	*5.51
					8-20-64	a.02

* Base flow.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Red River of the North basin--Continued				
Blackduck River	Lower Red Lake	On line between secs.22 and 23, T.151 N., R.32 W., at County Highway 101 ¼ mile below South Cormorant River and ½ mile southwest of Quiring, Minn.	-	-	4-29-64 5-26-64 7- 2-64 8-19-64	165 *47.7 *35.6 *1.65
Sandy River	Lower Red Lake	N½ sec.2, T.150 N., R.36 W., at U. S. Indian Service highway 2½ miles above mouth and 9½ miles west of Red Lake, Minn.	-	-	4-28-64 5-25-64 7- 1-64 8-19-64	88.7 *24.3 *18.1 *5.15
Moose River	Thief River	E½ sec.1, T.157 N., R.39 W., 8 miles east and 1¼ miles north of Gatzke, Minn.	-	-	6- 4-64	a4
Moose River	Thief River	NE¼SE¼ sec.36, T.158 N., R.40 W., at bridge on State Highway 89 about 3½ miles northeast of Gatzke, Minn.	-	-	4- 9-64 4-16-64 4-23-64 4-30-64 6-16-64 7- 9-64 7-30-64 8-27-64 9-30-64	3.97 342 137 78.8 485 *a10 0 0 356
Poplar River	Hill River	On line between secs.17 and 20, T.150 N., R.42 W., at County Road B3 2½ miles above mouth and 2¼ miles west of Brooks, Minn.	-	1950	4-29-64 5-25-64 7- 1-64 8-20-64	106 *28.1 *32.9 *4.47
Barnums Creek	Red Lake River	On line between secs.10 and 15, T.149 N., R.47 W., at town road about ¼ mile above U. S. Highway 75 and ¾ mile northeast of Girard, Minn.	-	-	4-28-64 5-25-64 7- 2-64 8-20-64	23.1 *3.23 *4.04 0
Tamarac River	Red River of the North	N½ sec.12, T.158 N., R.46 W., at Hegland, Minn.	-	-	10 -9-63 11-20-63	*.14 .14
Tamarac River	Red River of the North	W½NW¼ sec.22, T.158 N., R.46 W., 2 miles east and 0.8 mile north of Englund, Minn.	-	-	10- 9-63 11-20-63	*.22 *.29
Tamarac River	Red River of the North	SE¼NW¼ sec.34, T.158 N., R.46 W., 3 miles northeast of Florian, Minn.	-	-	10- 9-63 11-20-63	*.15 *.47
Tamarac River	Red River of the North	SW¼SW¼ sec.3, T.157 N., R.46 W., at County Highway 6, 2 miles east of Florian, Minn.	-	-	10- 9-63 11-20-63	*.06 *.43
Tamarac River	Red River of the North	NE¼ sec.18, T.157 N., R.46 W., 1.2 miles south of Florian and 9 miles southwest of Strandquist.	-	1953-56≠	10- 9-63 11-20-63	*.15 *.60
Tamarac River	Red River of the North	NE¼SE¼ sec.6, T.157 N., R.48 W., at highway bridge ½ mile west of Stephan, Minn.	-	1945≠	10- 9-63 11-20-63	0 0
Tamarac River	Red River of the North	E½ sec.22, T.158 N., R.49 W., 4½ miles northwest of Stephan, Minn. and 8 miles above mouth.	-	1945 1953-55≠	10- 9-63	0
South Branch Two Rivers	Two Rivers	At intersection of secs.20, 21, 28 and 29, T.161 N., R.47 W., 4 miles west and 1 mile north of Lake Bronson, Minn.	-	-	8-27-64	*5.55
South Branch Two Rivers	Two Rivers	On line between secs.25 and 26, T.161 N., R.48 W., 7 miles west of Lake Bronson, Minn.	-	-	10-17-63 8-27-64	*1.51 *5.21
South Branch Two Rivers	Two Rivers	NW¼NE¼ sec.32, T.161 N., R.48 W., 3¼ miles southeast of Hallock, Minn.	-	-	10-17-63 9-27-64	*1.08 *6.71
South Branch Two Rivers	Two Rivers	SE¼NE¼ sec.13, T.161 N., R.49 W., 1000 feet below dam at Hallock, Minn.	-	-	10-17-63	a.02

* Base flow.
a Estimated.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Lake of the Woods basin						
Little Fork River	Rainy River	SE¼NE¼ sec.13, T.62 N., R.19 W., at bridge on U.S. Highway 53, 0.6 mile west of Cook, Minn.	-	1950, 1958-63	10-14-63 12- 9-63 1-14-64 2-25-64 3-30-64 4-22-64 5-27-64 6-16-64 7- 8-64 8- 5-64 9-11-64	*2.48 *7.70 *.80 *.73 *.47 130 52.9 42.8 32.5 *5.39 30.6
Mississippi River main stem						
Mississippi River	Gulf of Mexico	NW¼SW¼ sec.35, T.144 N., R.36 W., at first culvert below Lake Itasca at Itasca State Park, near town of Lake Itasca, Minn.	-	-	6- 4-64 8- 8-64	*5.75 *2.41
Mississippi River	Gulf of Mexico	NW¼NW¼ sec.20, T.146 N., R.33 W., at County Highway 11, ¼ mile south of Bemidji, Minn.	-	-	6- 4-64 8- 7-64	*68.0 *61.6
Schoolcraft River basin						
Schoolcraft River	Mississippi River	SW¼SE¼ sec.31, T.146 N., R.33 W., ¼ mile below Plantaganette Lake outlet and 3 miles south of Bemidji, Minn.	-	1947	6- 4-64 8- 8-64	*65.0 *26.4
Turtle River basin						
Turtle River	Mississippi River	S½ sec.15, T.147 N., R.31 W., 7 miles northwest of Pennington, Minn.	-	1950	6- 5-64 8- 7-64	*71.7 *67.8
North Turtle River	Turtle River	NW¼NW¼ sec.24, T.147 N., R.31 W., about ½ mile above mouth and 5.8 miles northwest of Pennington, Minn.	-	1950	6- 5-64 8- 7-64	*24.6 *6.16
Leech Lake River basin						
Boy River	Leech Lake	NW¼SE¼ sec.34, T.141 N., R.28 W., at Longville, Minn.	-	1953	6- 5-64 7-29-64	*43.4 *33.6
Boy River	Leech Lake	S½SE¼ sec.28, T.142 N., R.27 W., at County Highway 53, about 1½ miles above Boy Lake and 8¼ miles west and 1 mile north of Remer, Minn.	-	-	7-29-64	*57.3
Prairie River basin						
Prairie River	Mississippi River	W½ sec.19, T.58 N., R.23 W., at County Road 336, 9 miles northwest of Nashwauk, Minn.	-	-	6- 6-64 8- 3-64	*85.8 *29.2
Willow River basin						
Willow River	Mississippi River	On line between secs.14 and 15, T.51 N., R.26 W., at U. S. Highway 169, 6 miles south of Hill City, Minn.	-	-	6- 6-64 7-29-64	*81.4 *39.2
Willow River	Mississippi River	At highway bridge on line between secs. 20 and 21, T.49 N., R.25 W., 2 miles west of Palisade, Minn.	442	1929 1944-49 1953-54 1957	7-31-64	*68.8
Rice River basin						
Rice River	Mississippi River	E½SE¼ sec.34, T.48 N., R.26 W., at U.S. Highway 169 at Hassman, Minn.	-	1936 1944-49 1951 1953-54 1957	6- 7-64 7-13-64	*91.7 *83.2
Ripple River basin						
Ripple River	Mississippi River	NE¼NE¼ sec.26, T.47 N., R.27 W., at U.S. Highway 169 at Aitkin, Minn. and about ¾ mile above mouth	-	-	6- 7-64 7-14-64 8-10-64	*40.6 *16.9 *27.7

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Pine River basin						
Pine River	Mississippi River	NE¼SE¼ sec.11, T.137 N., R.29 W., at County Highway 15 about ¾ mile above Upper Whitefish Lake and ¼ mile east and 1¾ miles north of Jenkins, Minn.	-	-	6- 8-64 7-15-64 8-19-64	*72.1 *97.3 *61.6
Little Pine River	Pine River	On line between secs.5 and 33, T.136 and 137 N., R.26 W., at town road 6 miles east and 2½ miles south of village of Cross Lake, Minn.	-	-	6- 7-64 7-14-64 8-15-64	*38.4 *61.6 *22.0
Crow Wing River basin						
Straight River	Shell River	NW¼NE¼ sec.18, T.139 N., R.34 W., at State Highway 87 about ½ mile below Fish Hook River, about 2 miles above mouth and 2 miles northwest of Hubbard, Minn.	-	-	6- 3-64 7-15-64 8-17-64	*82.5 *92.5 *85.9
Long Lake Outlet	Straight River	SE¼NW¼ sec.20, T.139 N., R.34 W., at outlet of Long Lake at Hubbard, Minn.	-	-	7-15-64	*17.4
Shell River	Crow Wing River	NW¼ sec.30, T.139 N., R.34 W., at town road about 0.2 mile below Straight River and 1 mile west of Hubbard, Minn.	-	-	6- 3-64 7-15-64 8-17-64	*160 *203 *119
Crow Wing River	Mississippi River	NE¼NE¼ sec.20, T.139 N., R.33 W., at State Highway 87, at outlet of Third Crow Wing Lake and about 6½ miles east of Hubbard, Minn.	-	-	6- 3-64 7-15-64 8-17-64	*60.2 *52.0 *59.5
Leaf River	Crow Wing River	E½ sec.20, T.135 N., R.34 W., at County Highway 22, 5½ miles north of Verndale, Minn.	-	-	6- 2-64 7-14-64 8-15-64	*72.4 *41.3 *35.7
Wing River	Leaf River	N½ sec.8, T.134 N., R.34 W., at County Highway 4, 2 miles north of Verndale, Minn.	-	-	6- 2-64 7-14-64 8-15-64	*27.8 *15.4 *13.2
Redeye River	Leaf River	On line between secs.13 and 24, T.135 N., R.34 W., at County Highway 7, 1½ miles above mouth and 8½ miles north of Aldrich, Minn.	-	-	6- 2-64 7-14-64 8-18-64	*38.2 *47.5 *17.5
Partridge River	Crow Wing River	NW¼SW¼ sec.15, T.134 N., R.33 W., on County Highway 29, about ¾ mile above mouth and 5½ miles northeast of Aldrich, Minn.	-	-	6- 2-64 7-14-64 8-18-64	*5.63 *4.29 *1.98
Mosquito Creek	Crow Wing River	E½SW¼ sec.7, T.133 N., R.31 W., at U.S. Highway 210 at Motley, Minn. and about 0.2 mile above mouth.	-	-	7-28-64	4.03
Platte River basin						
Platte River	Mississippi River	NW¼NW¼ sec.31, T.40 N., R.31 W., at bridge on County Road 35, below Rice Lake and 6 miles southeast of Little Falls, Minn.	-	1938, 1963	10- 2-63 10-24-63 12-16-63 1- 6-64 2-18-64 3-24-64 4-27-64 5-14-64 6- 8-64 7-20-64 9-15-64 9-23-64	*28.4 68.0 *13.0 *13.8 *13.8 70.4 341 753 *57.1 *54.1 183 108

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Bassett Creek basin						
Bassett Creek	Mississippi River	W½ sec.28, T.118 N., R.21 W., at bridge on County Highway 66 in Golden Valley, Minn. and ¼ mile west of underpass on State Highway 100.	-	-	10- 7-63	*1.75
					11-18-63	*.85
					12- 9-63	*.46
					3-25-64	*1.32
					4-21-64	5.84
					5-19-64	*6.18
					6-15-64	*3.12
					7-26-64	*2.90
					8-16-64	*7.19
					9- 9-64	20.5
					9-23-64	7.10
North Fork Bassett Creek	Bassett Creek	NW¼ sec.21, T.118 N., R.21 W., at culvert on 34th Ave. North, at Crystal, Minn., and ¾ mile above mouth.	-	-	10- 7-63	0
					11-18-63	0
					12- 9-63	0
					3-25-64	.22
					4-21-64	.25
					5-19-64	0
					6-15-64	0
					7-26-64	0
					9- 9-64	5.11
					9-23-64	.79
South Fork Bassett Creek	Bassett Creek	Near center of W½ sec.19, T.29 N., R.24 W., at culvert on Olsen Highway, Golden Valley, Minn. and ¼ mile east of State Highway 100.	-	-	10- 7-63	*1.87
					11-18-63	*.84
					12- 9-63	*.86
					3-25-64	*.99
					4-21-64	3.56
					5-19-64	*.97
					6-15-64	*.93
					7-26-64	*.78
					9- 9-64	8.27
					9-23-64	3.88
Bassett Creek	Mississippi River	SE¼ sec.20, T.29 N., R.24 W., at Fruen Mill, Minneapolis, Minn. and 700 feet downstream from Glenwood Ave.	-	1952	10- 7-63	*4.43
				1954-55	11-18-63	*3.03
				1963	12- 9-63	*3.13
					3-25-64	*4.04
					4-21-64	9.75
					5-19-64	*9.91
					6-15-64	*a.75
					7-26-64	*2.38
					9- 9-64	19.4
					9-23-64	17.2
Mississippi River main stem						
Mississippi River	Gulf of Mexico	At Washington Ave. bridge in Minneapolis, Minn. and 9 miles above Minnesota River.	-	1912, 1953-54, 1957, 1963	5-22-64	15,200
					7-23-64	2,510
Mississippi River	Gulf of Mexico	Below lock and dam No. 1, between Minneapolis and St. Paul, Minn., 4 miles upstream from Minnesota River.	19,700	1935, 1938, 1939, 1941, 1945-50, 1954, 1959, 1961, 1962	10-17-63	2,530
Minnesota River basin						
Stony Run	Minnesota River	NE¼NE¼ sec.30, T.121 N., R.45 W., at culvert on U.S. Highway 75, ¾ mile northwest of Odessa, Minn., and 1 mile above mouth.	-	1963	10-23-63	*1.12
					11-20-63	*.89
					5-15-64	*4.02
South Fork Yellow Bank River	Yellow Bank River	SE¼NE¼ sec.25, T.120 N., R.46 W., at bridge ¾ mile above confluence with North Fork and 4¼ miles northwest of Bellingham, Minn.	-	1963	10-23-63	*5.66
					11-20-63	*5.59
					6- 2-64	*4.44
Lac qui Parle Co. ditch No. 13	Minnesota River	Near center of sec.24, T.120 N., R.45 W., at bridge 3 miles above mouth and 4 miles northeast of Bellingham, Minn.	-	1963	10-31-63	*1.10
					6- 2-64	*.90

* Base flow.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Minnesota River basin--continued				
Five Mile Creek	Minnesota River	NE¼NW¼ sec.12, T.120 N., R.44 W., at bridge on State Highway 7, 2¼ miles east of Correll, Minn. and 3½ miles above mouth.	-	1963	10-22-63 11-19-63 6- 3-64	*2.58 *2.24 *2.19
Pomme de Terre River	Minnesota River	NE¼SE¼ sec.13, T.129 N., R.42 W., at highway bridge 1¼ miles below Pomme de Terre Lake and 4 miles east of Elbow Lake, Minn.	-	1963	10-24-63 11-22-63 8-11-64 9-12-64	*10.4 *15.4 *1.61 *9.30
Pomme de Terre River	Minnesota River	In NW¼SW¼ sec.7, T.128 N., R.41 W., at outlet of Barrett Lake at Barrett, Minn.	-	-	8-11-64	*.49
Pomme de Terre River	Minnesota River	In NW¼NW¼ sec.29, T.127 N., R.41 W., at County Road 37 and 4½ miles southwest of Hoffman, Minn.	-	-	8-11-64	*4.47
Pomme de Terre River	Minnesota River	SE¼NE¼ sec.7, T.125 N., R.41 W., at County Road 70, 4½ miles north and 3 miles east of Morris, Minn.	-	-	8-11-64	6.91
Pomme de Terre River	Minnesota River	NW¼NW¼ sec.24, T.124 N., R.42 W., at County Road 59, ¼ mile above Mud Creek 2 miles south of Morris, Minn.	-	-	8-11-64	*4.17
Mud Creek	Pomme de Terre River	On line between secs.22 and 23, T.124 N., R.42 W., 1 mile above mouth and 3 miles south of Morris, Minn.	-	1963	10-22-63 11-21-63 5-19-64 8-11-64 9-10-64	*.64 *.41 *1.87 *.10 *.32
Pomme de Terre River	Minnesota River	NE¼NW¼ sec.16, T.122 N., R.42 W., at County Highway 22, and 3 miles north of Fairfield, Minn.	-	-	8-11-64	7.57
Pomme de Terre River	Minnesota River	SW¼SW¼ sec.4, T.121 N., R.42 W., at County Road 56 and 2 miles south of Fairfield, Minn.	-	-	8-11-64	*9.13
Pomme de Terre River	Minnesota River	SW¼SE¼ sec.18, T.121 N., R.42 W., at dam 150 feet above U.S. Highway 12 and 4 miles northwest of Holloway, Minn.	-	-	8-11-64	*10.4
Pomme de Terre River	Minnesota River	NW¼NE¼ sec.1, T.120 N., R.43 W., at County Road 54, 3 miles northeast of Appleton, Minn. and 12 miles above mouth.	885	1931-52≠	8-11-64	*13.6
Emily Creek	Minnesota River	NE¼NE¼ sec.26, T.119 N., R.43 W., 1 mile above mouth and 4½ miles west of Milan, Minn.	-	1963	10-30-63 5-14-64	*1.80 *3.92
Canby Creek	Lac qui Parle River	SE¼SE¼ sec.30, T.116 N., R.44 W., at U.S. Highway 75, 8½ miles northeast of Canby, Minn.	-	-	6- 3-64 7- 7-64 8- 5-64 9- 3-64	6.81 4.75 *.23 *.51
Lac qui Parle River	Minnesota River	On line between secs.3 and 10, T.115 N., R.44 W., at bridge on State Highway 67, ½ mile above Canby Creek, and 8 miles northeast of Canby, Minn.	-	1963	11- 1-63 6- 3-64 7- 2-64 8- 5-64 9- 3-64	*2.51 *4.12 0 0 0
West Br. Lac qui Parle River	Lac qui Parle River	S½NE¼ sec.20, T.117 N., R.43 W., at dam in Dawson, Minn.	-	1963	10-31-63 6- 2-64 7- 7-64 8- 6-64 9- 3-64	*4.17 *11.0 *1.13 *1.40 *2.79
Chippewa River	Minnesota River	On line between secs.17 and 18, T.125 N., R.40 W., at highway bridge 1¼ miles north of Cyrus, Minn.	-	1963	10-22-63 11-21-63 5-20-64 9-10-64	*12.4 *1.92 90.2 *26.2

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1964

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Minnesota River basin--continued				
East Branch Chippewa River	Chippewa River	SE¼NW¼ sec.29, T.122 N., R.39 W., at county highway, 1½ miles north of Benson, Minn.	-	-	10-21-63	45.4
					11-21-63	25.4
					5-20-64	107
					8-12-64	*2.78
					9-10-64	*16.5
North Branch Yellow Medicine River	Yellow Medicine River	Near center of line between secs.1 and 2, T.113 N., R.43 W., 3 miles above confluence with So. Br. Yellow Medicine River, and 4½ miles north of Minneota, Minn.	-	1963	10- 2-63	*8.93
					6- 3-64	*5.74
					7- 8-64	*2.20
					8- 6-64	*.81
					9- 4-64	*.44
		Mississippi River main stem				
Mississippi River	Gulf of Mexico	At Hastings, Minn.	37,100	1929	4-23-64	22,800
				1931-39	5-27-64	17,600
				1945-48		
				1950		
				1953-57		
				1959-63		
		St. Croix River basin				
St. Croix River	Mississippi River	At Prescott, Wis.	7,650	1939	4-23-64	10,300
				1946-48	5-27-64	10,900
				1950		
				1953-57		
				1959-63		
		Des Moines River basin				
West Fork Des Moines River	Des Moines River	Near center of sec.20, T.105 N., R.38 W., at outlet of Talcot Lake, 3¼ miles northeast of Dundee, Minn.	-	1963	10- 4-63	*73.7
					11- 5-63	*23.0
					12- 6-63	*12.7
					1- 5-64	*2.37
					2-20-64	*2.48
					3-31-64	*16.0
					5-13-64	257
					6- 6-64	*14.9
					7- 9-64	*.70
					8- 7-64	*.24
					9- 9-64	4.22

* Base flow.

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